Decision Making for Initial Company Operations

DMICO-Student Manual

1st Edition, 1st Printing-December 2009

FEMA

FEMA/USFA/NFA
DMICO-SM
December 2009
1st Edition, 1st Printing

Decision Making for Initial Company Operations

FEMA

Decision Making for Initial Company Operations

DMICO-Student Manual

1st Edition, 1st Printing-December 2009

FEMA

U.S. DEPARTMENT OF HOMELAND SECURITY

UNITED STATES FIRE ADMINISTRATION

NATIONAL FIRE ACADEMY

FOREWORD

The U.S. Fire Administration (USFA), an important component of the Department of Homeland Security (DHS), serves the leadership of this Nation as the DHS's fire protection and emergency response expert. The USFA is located at the National Emergency Training Center (NETC) in Emmitsburg, Maryland, and includes the National Fire Academy (NFA), National Fire Data Center (NFDC), and the National Preparedness Network (PREPnet). The USFA also provides oversight and management of the Noble Training Center in Anniston, Alabama. The mission of the USFA is to save lives and reduce economic losses due to fire and related emergencies through training, research, data collection and analysis, public education, and coordination with other Federal agencies and fire protection and emergency service personnel.

The USFA's National Fire Academy offers a diverse course delivery system, combining resident courses, off-campus deliveries in cooperation with State training organizations, weekend instruction, and online courses. The USFA maintains a blended learning approach to its course selections and course development. Resident courses are delivered at both the Emmitsburg campus and the Noble facility. Off-campus courses are delivered in cooperation with State and local fire training organizations to ensure this Nation's firefighters are prepared for the hazards they face.

TABLE OF CONTENTS

COURSE SCHEDULE

Unit 1:	Introduction
Unit 2:	Integration of the National Incident Management System to Fireground Management
Unit 3:	Fireground Decision Making
Unit 4:	The Analytical Sizeup Process
Unit 5:	Building Construction Types
Unit 6:	Burn Time Considerations and Line-of-Duty Deaths from Collapse Incidents
Unit 7:	Fireground Decision Making Exercises

UNIT 1: INTRODUCTION

OBJECTIVE

The students will complete Activity 1.1 by introducing him/herself to the class.

COURSE OVERVIEW

Course Goal

Decision Making for Initial Company Operations (DMICO) is designed to develop the decision making skills needed by Company Officers (COs) to accomplish assigned tactics at structure fires.

Target Audience

It is important to understand that while the course material was developed for newly appointed officers or firefighters who may have acting CO responsibilities, it would also provide an excellent review for experienced officers.

Activities

All activities and scenarios used in this course are based on structure fires.

There will be a walk-through activity followed by one or more small-group, scenario-driven activities for each area covered.

A final, message-driven simulation activity will culminate Units 4 and 7.

Student Manual

Support material (for use in class) for activities.

Text material (for postcourse reference).

Provides background, and supplements course content.

Students should not try to follow the text while material is being presented.

Course Units

- Unit 1: Introduction;
- Unit 2: Integration of the National Incident Management System to Fireground Management;
- Unit 3: Fireground Decision Making;
- Unit 4: The Analytical Sizeup Process;
- Unit 5: Building Construction Types;
- Unit 6: Burn Time Considerations and Line-of-Duty Deaths from Collapse Incidents; and
- Unit 7: Fireground Decision Making Exercises.

Activity 1.1

Student Introductions

Purpose

To meet the instructors and other students.

Directions

1. An instructor will perform roll call.

2. The instructors will introduce themselves and briefly discuss their backgrounds.

3. You will introduce yourself and give a brief overview of your background and expectations for the course. Information should include your:

   a. Name.

   b. Rank.

   c. Department.

   d. Current position.

   e. Years of experience.

   f. Course expectations.

UNIT 2: INTEGRATION OF THE NATIONAL INCIDENT MANAGEMENT SYSTEM TO FIREGROUND MANAGEMENT

OBJECTIVES

The students will:

1. *State the purpose of the National Incident Management System (NIMS).*
2. *Identify the elements of NIMS that provide the template for managing incidents.*
3. *State the purpose of using the Incident Command System (ICS) effectively.*
4. *Identify the ICS positions and state their functions.*

NATIONAL INCIDENT MANAGEMENT SYSTEM

Overview

What is National Incident Management System?

- A comprehensive, nationwide, systematic approach to incident management, that includes the Incident Command System (ICS), Multiagency Coordination (MAC) System, and Public Information.
- A set of preparedness concepts and principles for all hazards.
- Essential principles for a common operating picture and interoperability of communications and information management.
- Standardized resource management procedures that enable coordination among different jurisdictions or organizations.
- Scalable, so it may be used for all incidents (from day-to-day to large-scale).
- A dynamic system that promotes ongoing management and maintenance.

What National Incident Management System is Not

- a response plan;
- used only during large-scale incidents;
- a communications plan;
- applicable only to certain emergency management/incident response personnel;
- only the ICS or an organization chart; and
- a static system.

National Incident Management System

It includes

- compliance;
- training;
- standards and technology; and
- resource management/Mutual aid--standardized procedures for resource management processes.

Command and Management

Command and management envision the most familiar (and easily implemented) part of NIMS--the ICS. Organizations must, as condition of the Federal preparedness assistance, take steps to begin institutionalizing the use of ICS during prevention and response efforts. Actions to institutionalize the use of ICS take place at two levels--policy and organizational/operational.

<u>At the Policy Level</u>

- Institutionalizing the ICS refers to government officials, i.e., governors, mayors, county and city managers, tribal leaders, and others.
- Adopt the ICS through executive order, proclamation, or legislation for the jurisdiction.
- Direct that incident managers and response organizations in their jurisdictions train, exercise, and use the ICS in their response operations.

At the organizational/operational level, evidence that incident managers and emergency response organizations are institutionalizing the ICS would include the following.

- ICS is being integrated into functional and system-wide emergency operations policies, plans, and procedures.
- ICS training is planned or underway for responders, supervisors, and Command-level officers.
- Responders at all levels are participating in and/or coordinating ICS-oriented exercises that involve responders from multidisciplines and jurisdictions.

USING THE INCIDENT COMMAND SYSTEM EFFECTIVELY

Understanding How to Use the System

Organizational charts do not put out fires--well-managed firefighters do. ICS provides numerous subordinate positions for the Incident Commander (IC) to delegate responsibility and maintain span of control. Positions are to be used **if** they are needed. As additional resources become available, IC can reduce span of control and delegate. If incident is escalating, IC can establish organization to meet the growing problem.

Think of the ICS organization as a toolbox. You do not need every tool in your toolbox to change the spark plugs in your car; you use only those tools you need to do the job. The rest of the tools remain in the toolbox until there is a job for which they are needed.

The IC should delegate only those positions that will help do the job. Overdelegating can be as disastrous as not delegating. Some ICs fall into the trap of creating subordinate positions, with the result that no one is left to fight the fire. Understanding the system will let you know what positions will help and how to use them to the best advantage.

Importance of First-In Officer as Initial Incident Commander

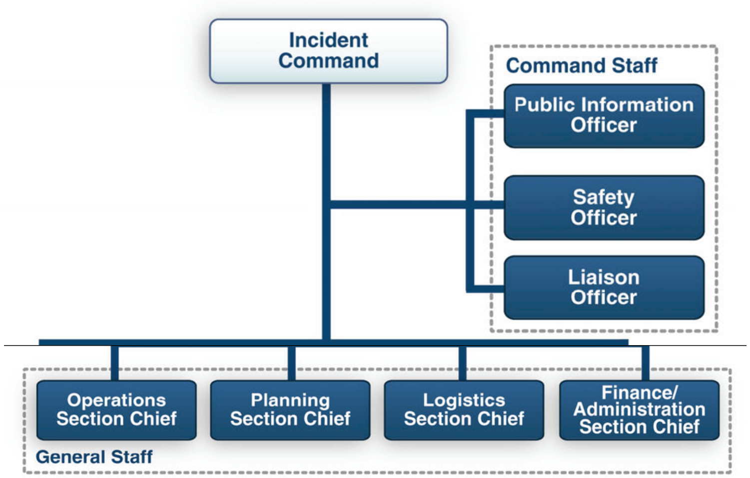
Every firefighter knows that "what starts well, ends well." How the first-in officer organizes the incident initially will affect the entire incident. It is important to recognize the scope of the incident. It is difficult to reposition equipment if it is not done properly on initial assignment. Changes to the initial action plan can cause delays, breakdown in coordination, and additional damage.

If initial response resources are well organized, it is easier to expand the organization if needed. Time is not wasted reorganizing original structure. Expansion of the system can be done in an organized, modular fashion.

The Company Officer's Role When Not the Incident Commander

The first-arriving Company Officer (CO) may act as the initial IC until Command can be passed, and then be assigned to a subordinate position. Officers not first in may be assigned to subordinate positions upon their arrival. Whether as initial IC or delegated to function in another ICS position, COs must understand the system if they are to do an effective job and the system is to work. A chain is only as strong as its weakest link. Coordination may be lost. Firefighter safety may be jeopardized.

OVERVIEW OF INCIDENT COMMAND SYSTEM POSITIONS



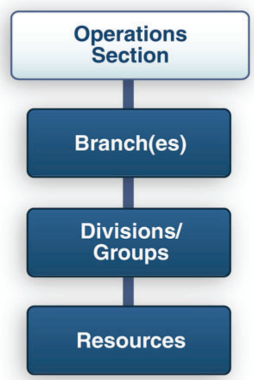
General Staff

Command

- responsible for overall management of the incident;
- establishes the strategy and tactics for the incident;
- responsible for firefighter safety;
- ultimately responsible for success of incident activities;
- command role is filled by IC; and
- established at every incident.

Operations

- Accomplishes strategy that Command develops by meeting the tactical objectives.
- Directs all tactical operations.
- Assists in the development of the action plan.



<u>Branches</u>

Branches may be functional, geographic, or both, depending on the circumstances of the incident. Branches are established when the number of Divisions or Groups exceeds the recommended span of control. Branches are identified by the use of Roman numerals or by functional area.

Divisions/Groups

Divisions and/or Groups are established when the number of resources exceeds the manageable span of control of Incident Command and the Operations Section Chief. Divisions are established to divide an incident into physical or geographical areas of operation. Groups are established to divide the incident into functional areas of operation. For example, Incident Command may assign evacuation or mass-care responsibilities to a functional Group in the Operations Section.

Planning

- collects and evaluates information needed for action plan preparation;
- forecasts probable course of events; and
- prepares alternative strategies for changes or modifications to the action plan.

Finance/Administration

- responsible for required fiscal documentation; and
- provides financial planning and advice.

Command Staff

Command Staff positions are designed to provide aid and assistance to help the IC fulfill incident responsibilities and handle key incident activities that enable the IC to manage the incident better. They are not part of the line organization and do not count when determining the IC's span of control.

Logistics

Provides services and supplies to support tactical operations, such as:

- facilities;
- transportation
- supplies;
- equipment maintenance and fueling;
- feeding; and
- medical services for response personnel and responder rehab.

Intelligence/Investigation

The IC may assign the intelligence and investigation functions to other parts of the ICS organization. Intelligence and investigation must be appropriately analyzed and shared with personnel, designated by the ICS, who have proper clearance and a "need-to-know" to ensure that they support decision making. The intelligence and investigation functions can be assigned as

- a separate General Staff Section;
- the Command Staff;
- a Unit within the Planning Section;
- a Branch within the Operations Section;
- investigation provided for the collection, analysis, and sharing of incident-related intelligence; and
- embedded in several different places within the organizational structure.

  - **As a Separate General Staff Section:** This option may be appropriate when a there is a significant intelligence/investigations component to the incident for criminal or epidemiological purposes or when multiple investigative agencies are involved. A separate Intelligence/Investigations Section may be needed when highly specialized information requiring technical analysis is both critical and time sensitive to lifesaving operations (e.g., chemical, biological, radiological, or nuclear incidents) or when there is a need for classified intelligence.

  - **Within the Command Staff:** This option may be appropriate for incidents with little need for tactical information or classified intelligence and where supporting Agency Representatives are providing real-time information to the IC/Unified Command (UC).

  - **Within the Planning Section:** This is the traditional placement for this function and is appropriate for incidents with little or no investigative information requirements nor a significant amount of specialized information.

  - **Within the Operations Section:** This option may be appropriate for incidents that require a high degree of linkage and coordination between the investigative information and the operational tactics that are being employed.

Safety Officer

- Responsible for monitoring and assessing safety hazards or unsafe situations and developing measures for ensuring personnel safety.
- Should be appointed when IC cannot adequately monitor hazards or unsafe conditions.
- Keeps IC informed as to existing or potential safety hazards and offers suggestions on how to minimize risks.
- Can take immediate action to correct unsafe acts or remove personnel from threat of danger.
- Must inform IC and other affected supervisors of the corrective actions taken and why.
- Normal chain of Command is used if personnel are not in imminent danger.
- Must have requisite background and knowledge of the incident factors that could affect firefighter safety.
- At structure fire, should have knowledge of building construction and fire behavior.

Liaison Officer

- Responsible for providing the point of contact and coordination for assisting agencies not involved in command functions.
- Helps IC coordinate the efforts of assisting agencies and reduces risk of those agencies operating independently.
- Liaison Officer must determine whether Agency Representatives have decision making authority for their agencies.
- If representatives need to check with someone else to get a decision, get the name of the person with whom they are checking.
- Time can be wasted and coordination lost if representatives can't make decisions for their agencies.
- Liaison Officer's role helps each agency do what it does best, which increases effectiveness of resources and has positive impact on incident safety.

Public Information Officer

- The Public Information Officer (PIO) is responsible for the development of accurate and complete information regarding the incident and for serving as the point of contact for the media and other appropriate agencies requiring information direct from the incident scene.

- Gets incident briefing and updates from IC for release to the media.

- Establishes a press area away from IC and the Command Post (CP).

- Provides for tours and photo opportunities from a designated safe area.

- Arranges for media to speak with IC if incident conditions allow.

UNIT 3:
FIREGROUND DECISION MAKING

OBJECTIVES

The students will:

1. *Explain the need for a logical thought process.*

2. *State the difference between Classical Decision Making and Naturalistic Decision Making (NDM).*

3. *Assess an incident scene and determine whether Classical Decision Making or NDM is the appropriate decision making model to use at a particular incident.*

4. *State the importance of knowing when to be proactive and when to be reactive.*

INCIDENT SCENE DECISION MAKING

There are many decision making models.

The Classical Model

- Is prescriptive in that it focuses on how decisions should be made.
- Assumes the decision maker is completely rational (i.e., seeks to maximize the payoff and utilizes a search process that proceeds in a planned, orderly, and consistent fashion) and unbiased.
- Assumes that the decision maker has available all the information needed to make a decision and that all possible alternatives are considered.
- The decision maker selects the optimum or best choice.
- Decision making proceeds through the following sequence of steps: problem identification, development of criteria against which alternative solutions can be evaluated, identification of alternative courses of action, evaluation of alternatives, selection of the best alternative, and implementation.

The Administrative (or Behavioral) Model

- Is descriptive in that it describes how decisions are actually made.
- Decision makers seek to simplify problems and make them less complex because they are constrained by their individual capabilities (e.g., limited information-processing ability) and by organizational conditions (e.g., availability of resources).
- Assumes that decision makers operate with limited (or "bounded") rationality; this means that decision makers are rational within a simplified model, which contains fewer components (e.g., fewer decision making criteria, fewer options, etc.).
- Assumes that decision makers identify a limited number of decision making criteria, examine a limited range of alternatives (only those which are easy to find, highly visible, have been tried before, or are only slightly different from the status quo), and that they do not possess all the information needed to make a decision.
- The decision maker selects a satisfying alternative. This is an alternative that is "good enough" or satisfactory in that it meets the minimum criteria established for a desired solution.
- Decision making proceeds sequentially: Alternatives are examined one at a time and the first satisfactory alternative that is found is selected.

The Implicit Favorite Model

- Is descriptive in that it describes how decisions are actually made.
- The decision maker seeks to simplify the decision making process by identifying an "implicit favorite" before alternatives are evaluated; this often occurs subconsciously.
- The decision maker is neither rational nor objective and unbiased.
- After a "favorite" is selected, the decision maker tries to appear rational and objective by developing decision criteria and by identifying and evaluating various alternatives; however, this is done in a biased way so as to ensure that the favorite appears superior on these criteria and can thus be selected legitimately as the "best" solution.
- In this model, decision making is essentially a process of confirming a choice/decision that has already been made. The actual decision was made in an intuitive and unscientific fashion.

The Political Model

- Is descriptive in that it describes how decisions are actually made.
- The decision maker is neither rational nor objective and unbiased.
- Since the group members have different agendas, they need to negotiate with each other.
- The process involves a cycle of bargaining among the decision makers in order for each one to try to get his or her perspective to be the one of choice--more specifically, to sway powerful people within the situation to adopt his or her viewpoint and influence the remaining decision makers.
- This model does not involve making full information available, since it is based on negotiation that is often influenced by power and favors. In fact, information is often withheld in order to maneuver a given perspective better.
- In this model, potential problems and conflict often can be foreseen and minimized. Once powerful people have been swayed to support a particular viewpoint, other group members usually fall in line behind them.
- The nature of bargaining and maneuvering (e.g., withholding information and social pressure) can produce effects that are long lasting and detrimental. Once they discover it, the individuals involved in the decision may not appreciate the duplicity inherent in the process.

CLASSICAL AND NATURALISTIC DECISION MAKING

The Naturalistic Decision Making (NDM) model identifies a reasonable reaction as the first one that is immediately considered. NDM combines two ways of developing a decision: The first is recognizing which course of action makes sense, and the second is evaluating the cause of action through imagination to see if the actions resulting from that decision make sense. However, the difference between being experienced and inexperienced is a major role in the decision making process.

NDM reveals a critical difference between experts and novices when presented with recurring situations. Experienced people generally will be able to come up with decisions more quickly because the situation may match a prototypical situation they have encountered before. Lacking this experience, novices must cycle through different possibilities, and tend to use the first course of action they believe will work. The inexperienced also have the tendency to use trial and error through their imagination.

Variations

There are three variations in NDM strategy.

1. Decision makers recognize the situation as typical, so they know what course of action they will follow. They immediately know the goals, priorities, and steps of the course of action in the given situation. Variation one is basically an "If, then," reaction. One situation can give rise immediately to the course of action due to its typicality.

2. The second variation occurs when the decision maker diagnoses the situation to develop a course of action. Variation two takes the form of "If (???), then." In order to prevent complications and misinformation, the decision maker is more concerned about the situation than about the course of action or the goal.

3. The decision maker is aware of the situation but unaware of the proper course of action. Mentally implementing a simulated trial-and-error process to develop the most effective course of action helps to ascertain the consequences of the different courses of action. The decision maker will cycle through different possible courses of actions; if one does not work, he or she will proceed to the next course of action and continue until he or she comes up with the first effective course of action. The third variation takes the form of "If, then (???)," where the decision maker considers other outcomes of a reaction. However, this is where inexperience is relevant. Inexperienced decision makers are more likely to develop different types of courses of action before choosing the most efficient one.

NDM is highly relevant to the leaders or officers of organizations that are affiliated with emergency services such as firefighting, search and rescue units, police, and other emergency services. NDM is applied to both the experienced and the inexperienced, and to the ways in which they manage their decision making processes. The NDM model is developed as samples for organizations on how important decisions can affect important situations--either saving or losing lives. The model developed can be used as a study mechanism to enable an organization to fill in the gaps and to determine which type of NDM is most applicable to that organization.

UNIT 4: THE ANALYTICAL SIZEUP PROCESS

OBJECTIVES

The students will:

1. *Discuss the scientific method.*
2. *Describe the primary sizeup factors and determine their impact on objectives and strategies.*
3. *Analyze the Command Sequence Action Planning Cycle.*

THE SCIENTIFIC METHOD

The scientific method involves observing facts and then testing the accuracy of these facts through continued observation. If the facts prove accurate, the scientist seeks some causal relationships between them and other happenings from which logical hypotheses can be deduced. Such hypotheses are in turn tested. If they are found to be true, they are used to explain some aspect of reality; their ability to do this means that they have value in predicting what will happen in similar circumstances. Hypotheses that are able to do this are then called principles.

For decades, the fire service has been observing facts at fire situations. These facts have led to valid hypotheses, or principles. By putting these principles into some logical order--that is, by systematizing them--we can take a step toward developing a science of firefighting. We can take an even greater step if we accept the help of scientific researchers in experimentation and verification.

Recognized authorities maintain that science is systematizing. This is not only because the underlying principles have been discovered, but also because the relationships between variables and limits have been ascertained. Accordingly, in this text, we will try to explain what variables and limits are, and how relationships between them have been ascertained. We will also try to explain how principles relating to firefighting or fire suppression have been derived.

Variable: In this text, variables associated with fire situations are classified as "primary" and "objectives and strategy." This is done to indicate a time sequence for evaluation, and does not necessarily indicate a degree of importance. Such factors are variables because they change from fire to fire. Primary factors are the conditions or elements that should be recognized and evaluated on arrival and during operations.

Strategy(ies) and tactics are the activities undertaken to achieve objectives; such activities include forcing entry, ventilating, using hoselines, overhauling, making decisions, establishing Command Posts (CPs), and so on. These variables have reciprocal relationships because of the inevitable effect of one activity on another.

For example, effective ventilation facilitates the advancement of hoselines. Yet ineffective stretching or laying of hoselines nullifies the effectiveness of ventilation, or even causes it to be harmful, if it results in spreading the fire before a line is ready to operate.

Therefore, objectives and strategy(ies) also can affect such primary factors as extent of fire after arrival, heat and smoke conditions, exposure hazards, duration of operation, requirements to operate, etc.

Limits: Limits are specifications for acceptable solutions at fires. For practical purposes, there are two particular limits. First, if there is a life hazard for occupants, risks to personnel ranging from merely unusual to extreme may be warranted. Second, if there is no life hazard for occupants, personnel are never to be jeopardized unnecessarily.

Underlying principles: Underlying or basic principles are fundamental truths applicable to a given set of conditions or circumstances; they indicate what may be expected to happen under these conditions or circumstances. Scientists already have discovered some of the principles that concern combustion: extinguishing of fire; transfer of heat by conduction, convection, and radiation; and the flow of liquids and gases. Using these basic principles, the fire service has formulated more specific principles governing fire activities, such as ventilating and using hoselines.

Principles governing the flow of fluids lead fire personnel to expect that when an obstruction reduces the velocity of convection currents rising through a vertical structural channel, pressure will increase and will be greatest immediately beneath the obstruction. This will cause the fire to spread toward areas of lower pressure, or least resistance, either mushrooming or moving horizontally. But if the obstruction is removed--for example, by making an opening in the roof directly above the involved vertical structural channel--the velocity of the rising gases will increase and the pressure will decrease. The decreased pressure will then minimize the possibility of horizontal spread of fire in the cockloft (the space between the top-floor ceiling and the underside of the roof). Similar reasoning applies to the formation of many other specific firefighting principles.

Firefighting principles are universal in application. That is, they are the same for all departments, large or small, paid or volunteer. However, they may have to be applied in different ways, because the primary factors change from one community to the next. For example, the primary factor of the availability of water supply varies in different communities. Regardless, when there is a life hazard for occupants the same principle applies to all: The first water available is used as quickly as possible, and as long as necessary, between the fire and the endangered occupants or their means of escape. It does not matter whether the water comes from a booster tank in a small community or a standpipe riser in a city highrise building. It is this universal application of firefighting principles that makes standardized training both possible and practical.

THE PRIMARY FACTORS CHART

In order to systematize the science of firefighting, it is necessary to define variables and limits and to ascertain the relationships between them. Primary factors are considered variables because they change from fire to fire. The study of primary factors and the relationships between them will help officers carry out the first two steps in the action plan. These two steps are quite important. The first is to note and evaluate as accurately as possible the primary factors that are pertinent in the given situation. The second is to select objectives and activities on the basis of the evaluation made.

The Primary Factors Chart (see page SM p. 4-6) facilitates the study of relationships between primary factors, and indicates the sequence of coverage. Extensive explanations are necessary since all primary and secondary factors that could conceivably be pertinent at all types of fires are considered. Lectures or discussions of past or structured fire situations, even when supplemented by motion pictures or diagrams, are of limited value. This is because the critical factors are specified, whereas at an actual fire critical factors must be recognized and evaluated under possible hectic conditions. In addition, such lectures or discussions may provide helpful information about only one set of circumstances in one given situation. Officers actually need helpful information about any set of circumstances in any fire situation.

EVALUATING PRIMARY FACTORS

Life Hazard for Occupants

Rescue work: Forcible entry is made with less regard for structural damage, exposure hazards, or the availability of a hose stream to protect personnel.

Ventilation unfavorable to controlling and extinguishing the fire may be needed to draw heat and smoke away from endangered occupants.

Available hose streams are used as required to cover the life hazard. In short, a life hazard for occupants and the resultant rescue activity can delay efforts to control the fire, making extinguishment more difficult.

Covering exposures: Life hazard may make the task of covering exposures more difficult and may delay the attack on the fire itself (e.g., aerial ladders used to remove occupants may have to be repositioned to use ladder pipes in protecting exposures).

This can entail a harmful delay, intensifying and possibly creating new exposure hazards. In addition, involvement in rescue work will delay the evaluation of factors to establish an order of priority in covering exposures. Such coverage may have to wait for the arrival of additional resources.

Column #1 — Primary Factor - Situation Awareness- Chart

Primary Factors	(Check appropriate boxes) Pertinent Sub-Factors (P)	P
Life Hazard	Occupants	
	Firefighters	
Location/Fire	Fire Building on Arrival– Burn Time	
	Exposures On Arrival - Burn Time	
	Fire Spread Considerations Radiation/Conduction/Convection	
Construction	Fire Building – Type 1-2-3-4-5 (Lightweight Awareness)	
	Exposures – Type 1-2-3-4-5 (Lightweight Awareness)	
Occupancy (Contents)	Fire Building – (Fuel Load)	
	Exposures (Fuel Load)	
Height	Fire Building (Front-Rear)	
	Exposures (Front-Rear)	
Area	Fire Building/Configuration	
	Proximity of Exposures /Configuration	
Structural Collapse	Fire Building – Burn Clock After Arrival	
	Exposures – Burn Clock After Arrival	
	Collapse Zone – Safe Corridors	
	Apparatus Placement	
Weather	Visibility	
	Temperature/Humidity	
	Wind – Direction/Velocity	
Resource Requirement	Apparatus/Personnel/Equipment - RIT	
	Water Supply/Suppression Agent	
Auxiliary Appliances	Fire Building Supplied	
	Exposures Supplied	
Topography	Front-Rear	
Explosions/ Back Draft	Proper Ventilation Flash-Over Time Awareness	
Time	Time of Day Time of Year Duration of Incident	

Column #2 — Incident Objectives Attainable/ Measurable/ Flexible

Examples of Incident Objectives:

- Safe Removal of All Occupants within 10 minutes.
- Contain and Control Fire to Room/Building of Origin within 10 minutes
- Contain, Control and Limit Fire in Exposures within 10 minutes
- Other.

List Incident Objectives:

1. ______________________________
____
2. ______________________________
____
3. ______________________________
____
4. ______________________________
____
5. ______________________________
____

Column #3 — Activities (Strategies)

[R] Rescue
- Interior/Exterior/Both

[E] Exposure Protection
- Exposure Examination

[C/E] Confinement/Extinguishment
- Hose Line Placement

[O] Overhaul
- Expose Hidden Fire

[V] Ventilation
- Removal of Occupants
- Fire Control

[S] Salvage
- Water – Run-Off
- Apply Covers

Forcible Entry
- Location
- Method

Special Equipment
- Imaging Cameras

List Incident Strategies	Assign Tactics:
For Objective # 1:	
For Objective # 2:	:
For Objective # 3:	
For Objective # 4:	
For Objective # 5:	
______________	

Column #4 — Evaluate Effect of Activities (Strategies) Every 10 Minutes

Effective	Ineffective

Identify alternative strategies for firefighter safety when occupant safety has been determined not to be a Primary Factor.

- ______________________
- ______________________
- ______________________
- ______________________
- ______________________
- ______________________
- ______________________

Life Hazard for Firefighters

Safety: Acceptance of warranted risks is essential for good results in carrying out fire activities.

Location of Fire on Arrival

Entry: It is preferable to force entry near the location of the fire, especially when the area involved is large. This enables firefighters to get water on the fire more quickly and minimizes the physical hardship entailed in advancing hoselines.

Ventilation: The main objective of ventilation is to localize the fire--to stop its horizontal spread within a structure. For example, if a fire is extending into a cockloft via a pipe recess or similar channel, the roof should be opened. If this were done in the wrong place, it could be disastrous.

Opening a roof in the front when the fire is coming up in the rear can involve the entire cockloft and turn a first-alarm fire into a major fire. It is not advisable however, to open directly over a fire on an intermediate floor, because this could involve the upper floor.

Another objective of ventilation is to protect occupants pending rescue. For example, if a fire has cut off the escape route of occupants, the decision where to vent is determined by the need to draw heat and smoke away from them. This is done even if the required openings increase the intensity of the fire and the possibility of spread (not to occupied areas, of course). If only horizontal ventilation is required, the location of the fire will indicate the floor to be vented and the openings in the roof.

The decision when to vent is determined by whether or not the location of the fire is creating a life hazard. If it is, ventilation may have to be started as soon as possible, even if hoselines are not ready or if an unoccupied exposure hazard may be created or intensified.

Removal of occupants: Location of fire is critical. A fire on the first floor of a five-story residential building could endanger all the occupants and necessitate their removal.

However, if the same fire originated on the fourth floor, it might be better to move occupants of the fifth floor to the first or second floor. This is especially true if the fire occurs on a cold night and occupants are scantily clothed.

Checking for extension of fire: A fire near a vertical or horizontal structural channel will spread readily. Officers assigned to check for fire extension should therefore note the location of fire and keep in mind how heat travels by conduction, convection, and radiation via exposed channels.

Placement and use of hoselines: The location of the fire determines the amount of hoseline to be stretched and, in some cases, the size. The minimum size hoselines to provide adequate protection for personnel are 1-3/4 inch and 2-1/2 inch. Smaller hoselines may not provide adequate water to combat the heat.

If the location of the fire has created a life hazard, hoselines should be placed to facilitate rescue, and should operate as soon as possible and until rescue is completed. If there is no life hazard, the fire location will still govern the placement of lines.

Use of special equipment: High-level fires may require the use of standpipe systems, ladder pipe, or other high-caliber streams. The fire may also influence the decision to use sprinkler systems or fixed systems of various types.

Extent of Fire After Arrival

Entry: A light haze of smoke visible through heavy glass doors that feels cool to the touch usually indicates fire of small extent. In such circumstances, entry should be made in the manner least damaging to property. Use of a key may be a solution. Where the extent is obviously substantial, however, such consideration is not warranted. Speed in getting an efficient operation underway is more important.

Ventilation: The amount of structural damage done in ventilating should have a reasonable relationship to the extent of the fire. That is, a hole should not be made in the roof when opening top-floor windows would be sufficient. But if the extent of fire is great, proper ventilation is more important than any structural damage.

Fire extent may determine whether roof ventilation should be attempted at all. For example, if two or more floors in an old loft building are fully involved in fire, one should not try to work either on the roof or in the structure unless rescue work makes it essential. If the fire is so great that roof or fire escape venting is out of the question, heavy outside streams or aerial-ladder pipes may be used to break windows.

Construction

It is important for fire officers to know the type of structure that is burning. Such knowledge will help them determine the speed with which the fire may spread, whether it will spread vertically or horizontally or both, and how the objectives of rescue and extinguishment can best be achieved.

Knowledge of construction is essential if officers are to operate efficiently at structural fires, which often proves the ultimate test of their knowledge and skill (science and art). Officers who can check internal extension of fire more frequently without unduly jeopardizing their subordinates should be rated more highly than those who resort to exterior operations. These latter operations cause maximum instead of minimum damage and consequently more often "lose the building."

Officers are not expected to be personally familiar with the structural layout of every building in their districts or communities. It is not unreasonable, however, to expect them to be familiar with structural features of special significance in local types of construction. In addition, they should realize that a fire in a highrise or large industrial complex is no longer solely the responsibility of city firefighters. Hence, suburban as well as city firefighters should know how the construction associated with such occupancies can affect other related factors, and thereby an entire fire operation.

Fire resistiveness in buildings depends, among other things, on the manner in which floors, walls, partitions, ceilings, columns, and girders are constructed. It also depends on floor areas, combustibility of the structural parts, roof conditions, and the degree to which horizontal and especially vertical channels are fire-stopped.

Horizontal channels could include hallways, corridors, ceiling spaces, cocklofts and plenums (the space between the ceiling and the floor above), floor spaces, doors, windows, and ducts. Fire also can travel horizontally when heat is conducted, for example, by metal beams, through intervening walls and partitions, or from wooden beam to wooden beam when they abut.

Vertical channels could include partitions, stairways, elevator shafts, dumbwaiter shafts, laundry chutes, ramps, escalators, air and light shafts, recesses enclosing pipes or electrical conduits, conveyors, and ducts associated with air-conditioning systems and large cooking ranges. Fires can also spread vertically by burning through floors or ceilings or from floor to floor on the outside of the building.

Materials used in construction naturally affect the spread of fire. Some masonry materials with high fire-resistive ratings contain water in their makeup. This water slows down the heat transfer rate; it absorbs large amounts of heat and delays transmission until it has been evaporated. On the other hand, good insulating materials generally have low fire-resistive ratings. They, too, can slow down the heat transfer rate, partly by means of entrapped air, which absorbs heat and delays transmission, but not as effectively as high fire-resistive materials.

Ordinary Construction in Residential Buildings

This construction is common in congested areas of many large cities. It features many combustible structural members, fire escapes with gated windows, and numerous inadequately fire-stopped horizontal and vertical structural arteries, both open and concealed. It has one advantage, however: It is not tight enough to prevent the escape of considerable heat by convection and radiation, and it is therefore less likely to cause a backdraft or smoke explosion. Roof bulkheads, doors, and plain glass windows allow for ordinary ventilation.

The disadvantages cited for this type of construction can cause extensive fires on and after arrival, severe heat and smoke conditions, poor visibility, interior exposure hazards, and life hazard for occupants. The open construction allows much heat to escape, but this can become a disadvantage if it creates or worsens an exterior exposure hazard. Such a hazard can increase requirements to operate effectively, prolong the operation, and increase hazards for personnel.

Entry: In recent years it has taken longer to gain entry because of the increase in crime and the resulting increase in locks on hallway doors and extended locked gates inside fire escape windows.

Ventilation: Horizontal ventilation is achieved by opening doors and windows. Vertical ventilation is achieved by opening roof bulkheads and making openings in the roof as conditions warrant. Usually both kinds of ventilation are required.

Placement and use of hoselines: Usually, hoselines are stretched via the interior stairs, and less frequently via fire escapes, ladders, and ladder-tower platforms.

Overhauling: There is likely to be more overhauling than usual if combustible structural parts are involved and concealed spaces have to be checked out.

Removal of occupants: Interior stairs are the preferred means of removing occupants, unless they are above the fire. In the latter case, fire escapes are used, but aerial ladders or tower-ladder platforms sometimes may be necessary. Occupants trapped in the rear without access to fire escapes or not reachable from ladders may be removed by firefighters who are lowered to them by ropes. In some instances, occupants taken to the roof via rear fire escapes can be brought down interior stairways of adjoining buildings.

Ordinary Construction in Commercial Buildings

These ordinary structures have combustible structural members that burn readily. They also lack fire-stopping material, thus enabling fire to spread quickly both horizontally and vertically. In addition, they are frequently old, which aggravates structural defects. Older loft buildings have still other unfavorable characteristics: subcellars, unusual depth (in some instances, 200 feet), unprotected metal columns, wide floor spans, and iron shutters.

Entry: In commercial buildings, entry is seldom a problem during business hours. At other times, entry is hindered by iron shutters and door locks that often are intricate and difficult to force.

Ventilation: Ventilation is hampered by iron shutters. Sometimes there are conditions conducive to smoke explosions. In such cases it is of utmost importance to vent the roof, side, rear, or front of the fire area before opening at lower levels for entry. Fires in cellars or subcellars have limited means of ventilation: deadlights in sidewalks, sidewalk covering of entrances into cellars, and, under definitely controlled conditions, openings made in floors above the fire. In some situations fog lines or smoke ejectors can be helpful.

Rescue work: Rescue work can be impeded by a number of factors. High temperatures are common; severe smoke conditions may impair visibility; floor space may be crowded by workbenches, machines, and other materials; in some instances only a 3-foot aisle space is required by law. Frequently there are many employees, and exits may be unfavorably located, particularly above the second floor. Some exits, for example, are about 40 feet from the street front because the stairs run straight back to the third-floor landing. In addition, these exits may be in the heart of the fire. In such cases, a ladder pipe or other appliance can be operated through the street-front windows so that entry can be made with a handline (two lines if warranted) via ladders or even the interior stairway.

Ventilation: Ventilation is a potent weapon for minimizing the life hazard. But it cannot always be used effectively unless the fire is located favorably or a roof opening can be made quickly to draw heat and smoke away from the life-hazard area. Occupants may be found conscious but so panic-stricken that rescuing them becomes unusually complicated. Some, unless strongly urged and guided, seek safety blindly, even disastrously.

Some of these buildings have two interior stairways, located at a distance from each other; others have one stairway and a fire escape. Occupants also can be rescued by means of ladders, tower-ladder platforms, and interior stairways of adjoining buildings when such buildings are accessible from the roof of the fire building. In extreme cases, life nets have to be used.

Placement and use of hoselines: Where a life hazard is present, the first hoseline is stretched and operated as quickly as possible between the fire and the endangered occupants or between the fire and the means of escape. Outside streams may be needed at times to help with the positioning of handlines.

Where no life hazard exists, lines are placed and used according to principles. However, in these loft buildings, the first line is more often stretched up the interior stairway and used to execute a holding action, to confine the fire to the involved occupancy, while the second line is brought up the fire escape, if one is available, to put out the fire. Because of the unusual depth of some buildings, and if the location of the fire is favorable for using such a technique, this is an acceptable variation of the usual procedure of operating the line from inside. Any auxiliary appliances (sprinkler, perforated pipe systems) must be supplied as conditions dictate. The correct inlet must be supplied, or warranted, and severe water damage may result. At low-level fires the correct inlet may be chosen by feeling for heat conducted from the fire area by connecting piping. Even the location of the fire may be found this way if all inlets are marked properly.

Supervision: The unusually risky nature of operations at loft fires requires extremely careful supervision. Entire fire companies have been injured or killed by falling through collapsed roofs and floors. Effects of the relationship among pertinent factors at these fires must be weighed with exceptional care before operations are initiated. All officers should be keenly alert to signs indicating possible structural collapse so that firefighters can be removed in time, and communication should be established promptly so that all units can be contacted quickly. Some authorities recommend an exterior operation when two or more floors in such buildings are fully involved. This is a sound recommendation, but an exterior operation may be advisable even before the fire reaches that extent if there are conditions such as wide floor spans, unusual depth, combustibility of structural parts, excessive age of building, extended burn time of fire, presence of heavy machinery or stock that absorbs water, and unprotected metal columns susceptible to failure under intense fire conditions. Unprotected steel begins to distort and lose strength at 1,100 °F (593 °C). When heated and then struck with cold water, cast columns, often found in older buildings, may fracture.

Overhauling: Since many parts of these structures are combustible, more than unusual amounts of structural overhauling can be anticipated.

Wood-Frame Construction

There are many variations of the exterior wall: wood shingles, clapboard, matched boards, brick veneer, stucco, metal-clad over wood sheathing, and so forth. Private, one-, or two-story dwellings feature such construction.

Some authorities maintain that large multistory frame buildings can be made reasonably safe if proper attention is given to protection against the horizontal and vertical spread of fire, against exposure fire, and against fire conditions which may be anticipated on the basis of expected fire loads. However, the same authorities also point out that conflagration may occur at fires in primarily residential sections due to closely built combustible construction and wood-shingle roofs. Conflagrations are considered possible where certain construction practices are allowed, and where protection forces are weak and water supplies are inadequate. As a matter of fact, such fires can occur even where protection is strong and water supply is adequate, as attested by a fire involving many beach bungalows within the limits of a large city.

Statistics show that there is a large loss of life in rural and urban dwellings, presumably in buildings of frame construction. The lack of a prompt and adequate response by firefighters has much to do with these statistics, but structural features also play an important role.

Fire-Resistive Construction

In fire-resistive construction, walls and structural members are made of noncombustible materials or assemblies with the following minimum fire-resistive ratings: 4 hours for exterior walls, firewalls, party walls, piers, columns, and interior structural members which carry walls; 3 hours for other girders, fire partitions, floors (including their beams and girders), roofs, floor fillings, and required stairway enclosures. Such construction does not feature central air-conditioning systems. The Empire State Building fire of July 1945 is a good example of how fire-resistive construction affects primary factors and objectives and strategy.

The Empire State Building is of steel skeleton construction and, although it differs somewhat from the specifications mentioned above, it fully qualifies as fire resistive. The fire occurred after a U.S. Air Force bomber crashed squarely into the upper part of the building, spraying approximately 800 gallons of gasoline in the area where it struck. Parts of the 78th and 79th floors caught fire and burned furiously. Gasoline also descended down one elevator shaft and caused a shaft fire all the way down to the basement level. "Too much cannot be said of the sturdy, well-constructed, and fire-resistive nature of the Empire State Building. Structural damage is comparatively negligible. The fire did not spread to other floors or portions of the building."

At the same time, it must be admitted that the fire is not always confined to one floor in the type of construction referred to as truly fire resistive. The Woolworth Building had a grease-duct fire that extended from the basement to the roof, and the Empire State Building had a water-pipe insulation fire in a shaft that reached from the 31st to the 66th floor. Fires in shafts enclosing electrical cables, as well as in elevator shafts, contribute to the spread of heat and smoke in any construction. However, the records show that spectacular fires were very few and the loss of life was minimal in such structures, as compared with their successors. The exception, of course, was the plane crash mentioned above that sprayed 800 gallons of gasoline on two floors of the Empire State Building, although it still did not jeopardize the strength of the building.

Fire towers in fire-resistive buildings are in all likelihood the best means devised for the escape of occupants from fires. With some exceptions, older building codes required at least one such tower for public and business buildings 75 feet or more in height. Enclosing walls have a 4-hour fire-resistive rating. Outside balconies or fireproof vestibules connect the fire tower and the structure. Such balconies or vestibules are separated from the structure and the stairs by self-closing fire doors which can be opened from both sides without a key. They open on a street or yard, or on a vertical open court, which has a minimum net area.

It is practically impossible for heat and smoke to get into such fire towers because when doors are open between an involved occupancy and the balcony to advance a line or for other reasons, emerging heat and smoke rise vertically through the open court, rather than traveling horizontally through the fire door into the tower. Stringent regulations governing openings in court walls minimize the hazard created by rising heat and smoke.

Entry: In commercial structures, the watch staff may cause some delay if they wait for the fire department at the fire floor instead of at the street level from where they can direct the firefighters. In residential fire-resistive structures, such as hotels, one should use great care in opening obviously hot doors to unventilated, involved guest rooms; this can cause a backdraft with drastic results for personnel. In such cases, it is suggested that the door be kept closed, and indirect attack be used by injecting fog through a small opening made in the partition to the fire room. The fire room can then be entered.

Ventilation: Doors and windows are used for cross-ventilation. Make openings first on the leeward and then on the windward side. Elevator shafts are not recommended because they only transfer the ventilating problem to an upper floor, endangering occupants who may be using the elevators and personnel working near the open shaft. In addition, they may cause unnecessary damage to the elevator mechanism. Use of fire stairs for ventilating is not recommended because the rising heat and smoke could endanger occupants trying to come downstairs. Also, if the occupants do not need the stairs, they could be used to alleviate heat and smoke conditions on the top floor.

Placement and use of hoselines: Fire departments have their own regulations about supplying and using hoselines from standpipe systems. Usually, it is advisable to stretch the first line from the outlet on the floor below the fire, and the second line (if needed) from the outlet on the fire floor. Lines are usually advanced from the windward side of the fire, especially down along corridors.

Overhauling: Overhauling is likely to be confined to contents rather than to structure, even though a major purpose of overhauling after control is established is to check contents and structural parts for any lingering fire. Since structural channels have to be checked out in order to declare a fire under control, comparatively little remains to be done about such channels thereafter, although smoldering contents may require much overhauling.

Removal of occupants: In buildings featuring fully fire-resistive construction without central air-conditioning systems, the fire department rarely has occasion to vacate occupants above the fire floor. As a matter of fact, at fires in hotels of this type, it is preferable to leave occupants of the floor in their own rooms rather than take them out of smoke- and heat-free areas into hot and smoky corridors toward fire stairs.

In very unusual cases, however, fires can extend vertically in the best fire-resistive construction due to explosions or via exterior windows or shafts enclosing electrical conduits or insulated water pipes. In these instances, occupants above the fire floor must be removed, preferably by means of fire towers. Other ways include using a stairway that does not enclose the standpipe riser used to supply hoselines, because such a stairway is open at the fire floor and allows smoke and heat to enter and rise. Where removal of occupants from above the fire is necessary, particularly at high levels, leaving them just a floor or two below the fire can speed such removal, unless the need for medical attention dictates otherwise. Elevators exposed to heat and/or smoke, or affected by call buttons responsive to heat, smoke, or flames, should not be used.

Modern Highrise Buildings

These structures generally have been built in the international style of steel and glass, with open floors, service cores, sealed windows, air-conditioning systems, and plenums. The cores are of reinforced concrete and contain stairs, elevators, utilities, and air-conditioning equipment. Plenums contain air-supply ducts, lighting fixtures, and powerlines in conduit, telephone cables, and communication cables. Careful study of the 1993 World Trade Center fire shows how modern highrise construction affects other primary factors.

The building is subdivided into many vertical components so that the possibility of total involvement in fire is almost negligible. There are only three vertical shafts (elevator) that travel the height of the building. Only one of these has openings on every floor and is designated for fire department use. The other two shafts open only at the ground floor, the sky lobbies (44th and 78th floors), and in the upper third of the building. The chimney effect so often mentioned in highrise buildings is not 110 stories in effect, but is divided into four components by the action of the air-conditioning systems. None of the stairways runs straight from the top to the bottom of the building. Stair towers are offset at various floors where the size of the core changes or the number of elevators serving a floor is reduced. At each of these points, horizontal passageways lead to the new shaft location and fire doors are provided in the passageway. These doors would prevent smoke from contaminating a stairway from top to bottom. The arrangement of elevators is such that they could not carry fire throughout the building, but could be a factor in only a limited number of floors. It might even be feasible to use most elevators for evacuation--all except those that served the seven or eight floors that included the fire floor.

An item of particular interest to the fire service is the fact that the air-conditioning system can be placed in the purge mode after a fire alarm is received. This means that fresh air is drawn out of all the tenant areas on the affected floor to prevent smoke from spreading throughout the building. By supplying fresh air to the core and shutting down its normal vents, elevators as well as stairs can be pressurized and exit corridors can be kept free of smoke. To draw air out of the tenant areas, only the return air fans operate and discharge to the outside of the building.

Proponents of this system apparently feel that a normal temperature would exist in the return airshaft because of the volume of cool air being drawn in from other floors. In the meanwhile, the supply air fans are shut down, and the question arises about the overall effects of such tactics on occupants in the tenant areas affected, especially if the fire operation is prolonged and the weather is hot.

Air-conditioning systems: In one of the types of highrise construction, the air-conditioning system serves the core only, and occupancies around the perimeter of the building are provided with individual units. Thus, smoke and heat cannot be conveyed into these occupancies by air-conditioning system ducts. In case of fire, the main system can be shut down temporarily and the individual units can be operated on exhaust, thereby creating a favorable flow of smoke and heat, facilitating the advancement of hoselines, and expediting extinguishing. At the same time, smoke and heat are being driven away from, rather than toward, the main air-conditioning system, thus lessening the likelihood of the spread of smoke to other floors via the ducts in such systems. If necessary, operating the return-air fans only and dumping outside the building can dissipate smoke and heat effectively in the plenum area over an involved occupancy. Low-velocity fog injected into involved plenums could minimize heat conditions. In addition, it is possible that individual air-conditioning units, operating on intake on the fire, except in the involved occupancy, may abet the flow of heat and smoke out of the structure. They may also make it unnecessary to break windows to get air.

In the best fire-resistive construction, mechanical failure of controls, inadequate control over flammable contents, and structural defects which negate the fire-resistive rating of floors and partitions, increase the possibility of both vertical and horizontal spread of heat and especially smoke at a highrise fire. Aside from such possibilities, however, construction that features an air-conditioning system that serves the core of the building only and individual units for occupancies around the periphery of the building is a major improvement in fire protection.

Moreover, fire operations can be carried out more safely and effectively. Finally, such construction suggests a favorable alternative to the use of pressurized stairways and elevators. Pressurized systems are not features of the construction discussed here.

Although the air-conditioning systems in new highrise buildings prevent some hazards, older systems present even more. Many systems in use today were installed before effective laws governing their installation came into being. At the least, this lack resulted in little standardization, and generally it resulted in many shortcomings. Combustible materials such as cotton, paper, steel wool, and felt were used for filters, and many were also coated with high-flashpoint oil to catch the dust. Some portions of the ducts were lined to reduce transmission of noise or heat through the duct walls, and sometimes the lining was combustible. In addition, ducts could be dangerously near other combustible materials, which eventually would be susceptible to ignition. Sometimes, too, coils containing a toxic or flammable refrigerant gas could be distributed throughout the ducts, intensifying the life hazard for all concerned.

Dampers may help to check the spread of heat in both new and old systems, but to date there is no evidence that they can control the spread of smoke and gas satisfactorily. Another common feature is supply inlets in exterior walls that create an exposure hazard from fires in other buildings.

Other air ducts: Of special significance are air ducts with roof fan housings that are designed to remove gas and heat from large cooking ranges in restaurants, nightclubs, hospitals, and so forth. With improper maintenance, grease can accumulate in ducts and ignite, usually in peak hours in restaurants and nightclubs. Rescue work can be difficult when owners are reluctant to let customers go without paying their bills, customers are reluctant to leave without their coats and hats, or exits are chained to prevent people from sneaking in without paying.

Smoke may obliterate exit signs and occupants may try to get out by the way they entered. Or a sudden worsening of heat and smoke conditions caused, for example, by prematurely shutting down the fan, can result in panic. The life hazard can be worse if the involved occupancy is below ground or inaccessible from ladders or tower-ladder platforms.

Regulations governing access to exits are frequently violated. Difficulties are worsened by the fact that protective hoselines have to be stretched without interfering with the egress of occupants. In such cases, fans should be kept operating to alleviate smoke and heat conditions pending rescue, assuming a worse hazard is not thereby created on the leeward side of the roof fan housing.

While operating in an involved kitchen area, personnel should be aware of some unusual hazards: gas valves still in the "on" position after the flame is out, large pots containing very hot contents which can be overturned, and floors made slippery by melted grease. Extinguishing can usually be achieved in the kitchen area by one or two fog lines.

Extension can be reduced by sweeping the exterior surface of exposed ducts with fog, or injecting fog into the duct if there is sufficient heat to cause vaporization. A line to the roof fan housing also may be needed to extinguish and prevent extension of fire.

The hazards presented by these fires can be reduced greatly by the installation and proper maintenance of auxiliary appliances such as approved steam extinguishing, carbon dioxide, dry powder, fine water spray, or the newly developed combination fan-and-grease collector systems. However, such protection is not provided everywhere and, in addition, there is always the possibility of mechanical failure or human shortcomings relative to maintenance.

Ducts are present in many forms in various occupancies, and in many respects their effects resemble those created by horizontal and vertical structural channels. Fog can be helpful in coping with fires in such ducts and channels, provided there is sufficient heat to vaporize the fog so that it can exert an effective smothering and cooling effect. In vertical ducts and channels it is preferable to inject the fog at fire level. Experimentation by fire research scientists in this area is desirable.

Alterations in Building Construction

Alterations are not always carried out in accordance with the law or with recommendations in nationally recognized codes, nor are defects of many years' standing always fully rectified by retroactive laws. In addition, structural changes required at times because of a new occupancy are not always made. As a result, in some cases areas remain excessive, metal columns are inadequately protected, and door assemblies in dividing walls lack the required fire resistance. In other cases, installed dropped ceilings cover structural defects, and frequently alterations increase the number of concealed spaces by various kinds of false-work, double or triple flooring, and so on. Before explaining how alterations in construction can affect other primary factors and objectives and strategy, let us review an actual fire in a building that had undergone alterations.

The fire originated about noon on a Sunday in September. It started in the kitchen area at the rear of a restaurant in a seven-story residential brick-and-joint building erected in 1887. Originally a brick and concrete roof served as a terrace, but it was subsequently covered with wood roofing, seven layers of tarpaper, and tar finish. Many years later, in 1967, extensive alterations were made to increase the number of apartments per floor. In the process, ceilings of bathrooms and the public hallway were dropped and sheet-rock was used between apartments and public hallways. The sheet-rock was omitted, however, on the inner side of public hallway partitions next to furred-out pipe spaces, and these pipe spaces were not adequately fire-stopped. The required sheet-rock had also been omitted on one or both sides of public hallway partitions, but the hung ceiling covered this omission. Fiberglass bats used between studs for fire-stopping and soundproofing proved to be completely ineffective as a fire-stop under the heavy fire conditions.

As a result, the fire entered an L-shaped 5- by 5-foot pipe recess at the second floor and raced unimpeded into the cockloft. Openings punched through walls for wiring and plumbing lines and covered by the hung ceiling caused horizontal spread of the fire. Fortunately, the time of origin of the fire minimized the life hazard for occupants, who could be alerted and removed readily. Fortunately also, fire escapes had been provided during the alterations and were helpful in the operation.

The major objective was to confine, control, and extinguish. The greatest difficulties were in trying to confine and control the fire in the cockloft. The fire there had to be attacked from below, and the severe heat and smoke conditions and poor visibility could not be alleviated effectively by roof ventilation. Control finally was achieved by a third-alarm assignment and use of 11 handlines, aided by the work of ladder and rescue companies. Thirty-seven injuries were reported as a result of this fire, and 44 air cylinders were expended, attesting to the severity of the smoke conditions and the absence of effective roof ventilation.

Alteration in this case represented errors of omission as well as commission, and adversely affected location and extent of the fire on and after arrival. They also worsened heat, smoke, and visibility conditions and the exposure hazard; increased the duration of operation and requirements to operate, especially rescue company equipment; intensified the life hazard for personnel; and could have created a very serious life hazard for occupants if the fire had occurred at night.

Neither alterations abetting horizontal spread of the fire, nor the pipe recess abetting vertical spread were visible, which made it difficult to determine the location and extent of the fire on and immediately after arrival. Concrete and brick construction on the roof prevented ventilation that could have localized the fire and alleviated smoke and heat conditions. This made it extremely difficult to operate lines used to attack the fire in the cockloft from the floor below. Roof construction and other alterations increased the amount of structural overhauling needed both before and after control was established.

If required structural alterations are not made when an occupancy changes from noncombustible, highly undesirable results can accrue. Such alterations may necessitate new partitions to subdivide areas, protection of metal columns, a higher fire-resistive rating for doors in subdividing walls, and so forth. In one case, however, failure to comply with these requirements resulted in total involvement and collapse of the fire building, and a $2 million fire loss.

Buildings Under Construction

During the day, fires in these structures usually do not present serious life hazards because they are discovered quickly and the average worker can get out of harm's way readily. At night, however, the fire department may have to search for one or more watch staff, and the hazards in general, already great, are intensified.

Fires in buildings under construction, particularly at high levels, can reach major proportions quickly. There are many reasons for this: construction is wide open, providing ample oxygen; much fuel is supplied by combustible debris, wooden interior scaffolding, chutes, sheds, shanties, and possibly concrete forms; paints, oakum, excelsior, tarpaulins, and the like are additional sources of fuel; tanks containing flammable gases for use in cutting torches, dangerous gases for heating purposes, and cartridges used for riveting, may be present and exposed; winds prevailing at high levels generally are strong. There may be, and often are, abnormal delays in getting water to the fire floor. In addition, openings in floors and the absence of windows, doors, and completed walls and partitions abet horizontal and vertical extension of the fire.

There is always the danger of timbers falling from topsides. The exposed steelwork on top may buckle, weakening the structure. The concrete beams and slabs on upper stories may not be set; if the wooden supporting forms burn, the floors may drop. Fires at high levels beyond the range of high-caliber outside streams present the most serious problems, especially if standpipe systems are inoperative. In such cases, a fire that actually requires only one stream for extinguishing may necessitate the use of a full first-alarm assignment because the line may have to be stretched up the outside of the structure, and this is a laborious process.

Danger from the use of explosives for blasting in the very early stages of construction is somewhat alleviated by strict regulations, careful surveillance, and competent watch staff. Some fire departments, as a precautionary measure, prohibit the use of radio transmitters on department vehicles within 150 feet of magazines containing explosive caps; at close quarters radio waves may energize the detonating mechanism.

Structural features are considered in conjunction with occupancy contents (such as combustible materials and flammable gases). Such total situations can have adverse effects on the location and extent of the fire on and after arrival. They can create smoke conditions that develop problems in exterior exposures, heat conditions that can buckle exposed steelworks, and a spark-and-ember hazard that can worsen the exterior exposure hazard. They also can result in greater alarm requirements to operate and a prolonged operation, with considerable danger for personnel, especially if the fire is at night. There is even more danger if tanks containing flammable gases explode.

An oddity about this type of structural fire is the minimal need for forcible entry and ventilation. Stress is on the placement and use of lines. Inadequate guardrails may protect when lines are being advanced via stairways and on floors. Supervision is exceptionally important because stairs at the upper levels may be unfinished and there may be floor openings. Operative standpipe systems should be supplied and used, or else lines may have to be stretched up the outside of the structure, in which case the need for sufficient personnel must be anticipated.

Fire in buildings under construction can sometimes be kept minor by the prompt use of a deck pipe or similar equipment. For example, one case where the standpipe system was inoperative, a deck pipe was used to extinguish a fire in debris on a setback on the 12th floor while a line was being stretched up the outside of the building.

If the fire is within reach of streams from ladder pipes or tower-ladder platforms, fog from the windward side can be effective. Solid streams would be advisable, however, if greater penetration were needed.

The exterior exposure hazard in buildings under construction can present multiple problems because, besides the danger to nearby buildings from radiation and convection of heat, a spark-and-ember hazard may exist. Sparks can start fires at surprising distances from the original fire building. At times, they are drawn into buildings by fans in exterior wall openings on the leeward side of the fire.

Officers should remember that hoists for materials are not intended to transport people. If possible and feasible, however, they can be used to transport rolled-up hose and other equipment to upper floors. Where elevators designated for fire department use are required and provided, it is preferable to use them if the fire does not affect them. When such elevators have been installed, guards should be provided to operate them.

In some localities, standpipe systems are required under certain conditions--for example, when floors are in place above the seventh story, or more than 75 feet above the curb level. Quite often, however, these systems are not dependable at night because of carelessness about closing valves that have been opened during the day.

New highrise building construction has presented serious problems for the fire service, but in some respects it has one advantage: The buildings are erected more quickly because of the curtain wall construction, thereby reducing the time period of the existence of the potential hazards inherent in buildings under construction.

Building Under Demolition

Much that has been said about buildings under construction applies to those under demolition. For example, the fire department may have trouble getting water to high fires if the standpipe system already has been put out of service, but the structure is still 25 stories tall. Some builders, using modern techniques, just peel off exterior walls, remove undesirable partitions, and erect a new building on the metal framework of the old.

Dismantling sprinkler systems can also have disastrous results, as demonstrated on several occasions. A notable example was the Wanamaker fire, which originated in the building's subcellar in New York City. The building was in the process of demolition. The fire injured more than 200 fire personnel, did extensive damage to the subway system, and took several days to extinguish. A major cause of this disaster was the fact that the dismantled sprinkler system in the subcellar and cellar prevented the fire department from discharging water upon fire in accessible areas.

Occupancy

Human occupancy: An awareness of the mental, physical, emotional, or other relevant condition of the human element in various types of occupancies helps officers gauge the severity of the life hazard and anticipate problems of rescue.

In nightclubs, churches, theaters, and so forth, the allowable occupancy may be so large, and there may be such density, as to induce panic in the event of fire and smoke. Schools can present somewhat similar problems.

At inns, hospitals, and institutions for the care of infants, the elderly, the blind, the deaf, or other physically handicapped, occupants may have to be carried or led out of the building with unusual care.

In jails or mental hospitals, rescuers may have to deal with uncooperative, hostile, or generally difficult occupants, as well as coping with heavy locked doors, or cutting through bars and windows.

Multiple-residential structures, particularly those of old, ordinary construction, often are overcrowded, at times by tenants who speak mostly foreign languages and therefore have difficulty in conveying where other occupants are trapped.

Contents

Ventilation: Oils, fats, rubber, wax, tar, and some plastics produce large volumes of smoke, which may be unburned vapors. The heat from this type of smoke is low, as is its buoyancy. Visibility therefore is impaired, and ventilation is slowed down. Some materials give off gases that are toxic or injurious to the eyes or skin. Burning silks and woolens, for example, give off carbon dioxide and hydrogen cyanide gases. Both are toxic, and the skin can absorb the latter. Ammonia is also given off and cause injuries to the eyes, lungs, and damp skin areas.

Polyvinyl chloride (PVC) gives off chlorine gas and forms hydrochloric acid with water in eyes, armpits, groins, and wherever the human body perspires. Ventilation is achieved more slowly in such cases because firefighters must take time to don appropriate protective clothing and are hampered by poor visibility.

Where the presence of explosive mixtures or substances is suspected, exterior ventilation measures should be taken to prevent an explosion or minimize the results.

Placement of hoselines: Difficulty in ventilating can reduce the effectiveness of hoselines. Effectiveness also may be affected adversely by an excessive amount of contents and by the manner in which they are stored. Stock may be stored so high that it reduces the effectiveness of sprinklers and streams.

Where contents are combustible and plentiful, as in a lumberyard, rapid spread, high temperatures, and a spark-and-ember hazard characterize fires. To extinguish the main body of fire, heavy-caliber and high-pressure streams are in order. Lighter mobile lines can cover the spark-and-ember hazard and finish the job.

In some cases, two occupied structures can be equally distant from and endangered by a fire in an unoccupied building. "Equally endangered" implies similar construction height, area, and so on. In such an event, the human element in the occupancy presenting the greater life hazard would be covered first. Thus, an endangered hospital would be given priority over a factory, because many occupants might be able to walk from the factory fire.

Selecting an extinguishing agent: In some cases, water will spread the fire. For example, gasoline, kerosene, and similar materials are lighter than water and will float on the top of it, thus spreading the fire.

Calcium carbide with water gives off acetylene gas and may cause an explosion. Some flammable liquids are miscible with water, and unless they can be diluted to a point at which flammability is no longer possible, the fire may spread.

Water used improperly in the presence of combustible dusts, such as wood, flour, zinc, or magnesium, may throw them into suspension and develop an explosive mixture.

The use of water near acid in carboys, such as wholesale drug occupancy, may cause failure of the carboys by sudden chilling or impact of the stream, permitting spread of the acid. The resulting release of gases may intensify and abet extension of the fire.

These examples are far from exhaustive. Chief officers should carry reference material to help them evaluate the occupancy factor in case of unusual hazardous flammables or chemicals requiring special extinguishing agents. It is dangerous to depend on memory or the availability of competent advice.

Overhauling: The quantity of material involved, the manner in which it is stored, its nature, and the degree to which it has been subjected to the fire, affect overhaul. In addition, the degree to which contents have been subjected to fire and heat affects the amount of overhauling required.

Height

Ventilation: Height can affect activities at fires in highrise buildings. At lower-level fires, roof or window ventilation may be possible, thus facilitating the advance of lines from either side of the fire as well as the search for and removal of occupants.

Placement of hoselines: Exterior lines also may be used. In either case, control is likely to be established more quickly than at a similar but higher fire which can be attacked only from the interior. This earlier control tends to minimize the overhauling required at lower-level fires.

Area

If the fire can be confined to a small room, the fact that the total floor area is 200 by 200 feet hardly matters. However if such an area is not subdivided effectively and there is no small room, the fire sooner or later can spread to the total floor area.

If there is no life hazard, this development should make it logical to select confine, control, and extinguish as the major objectives. The decision could be to operate from the exterior but not to try to ventilate the roof, especially at supermarkets with wide roof spans.

The extent of fire--rather than merely the area of an occupancy, such as a lumberyard--influences the placement and use of hoselines.

Proximity of Exposures

Proximity alone does not make an exposure vulnerable. To evaluate the effects of proximity in selecting objectives and activities, it must be considered in conjunction with other contributing factors, such as construction, location of fire, occupancy, and wind direction and velocity.

Proximity is hardly a problem if the construction of both the fire and adjoining buildings feature exterior windowless walls with 4-hour fire-resistive ratings, assuming that no inlets to air-conditioning systems are exposed. On the other hand, inferior construction, with inadequately protected openings in intervening shafts or narrow courtyards, can intensify proximity hazards.

In evaluating proximity of exposures, special considerations always must be given to the factors of direction and velocity of wind. These factors can minimize the effects of proximity on the windward side of the fire and maximize those on the leeward side to such a degree that the building nearest the fire is not necessarily the one most severely exposed.

Structural Collapse

In assessing the effects of other factors on structural collapse, officers should consider carefully the type of construction involved in the fire. Nonfireproof or brick-joist construction usually is susceptible to collapse and has presented some of the most serious problems.

Age of the structure intensifies structural defects. Duration of fire--how long it has been in progress and how much water has been poured into the building--location, and extent of the fire present obvious problems. Other important considerations are conditions upon arrival, particularly where an explosion or backdraft condition is present, or where an explosion has already occurred; presence of heavy machinery; and the nature of the burning or exposed material.

Still other points to consider are proper supervision (overloading of stairs); the span of floor between supporting members (wide spans are more susceptible to collapse); and whether or not metal structural members are protected. Unprotected metal structural members begin to lose strength when heated to 1,100 °F and may fail rapidly once temperatures exceed 1,500 °F (816 °C). In addition, if the metal structural members are made of cast iron and are struck with cold water after being heated, they may fracture and collapse.

In vacant buildings, officers can anticipate that floor beams have been weakened by vandalism and, quite often, by previous fires. Signs of imminent collapse include a rumbling sound that may accompany a wall disturbance or collapse, cracking or bulging walls, water or smoke seeping through the walls, twisted or warped columns and beams, and floors sagging or pulling out from walls.

Time Elements

Time of origin: Time of origin tells when a fire occurs, in terms of time of year, holiday time, and day or night. The time of year ordinarily reflects the usual seasonal tendencies relative to topography in woodland areas--humidity, rain, snow, and dry spells. Major holiday seasons maximize the hazards associated with churches and department stores.

Nighttime fires: Visibility is poor and it takes longer to evaluate factors that are pertinent in determining objectives and activities. The life hazard is maximized. In night fires in unoccupied buildings the selection of objectives and activities may be more difficult in borderline cases because of darkness. It is likely that these fires have been burning for some time before discovery, thereby worsening the effects of all related primary factors.

Consequently, night fires usually require more hose streams, apparatus, and personnel for control and extinguishments.

Daytime fires: The fact that occupants are awake can result in quicker discovery, alarm, and response, with favorable effects on the life hazard, location, and extent of the fire on and after arrival, on heat and smoke conditions, and on exposure hazards. In ordinary weather visibility is good and fire officers can evaluate more quickly the primary factors pertinent to selecting objectives and assigning activities.

On the other hand, traffic conditions are heavier during the day, hydrants may be blocked, and pressure in the water mains is generally lower because of higher demand.

Heat, Flame, and Combustion

Heat transfer--radiation: Radiation is energy in the form of electromagnetic waves, which are traveling disturbances in space that include light, heat, radio, and cosmic rays. The distance is the major consideration in cases where structures are endangered by heat conditions. Consequently, proximity of exposures to the fire building in some cases determines order of priority in covering exposures despite the direction of the wind.

The wind influences the situation, however, when it changes the direction of the convection current. Wetting down the exposed surfaces with water fog best protects exterior exposures against radiation.

Heat transfer--conduction: Conduction is the process by which heat is transferred within a material from one particle to another or from one to another in contact with it, without any visible motion. The amount of heat transferred by conduction varies with the conductivity of the material and the area of the conducting path.

Heat transfer--convection: Convection is the process by which heat is transferred by a circulating medium in the gas or liquid state. If the rise of convection currents in a shaft is checked by some obstruction, and if the stoppage is complete and sufficiently prolonged, a positive pressure will build up and will be greatest immediately below the stoppage.

Weather

The Effects on Objectives and Strategy

Low temperatures: Extremely low temperatures retard the initial development of fire, but once a fire has started they impair the efficiency of the operation in general, inasmuch as they necessitate such things as heavy, encumbering clothing, which slows actions.

The freezing of hydrants and appliances hampers operations. Snow accentuates the disadvantages of low temperatures.

High temperatures: High temperatures generally are classified as temperatures in the 80s and 90s. High humidity and inversion conditions are characterized by dense smoke and poor visibility.

High humidity and high moisture content make it more difficult for a vigorous fire to become established, but do not slow its spread once it is well started.

Rain: Rain greatly reduces the probability of fire spreading from building to building.

Rain droplets cool convection currents and help extinguish flying sparks and embers.

Steaming sections of roof during a fire may indicate the location of hot spots, and those sections are where openings should be made.

Wind conditions: Velocity is an important factor. Winds under 15 miles per hour (mph) can usually be controlled if defensive measures are taken; with winds 15 to 30 mph, the rate of fire propagation increases dramatically. Wind of 30 mph is a threat to exposures downwind, and is conducive to conflagrations.

The higher the velocity, the more the pillar slants from vertical in the direction of the wind, and thereby limits the need for other requirements. Chief officers should know the benefits and limitations of the effects of stream application. On the leeward side fog streams may be ineffective. Conversely, on the windward side, high winds can make fog preferable when operating streams.

Firestorm: A firestorm may develop in the absence of ground winds sufficiently strong to support conflagration. Data from wartime experiences indicate that an area less than one square mile is probably incapable of sustaining a firestorm. In addition, building density (the total ground area of buildings divided by the total area of the zone) must be greater than 20 percent.

A firestorm is basically a windstorm. It may produce rain if the rising column of hot smoke meets a stratum of cold air, causing the moisture in the air to condense around particles of smoke or soot and fall in large black raindrops. To the fire service, however, the firestorm is comparable to a conflagration in size, although different in other ways. It results from the merging of numerous smaller fires into one massive inferno and is more likely to be a wartime, rather than a peacetime, phenomenon.

Visibility: Impaired visibility makes it more difficult to recognize and evaluate pertinent factors properly, thereby hampering decision making and increasing the possibility of error. Poor visibility is a serious handicap in searching for trapped occupants, in determining the order in which exterior exposures should be covered, or in carrying out any fire activity.

In addition, supervision becomes a more critical matter because of the increased dangers to personnel.

Minimum area and building density are essential, and absence of strong ground wind is necessary. The thermal columns (convection currents) rise almost vertically (that of a conflagration is bent over by the prevailing wind), and the rising column creates a powerful centripetal force that draws air along the ground at velocities that may exceed 100 miles per hour, toward the expansive low-side-pressure area at its base. The true firestorm should not extend beyond its perimeter because of the centripetal pattern of the air currents created. High temperatures prevail, and combustible building material and plant life are consumed, with only brick and similarly resistant walls and charred trees remaining.

Requirements to Operate

The term **requirements to operate** pertains to the water, apparatus, equipment, personnel, and special extinguishing agents required and available for an effective fire operation.

All of these items form a balance. If, for example, the water supply required is available, the need for additional personnel, apparatus, and so forth ordinarily is decreased. If water supply required is not available, the other needs ordinarily are increased. The same "rule" holds true for each of the other primary factors comprising requirements to operate.

Water: To use water most effectively, and thereby limit the need for other requirements, chief officers should know the benefits and limitations of fog and additives, when and how to employ master streams, and the principles governing the use of hose streams, apart from the effects of ventilation, selecting hydrants, the mechanics of stretching hoselines, etc.

Advantages of fog: Fog can be used effectively with master stream appliances, with wetting agents, and also with foam. It has greater and quicker absorption of heat per gallon than plain water.

Water has its maximum cooling and extinguishing effect when applied as a cold fog and evaporated into steam. Fog causes less water damage to property and the contents of fire buildings than water does. This has a favorable effect on the public, as the salvage problem is simplified and business can be resumed and homes reoccupied more quickly.

Disadvantages of fog: It has been proved many times that personnel are uselessly endangered and injured when they try to advance fog lines into seriously involved, unventilated fire areas; the steam created pushes back through the means of entry.

Unless ventilation can be effected to prevent such an occurrence, another technique must be used. Fog cannot be aimed as well as a solid stream. The latter can throw 75 percent of the water within a 10-inch circle or 90 percent within a 15-inch circle when it reaches the seat of the fire. Much of the water from a fog stream will not reach the seat of the fire if turbulent currents have to be overcome.

Under ordinary conditions, fog lines do not have a good vertical or horizontal range. This could be a disadvantage in extinguishment or in covering exposures. A serious disadvantage is that some firefighters do not realize that fog is no more a panacea than are solid streams. It is important to know how to use each kind of stream to maximum advantage.
Chief officers who favor the use of one technique for all fires have closed their minds to the possible alternatives. Officers should be familiar with all recognized techniques and should learn to select and apply the most appropriate one in each situation.

Placement and use of fog lines: In covering life hazard, extinguishing fires, and protecting exposures, the principles that govern solid streams are applied, bearing in mind the limitations and peculiarities of fog.

For example, when life hazard is present, the first line must be placed to operate between the fire and the endangered occupants or between the fire and the means of escape. However, keep in mind the possible effects on the occupants of the fog as it vaporizes to steam. Accordingly, where there is a life hazard, the use of fog attack is inadvisable.

Water With Additives

Advantages: In the use of water with additives, there are greater penetrating qualities and less runoff, and consequently less water is required. It could be used with fog, resulting in greater heat absorption. In this form, it is particularly effective on some Class B fires involving high-flashpoint products.

It is effective on smoldering and hidden fires, as in baled cotton, paper, and rags; fires in sawdust or where charring might ordinarily repel water penetration; brush, grass, and duff fires.

It is estimated that one-fifth to one-third of the usual amount of water will suffice when a wetting agent solution is used on such fire. It has a definite favorable effect on the overhauling phase of an operation, on preventing rekindling, protecting exposures, and reducing the life hazard for fire personnel.

Disadvantages: It is sometimes corrosive. It may increase the electrical conductivity of the stream. If electrical equipment comes in contact with wet water, it must be flushed clean before it is restored to service. It should not be used with foam. The wetting agent breaks down foam. Its lower surface tension tends to increase the breaking up of a stream.

Foam

Mechanical: Foam is applied primarily to extinguish fires in flammable liquids by blanketing the liquid surface, sealing off the escape of vapors, insulating the liquid from the heat of the fire, and cooling the surface. Foam is effective on hydrocarbon fires that are liquid at ordinary temperatures and pressures, but cannot extinguish fire in liquefied compressed gases. Foam can be used for alcohols and esters.

Foam must have a lower density than the flammable liquid it is used on, so that the foam will float on the surface. The quantity of foam required for extinguishment varies widely. For fires in small indoor tanks of flammable liquids, a few inches may suffice; in larger outdoor tanks, several feet of foam may be required.

The amount of foam needed will be affected by (1) the required rate and time of application, and (2) the quality of the foam and the effectiveness with which it is applied.

Wetting-agent foams: They break down into their original liquid state at temperatures below the normal boiling point of water, and in this respect they differ from mechanical foam. If a wetting agent of the synthetic detergent type is used, the structure formed can intercept and reflect radiant heat, and thereby provide effective protection for exposed surfaces of exposures.

The effectiveness of wetting-agent foams as a blanket on Class B fires is limited because of the comparatively quick breakdown when heat is absorbed. However, the resulting liquid retains the penetrating qualities of the wetting agents and this aids in creating cooling action.

Surfactant foams: Surfactant means a **surface-active** material. The surfactant foam referred to as "light water" is a fluorochemical material, and is described as a fluorinated surfactant. It produces aqueous film-forming foam (AFFF) when mixed with air, either in a foam pump or at an aspirating-type nozzle.

Apparatus and equipment: Apparatus and equipment can be more effective if selected in accordance with the potential fire problem in the community as indicated by such primary factors as life hazard, possible location and extent of fire on and after arrival, heat and smoke conditions, exposure hazards, construction, height, area, auxiliary appliances, weather conditions, time of response, and naturally, the water, personnel, and special extinguishing agents available.

Apparatus and equipment obviously are more effective if they arrive at their destinations on schedule. Placement of apparatus is a matter of prime importance. One poorly placed apparatus can seriously impair the usefulness of others.

Misplacement is a particularly severe handicap at the start of an operation and should be guarded against when much of the assignment is approaching the fire from the same direction.

Tools such as electric-powered or hydraulic-powered tools and thermal imaging cameras (TICs) should be used appropriately. Chief officers should understand their capabilities and limitations.

Protective clothing: Enforcing department policies by chief officers for wearing protective equipment appropriately, such as approved bunker gear, helmets, hoods, gloves, and breathing apparatus, is critical to the safety of personnel.

Auxiliary Appliances

Sprinkler systems: Long-term records show that automatic sprinklers either extinguished a fire or held it in control more than 96 percent of the time in a wide variety of occupancies. Reasons for unsatisfactory performance included water to sprinklers being shut off, only partial sprinkler protection, inadequate water supplies, faulty building construction, and obstruction to distribution of water, hazards of occupancy, inadequate maintenance, antiquated systems, and slow operation.

Pressurization of stairways or other building areas: Internal systems may have this capability; therefore, building maintenance personnel knowledgeable about building systems should be brought immediately to the Incident Command Post (ICP) for consultation with the Incident Commander (IC).

Topography

Hilly communities: When operating at a fire on a steeply-graded street, it also may be advisable to position aerial trucks or tower ladders on the high side of the fire to ensure maximum reach. The effective use of wedges to level portable ladders to allow for safe climbing on hilly terrain must be enforced.

Explosions

Backdraft or smoke explosions: Smoke explosions or backdrafts at fires essentially are caused by the rapid combustion of a mixture of flammable gas, vapor, mist or dust, and air. They can occur before or after arrival of the fire department. Smoke explosions or backdrafts can occur before arrival if heat breaks windows, abetting an inflow of air to an unventilated fire area in which active combustion has ceased because of oxygen depletion. The inflow of air replenishes the oxygen supply and can accelerate combustion of the accumulated smoke and gases, with explosive results.

This can also happen after arrival if injudicious forcible entry supplies air to otherwise unventilated and susceptible fire areas. Smoke explosions or backdrafts can cause structural collapse. If they occur before arrival, they can have an adverse effect on the life hazard, location, and extent of fire. After arrival, occupancy, auxiliary appliances, smoke and heat conditions, exposure hazards, requirements to operate, duration of operations, life hazard for personnel, and street conditions can be affected, especially if there is frontal collapse.

If smoke explosions or backdrafts occur after arrival, the foregoing effects are intensified, especially for fire personnel who may be in the fire building or within range of collapsing walls. In some cases, the first explosion throws flammable dusts into suspension, causing additional explosions.

A cardinal principle is that any enclosed and inadequately ventilated fire area should be considered susceptible to a smoke explosion or backdraft. If the fire building is unoccupied, such areas should not be entered until they are ventilated.

Bomb explosions: Sporadically, certain groups explode bombs as a means of "sending their message." Warnings of the impending explosion may or may not be given. Chief officers responding to the designated target must assume that the warning is authentic and conduct operations accordingly.

If the suspected building is occupied, it should be vacated immediately. Fire personnel can assist in the evacuation but should not participate in searching for the bomb, since they have neither the protective equipment nor the special training required for such a task.

<u>Exposure Hazards</u>

Covering interior exposures: The interior exposure hazard, depending on the degree of severity, can affect life hazard favorably or unfavorably. Also affected are extent of fire after arrival, occupancy (human element and contents), structural collapse, heat and smoke conditions, wind direction and velocity, requirements to operate, duration of operation, smoke explosion or backdraft, and exterior exposure hazard.

Covering exterior exposures: Exterior exposure hazards concern buildings or occupancies that may be endangered by the original fire. Occupied exposures may create a life hazard or intensify the one already present in the original fire building, thereby increasing the risks that may have to be taken by personnel in rescue work. The presence of a life hazard can have detrimental effects on many other primary factors.

Interior and exterior exposures hazards are affected by the same primary factors, except that the exterior exposure hazard can also be affected by proximity.

Duration of Operations

For one reason or another, fire operations of long duration generally are difficult to deal with from the beginning. They may feature heavy involvement and structural collapse, especially if the structure is old and the contents are water-absorbent.

They may maximize the exposure hazard and cause other fires if sparks or embers created by structural collapse are carried by the wind. They indicate that auxiliary appliances such as sprinklers are absent or ineffective, and usually necessitate more than the usual requirements to operate.

STREET CONDITIONS

The Effects on Objectives and Strategy

Streets that are one-way are congested by vehicular traffic or are covered by snow or ice tend to delay response of the fire department. Under such conditions, fires are likely to be more extensive than usual on arrival, intensifying the existing hazards. Ice-covered streets can slow down the movements of personnel.

Canopies, overhead wires, and tree-lined streets can handicap efforts to use portable, aerial, or tower ladders. The width of the streets naturally has a bearing on proximity of exposures and therefore on the exterior exposure hazard.

Piers, dead-end streets, and buildings facing only one street, restrict avenues of attack. Steeply-graded streets can affect the placement of apparatus. The danger of falling glass from involved highrise buildings has added a new and sizeable dimension to the problems of the fire service.

Some communities convert a main thoroughfare into a mall with sidewalk cafeterias and extensive garden trimmings. This creates considerable problems for the fire and rescue efforts.

THE COMMAND SEQUENCE CYCLE

Critical factors of incident operations are often overlooked (or not given enough emphasis). This problem can result in poor use of resources, inappropriate strategies and tactics, safety problems, high incident costs, and lower effectiveness.

A simple (but thorough) process for planning can be used for small, short-term, long-term, or more complex incidents and events. This process is referred to as the Command Sequence Cycle and consists of six sequential steps used to develop the Incident Action Plan (IAP).

The Command Sequence Cycle

The first of these steps can be done by the IC or at a formal Planning Meeting. The last steps ensure that the plan does its intended job. The steps follow

1. Understanding the situation.
2. Establishing Incident Objectives.
3. Developing Incident Strategy.
4. Developing tactical direction and making resource assignments.
5. Implementing the plan.
6. Evaluating the plan.

Understanding the Situation

In general, the essential information needed to understand the situation fully consists of:

- what has occurred;
- whether or not the incident will get bigger (or smaller); and
- present (and future) resource and organizational needs.

Incident Objectives and Strategy

Incident Objectives are statements of guidance and direction necessary for the selection of appropriate Strategy(ies) and the tactical direction of resources. They answer the question of **what** can be accomplished when all allocated resources have been deployed effectively (based on realistic expectations). Determining Incident Objectives and Strategies is an essential prerequisite to developing a plan.

Incident Objectives must be

- **Attainable** with the resources available to the agency.
- **Measurable,** so that a final accounting can determine whether Objectives were achieved.
- **Flexible and broad** enough to allow for consideration of strategic and tactical alternatives.

Developing Tactical Direction(s) and Making Resource Assignments

Tactical direction includes determining the tactics and operations necessary for the selected strategy and determining and assigning appropriate resources. The tactical direction is developed around a specific operational period and must have measurable results.

For large incidents that may last for some time, there is a limit to what may be achieved (in terms of accomplishing an Incident Objective in a **single** operational period). Therefore, tactical directions should be stated in terms of accomplishments that can be achieved realistically within the timeframe of an operational period.

Resource assignments will be made for each of the specific work tasks. These assignments will consist of the kind and number of resources needed to achieve the tactical operations for each operational period.

If resources are not available for a specific tactical operation, then the IC may need to prioritize tactical assignments or reassess the Tactics (and perhaps the overall Strategy).

Implementing the Plan

The IC/Company Officer (CO) should communicate the appropriate tactical assignments to incident resources via radio or face-to-face. The IC should ensure that the tactical assignments are understood clearly by the resources assigned and that they are facilitating the Strategy developed to meet the overall Incident Objectives.

Evaluating the Plan

The IC/CO should evaluate the effectiveness of the IAP continually to meet the overall Incident Objectives. This evaluation should occur every 10 minutes while operating under emergency conditions at an incident. Fireground conditions can change very rapidly during emergency operations, and fireground commanders must evaluate the effectiveness of the IAP continually.

Example: Occupied house fire.

Two-story occupied dwelling, 20 by 40 foot ordinary construction, fire located in living room area first floor, Side D, report of occupants trapped in second-floor bedroom, Side A. No external exposures.

<u>Objectives</u>

- safe removal of occupants within 10 minutes; and
- contain and control fire to room/building of origin.

Strategies

Example of Strategies for Objective #1: safe removal of occupants.

- Strategy #1: rescue occupants;
- Strategy #2: confinement/extinguishment; and
- Strategy #3: ventilation.

Tactics

For the rescue Strategies, the Tactics might be

- Tactic #1: deploy search/rescue group to upper floors;
- Tactic #2: deploy one 1-3/4-inch hoseline to first floor for stairwell/occupant protection; and
- Tactic #3: ventilate stairwell (if possible) and Side A to support occupant removal.

Strategies

Example of Strategies for Objective: contain and control fire to room/ building of origin.

- Strategy #1: confine/extinguish;
- Strategy #2: ventilation; and
- Strategy #3: salvage.

Tactics

For the confine and extinguish Strategies, the Tactics might be

- Tactic #1: deploy one 1-3/4-inch hoseline to first floor Side D for confinement/ extinguishment;
- Tactic #2: deploy one 1-3/4-inch hoseline to second floor Side D for interior exposure protection; and
- Tactic #3: vertical ventilation of roof apertures and horizontal ventilation first and second floors.

Alternatives

- Tactic #4: positive-pressure ventilation with proper use of fans; and
- Tactic #5: use of salvage covers and control of water runoff.

Activity 4.1

Primary Factors Chart Exercise

Purpose

To identify primary factors at an incident scenario.

Directions

1. You will be placed into groups of five or six.

2. The instructor will select the exercise or exercises for your group to work on.

3. Review the exercise or exercises within your group.

4. You will develop a Primary Factors Exercise Chart report for your assigned scenario.

    a. Identify the most pertinent 13 primary factors for each scenario.

    b. Place findings on Column 1 of the Primary Factors Exercise Chart.

    c. Identify the most pertinent subfactors for each identified primary factor for your exercise scenario. Place findings on Column 2 of the Primary Factors Exercise Chart.

    d. Identify pertinent precautions that will be taken to address each identified subfactor for your exercise scenario. Place findings on Column 3 of the Primary Factors Exercise Chart.

    e. You will select a spokesperson to report Primary Factors Exercise Chart findings to the class.

Primary Factors Chart

Column #1
Primary Factor - Situation Awareness- Chart

Primary Factors	(Check appropriate boxes) Pertinent Sub-Factors (P)	P
Life Hazard	Occupants	
	Firefighters	
Location/Fire	Fire Building on Arrival– Burn Time	
	Exposures On Arrival - Burn Time	
	Fire Spread Considerations Radiation/Conduction/Convection	
Construction	Fire Building – Type 1-2-3-4-5 (Lightweight Awareness)	
	Exposures – Type 1-2-3-4-5 (Lightweight Awareness)	
Occupancy (Contents)	Fire Building – (Fuel Load)	
	Exposures (Fuel Load)	
Height	Fire Building (Front-Rear)	
	Exposures (Front-Rear)	
Area	Fire Building/Configuration	
	Proximity of Exposures /Configuration	
Structural Collapse	Fire Building – Burn Clock After Arrival	
	Exposures – Burn Clock After Arrival	
	Collapse Zone – Safe Corridors	
	Apparatus Placement	
Weather	Visibility	
	Temperature/Humidity	
	Wind – Direction/Velocity	
Resource Requirement	Apparatus/Personnel/Equipment - RIT	
	Water Supply/Suppression Agent	
Auxiliary Appliances	Fire Building Supplied	
	Exposures Supplied	
Topography	Front-Rear	
Explosions/ Back Draft	Proper Ventilation Flash-Over Time Awareness	
Time	Time of Day Time of Year Duration of Incident	

Column #2
Incident Objectives
Attainable/
Measurable/
Flexible

Examples of Incident Objectives:

- Safe Removal of All Occupants within 10 minutes.
- Contain and Control Fire to Room/Building of Origin within 10 minutes
- Contain, Control and Limit Fire in Exposures within 10 minutes
- Other.

List Incident Objectives:

1.
2.
3.
4.
5.

Column #3 Activities (Strategies) / **Column #4 Evaluate Effect of Activities (Strategies) Every 10 Minutes**

Column #3 Activities (Strategies)	Effective	Ineffective
[R] Rescue • Interior/Exterior/Both		
[E] Exposure Protection • Exposure Examination		
[C/E] Confinement/Extinguishment • Hose Line Placement		
[O] Overhaul • Expose Hidden Fire		
[V] Ventilation • Removal of Occupants • Fire Control		
[S] Salvage • Water – Run-Off • Apply Covers		
Forcible Entry • Location • Method		
Special Equipment • Imaging Cameras		

List Incident Strategies	Assign Tactics:
For Objective # 1:	
For Objective # 2:	:
For Objective # 3:	
For Objective # 4:	
For Objective # 5:	

Identify alternative strategies for firefighter safety when occupant safety has been determined not to be a Primary Factor.

-
-
-
-
-
-
-

Activity 4.1 (cont'd)

Residential--Type V--Balloon Frame--Exercise #1

Structure:	Three-story, 18 by 40 foot
Building Construction:	Type V--balloon frame
Roof Construction:	2- by 6-inch beam-and-rafter system
Floors:	2- by 6-inch plywood flooring system
Alarm System:	No smoke detectors installed
Occupants:	Six occupants per occupancy Three children, three adults each occupancy
Special Concerns:	One bedridden occupant on O_2--located front bedroom--third floor --Side A/D

Situation Report:

Fire Building:

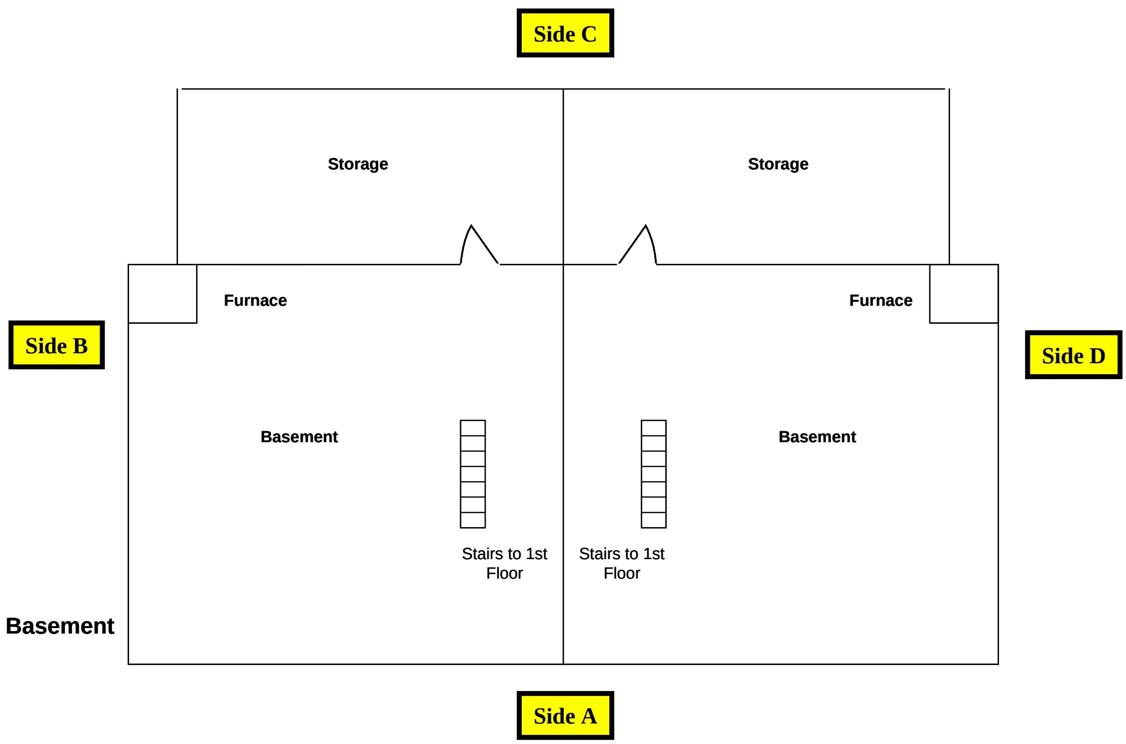
It is November 30, 0600 hours, temperature is 23 °F (-5 °C), wind from east at 10 mph. Upon arrival, one adult and three children are outside of the fire building. Occupants report two adults unaccountable from fire building including bedridden occupant in third floor front bedroom. The other missing occupant slept on second floor, but could not be located by occupants.

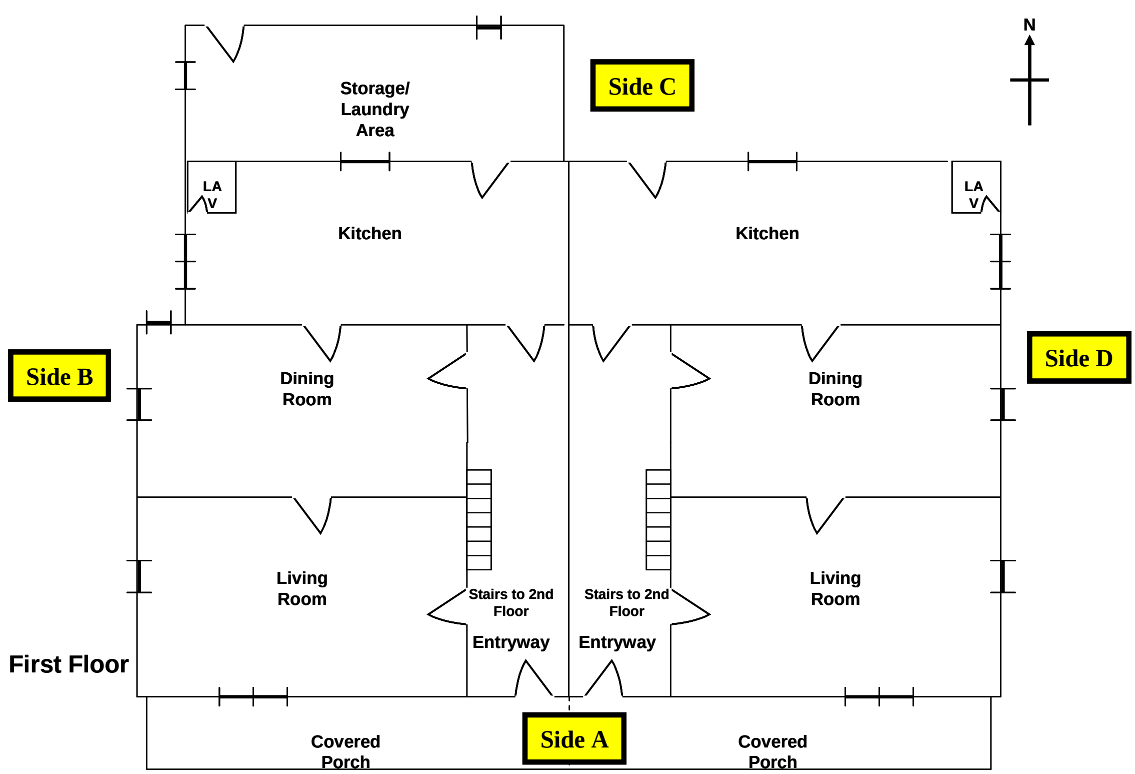
Exposure Building:

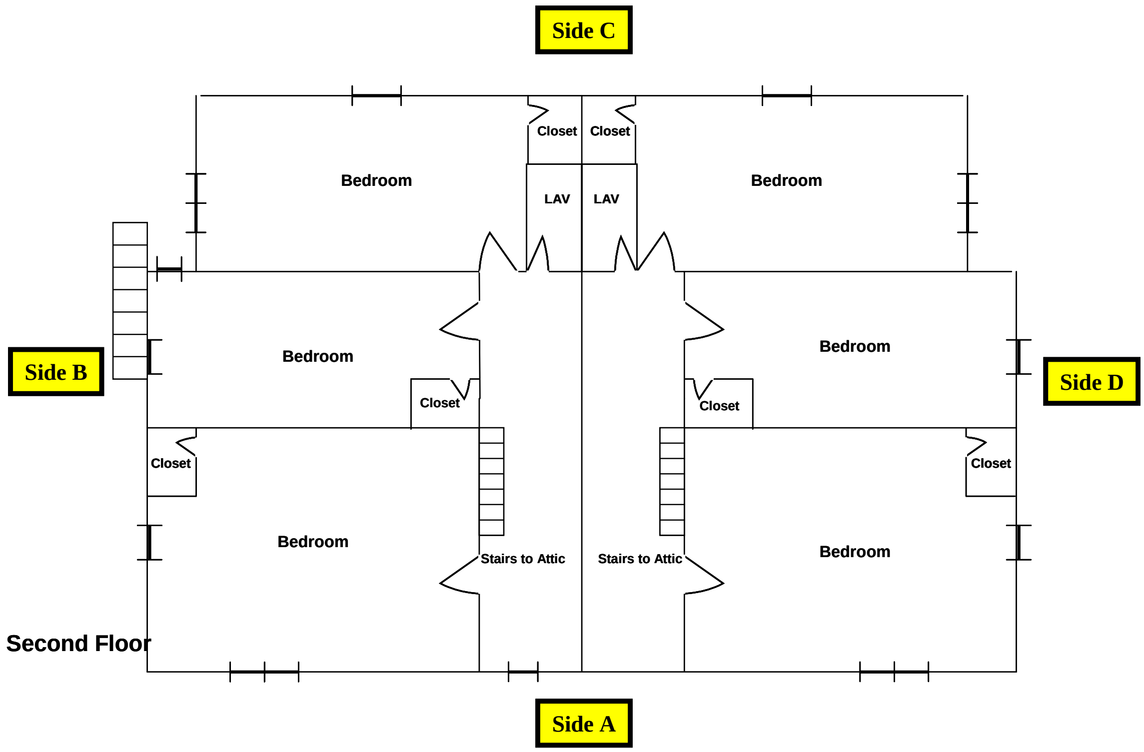
Two adults and three children from attached exposure occupancy are also outside.

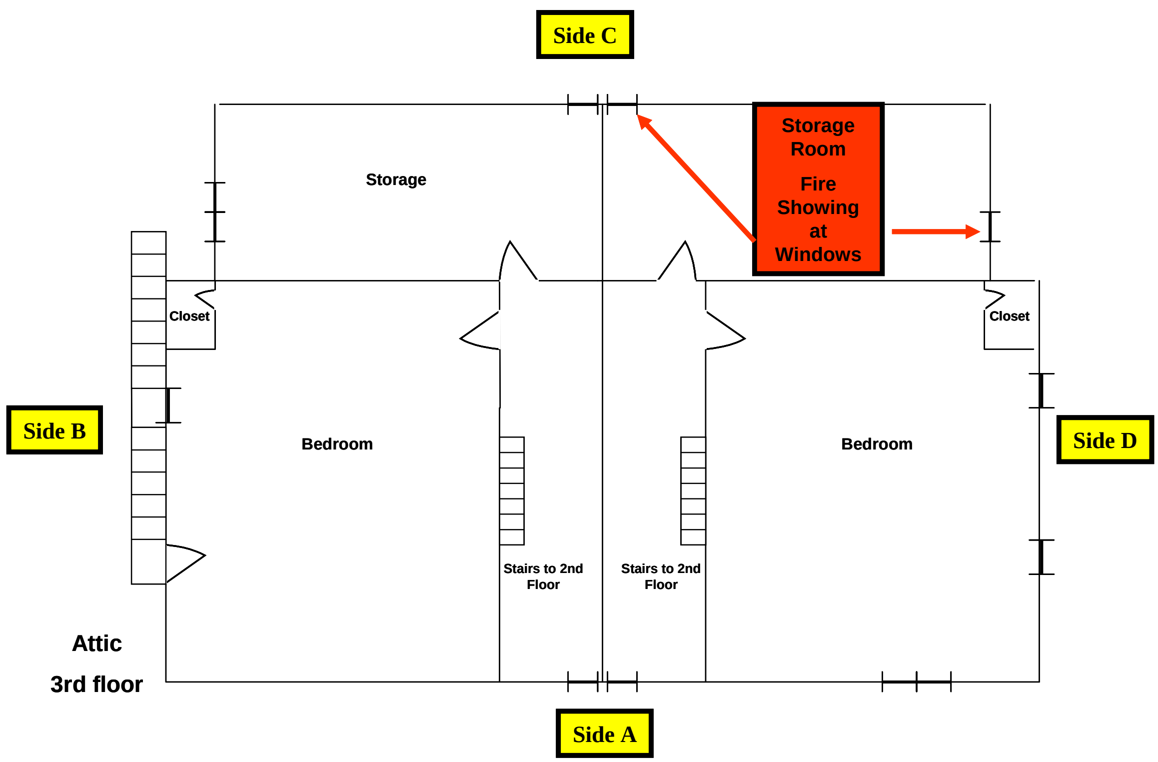
Activity 4.1 (cont'd)

Exercise #1 Plot Plans






Side C
Closet
Closet
Bedroom
LAV
LAV
Bedroom
Side B
Bedroom
Closet
Bedroom
Side D
Closet
Closet
Closet
Bedroom
Bedroom
Stairs to Attic
Stairs to Attic
Second Floor
Side A


Side C
Storage
Storage Room
Fire Showing at Windows
Closet
Closet
Side B
Bedroom
Bedroom
Side D
Stairs to 2nd Floor
Stairs to 2nd Floor
Attic
3rd floor
Side A

Activity 4.1 (cont'd)

Primary Factors Exercise Chart

Pertinent Primary Factors	Pertinent Subfactors	Pertinent Precautions To Be Taken
1.	1. 2.	1. 2.
2.	1. 2. 3.	1. 2. 3.
3.	1. 2.	1. 2.
4.	1. 2.	1. 2.
5.	1. 2.	1. 2.
6.	1. 2.	1. 2.
7.	1. 2. 3. 4.	1. 2. 3. 4.
8.	1. 2. 3.	1. 2. 3.
9.	1. 2.	1. 2.
10.	1. 2.	1. 2.
11.	1.	1.
12.	1. 2.	1. 2.
13.	1. 2.	1. 2.

Activity 4.1 (cont'd)

Residential--Type V--Platform Frame--Exercise #2

Structure:	Two-story, 40 by 60 foot
Building Construction:	Type V--platform frame
Roof Construction:	2- by 6-inch truss roof support system
Floors:	2- by 4-inch truss floor system
Alarm System:	No smoke detectors installed
Occupants:	Eight occupants Two adults--three children Ages--8, 10, and 12 years One dog (collie)
Special Concerns:	One 12-year old child has a lower leg cast suffering from a dislocated left knee

Situation Report:

Fire Building:

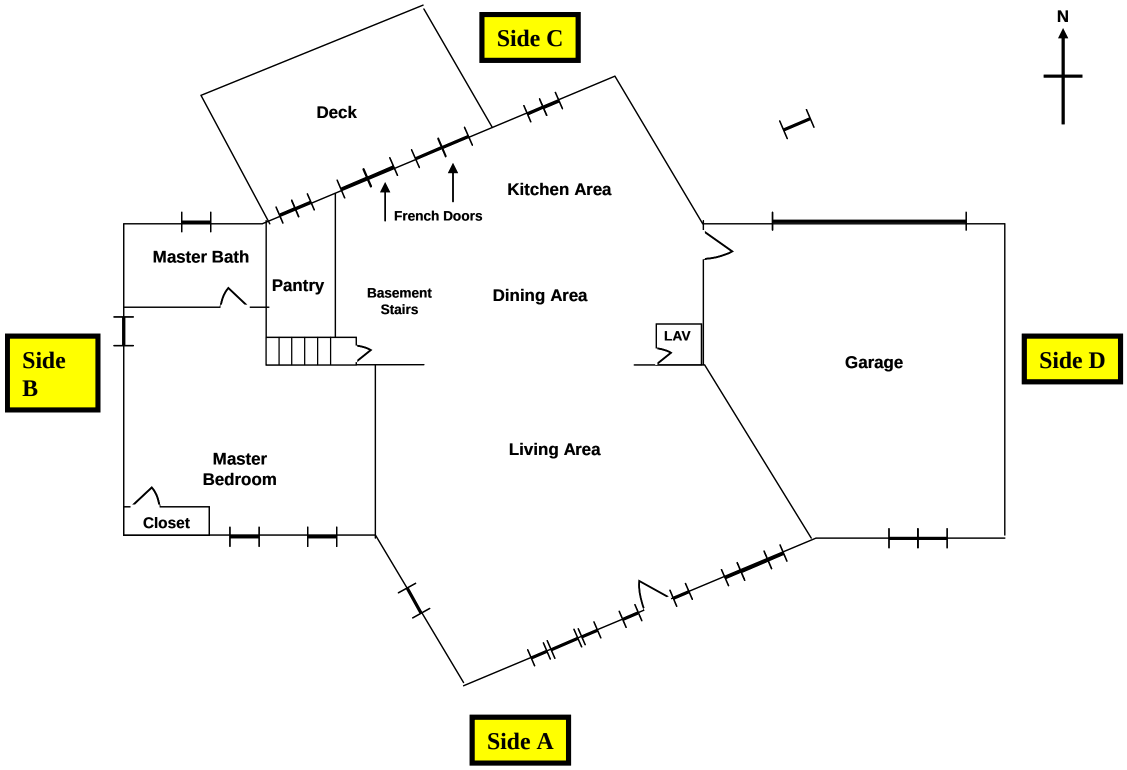
It is Sunday, February 2, 0800 hours, temperature is 18 °F (-8 °C), wind from east at 12 mph. Upon arrival, two adults and one child are outside of the fire building. Occupants report two children, ages 10 and 12 years are unaccounted for along with their collie dog. Missing children slept in bedrooms #2 and #3 downstairs.

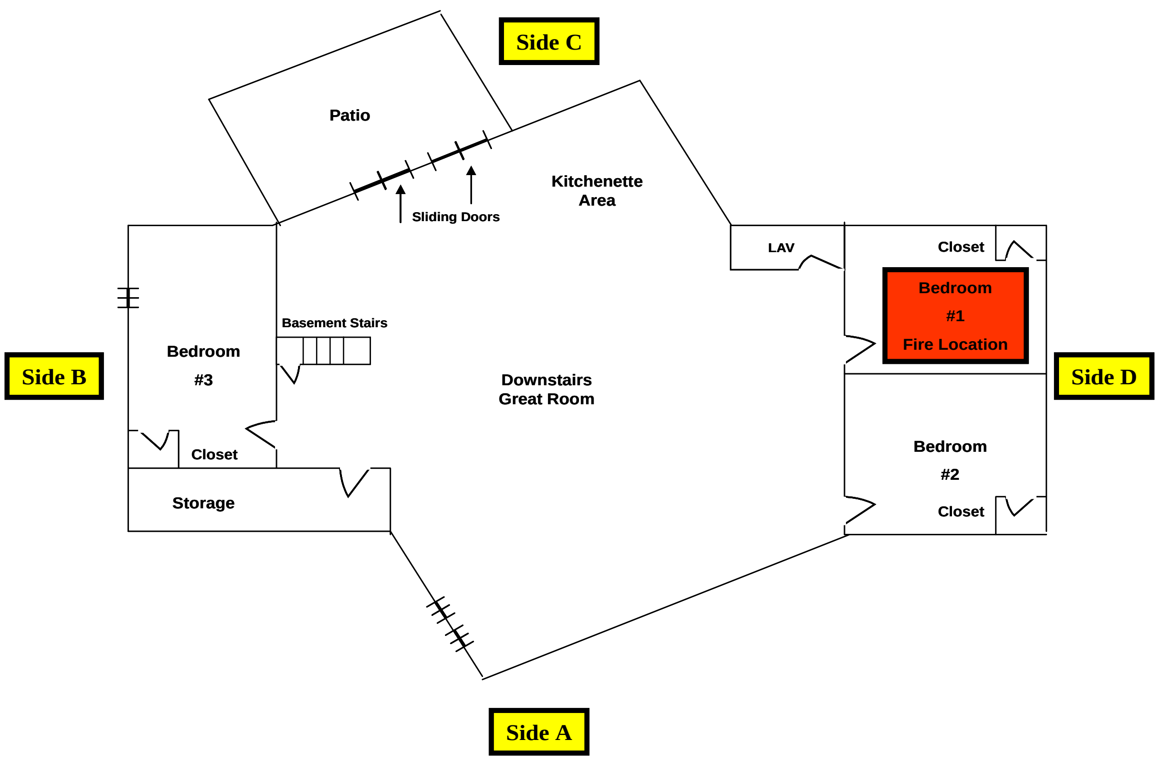
Exposure Building:

No immediate exposures.

Activity 4.1 (cont'd)

Exercise #2 Plot Plans





Activity 4.1 (cont'd)

Primary Factors Exercise Chart

Pertinent Primary Factors	Pertinent Subfactors	Pertinent Precautions To Be Taken
1.	1. 2.	1. 2.
2.	1. 2. 3.	1. 2. 3.
3.	1. 2.	1. 2.
4.	1. 2.	1. 2.
5.	1. 2.	1. 2.
6.	1. 2.	1. 2.
7.	1. 2. 3. 4.	1. 2. 3. 4.
8.	1. 2. 3.	1. 2. 3.
9.	1. 2.	1. 2.
10.	1. 2.	1. 2.
11.	1.	1.
12.	1. 2.	1. 2.
13.	1. 2.	1. 2.

Activity 4.1 (cont'd)

Commercial--Type III--Ordinary--Exercise #3

Structure:	Two-story, 20 by 40 foot
Building Construction:	Type III--ordinary
Roof Construction:	Post-and-beam
Floors:	2- by 6-inch flooring system tongue and groove
Alarm System:	Smoke detectors installed
Occupants:	Eight employees
Special Concerns:	High fuel load--all floors Flammable materials--basement

Situation Report:

Fire Building:

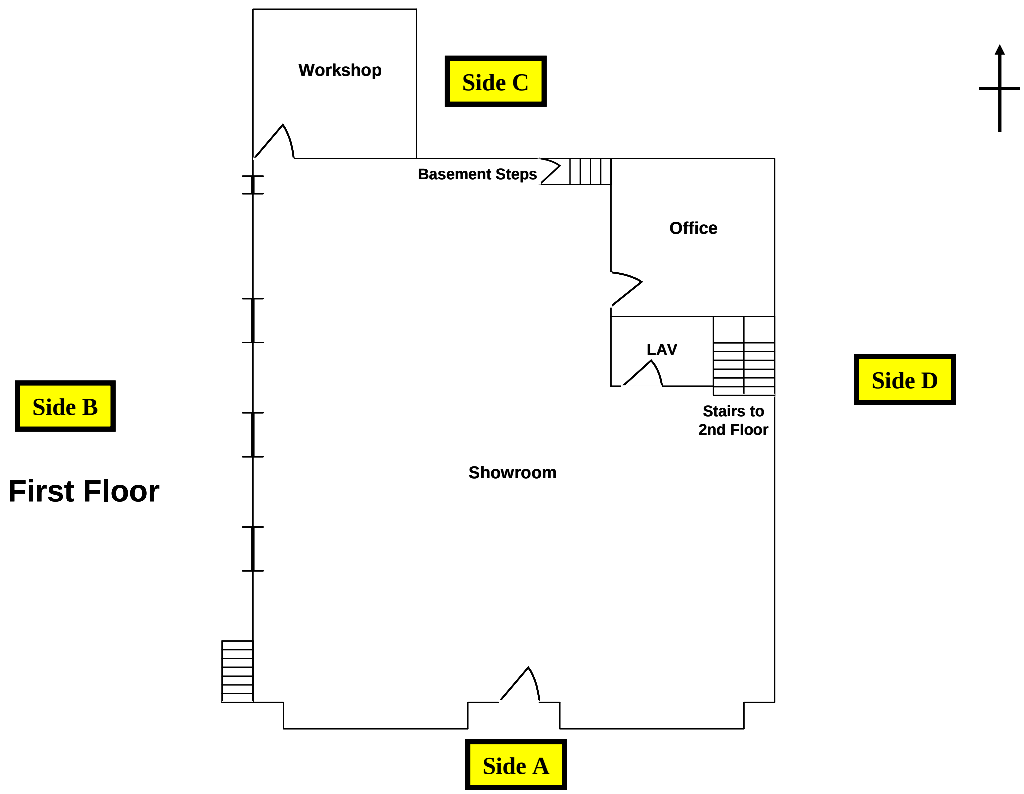
It is Saturday, March 5, 1300 hours, temperature 25 °F (-4 °C), and wind from north at 7 mph. Upon arrival, the Art Gallery manager reports two employees are unaccounted for; they were refinishing wooden antiques in the basement. He reports that he has a large amount of flammable paints and solvents in 5 to 10 gallon cans in the basement. Three employees were in the basement working at the time. They report that a small explosion occurred in the finishing room. Two of those employees are outside with severe arm and face burns. One employee is still missing. All other customers and employees are accounted for.

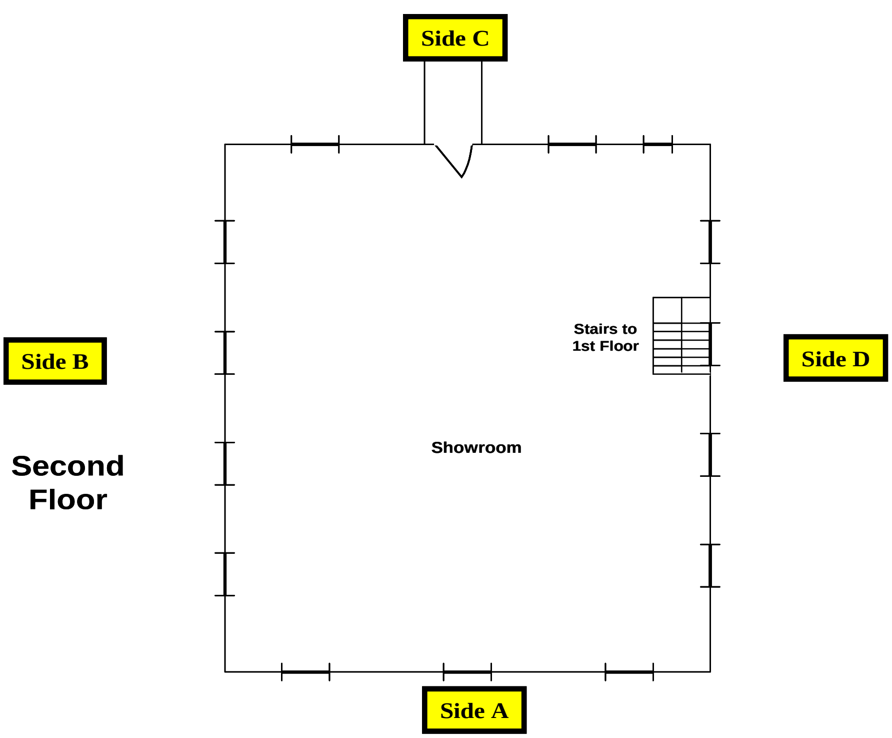
Exposure Building:

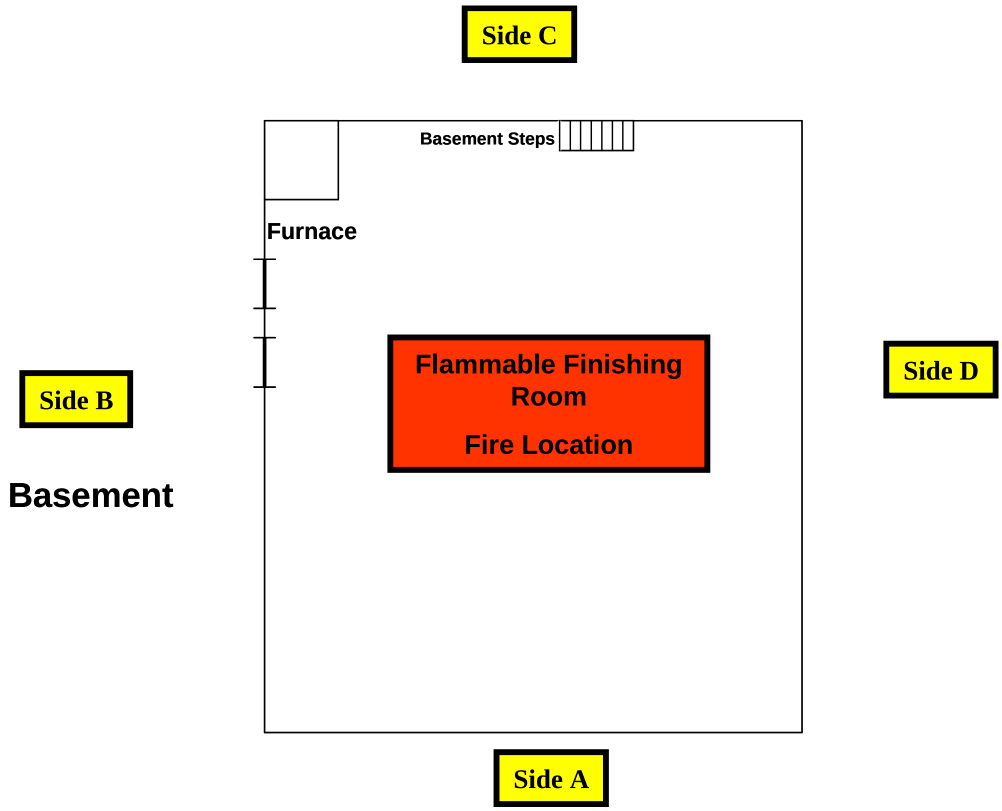
Occupied as Richmond Art Gallery Side B--two-story, 20 by 40 foot--Type III--ordinary balloon frame.

Activity 4.1 (cont'd)

Exercise #3 Plot Plans






Side C
Basement Steps
Furnace
Side B
Basement
Flammable Finishing Room
Fire Location
Side D
Side A

Activity 4.1 (cont'd)

Primary Factors Exercise Chart

Pertinent Primary Factors	Pertinent Subfactors	Pertinent Precautions To Be Taken
1.	1. 2.	1. 2.
2.	1. 2. 3.	1. 2. 3.
3.	1. 2.	1. 2.
4.	1. 2.	1. 2.
5.	1. 2.	1. 2.
6.	1. 2.	1. 2.
7.	1. 2. 3. 4.	1. 2. 3. 4.
8.	1. 2. 3.	1. 2. 3.
9.	1. 2.	1. 2.
10.	1. 2.	1. 2.
11.	1.	1.
12.	1. 2.	1. 2.
13.	1. 2.	1. 2.

Activity 4.1 (cont'd)

Commercial--Type II--Noncombustible--Exercise #4

Structure: One-story, 40 by 50 foot

Building Construction: Type II--noncombustible

Roof Construction: Metal truss roof support system

Floors: Concrete

Alarm System: Smoke detectors installed

Sprinklers: Yes--partial playroom area

Occupants: Thirty preschool children
Five adults

Special Concerns: Locked fence--rear play area

Situation Report:

Fire Building:

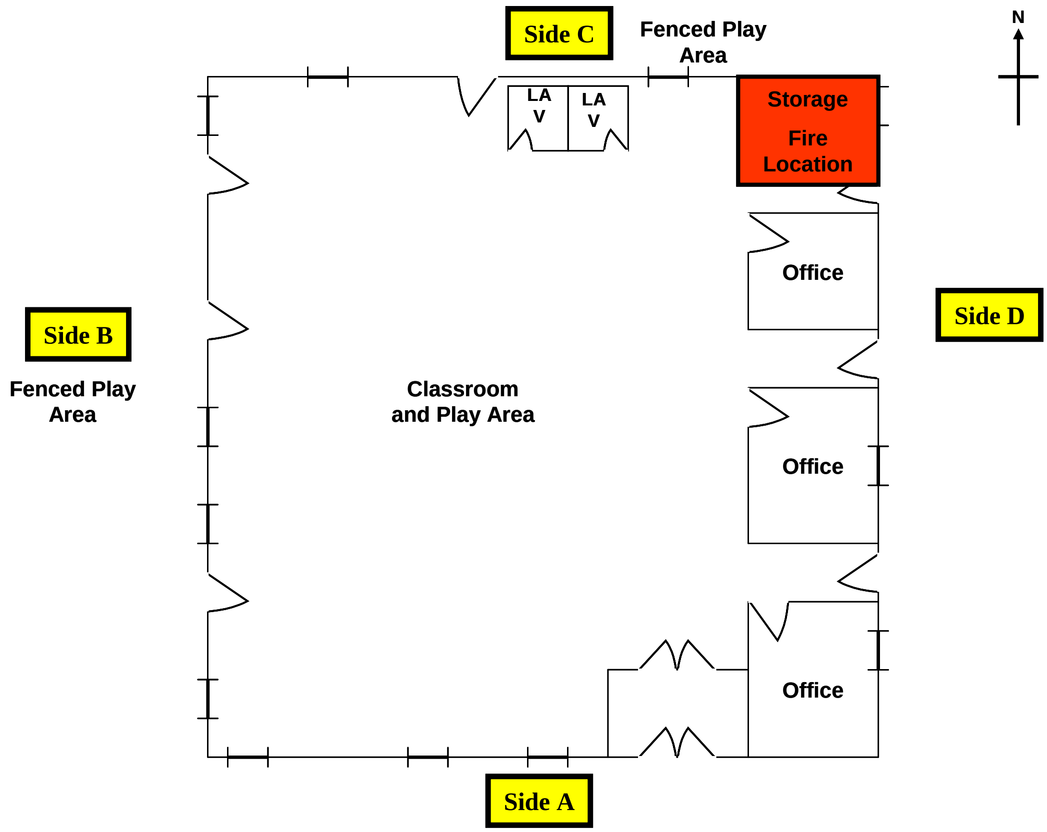
It is January 25, 1015 hours, temperature 15 °F (-9 °C), wind from north at 10 mph. Upon arrival, several children are outside along with four adults. Two children and one adult are unaccounted for. All three were last seen in the children's lavatory.

Exposure Building:

No immediate exposures.

Activity 4.1 (cont'd)

Exercise #4 Plot Plans



Activity 4.1 (cont'd)

Primary Factors Exercise Chart

Pertinent Primary Factors	Pertinent Subfactors	Pertinent Precautions To Be Taken
1.	1. 2.	1. 2.
2.	1. 2. 3.	1. 2. 3.
3.	1. 2.	1. 2.
4.	1. 2.	1. 2.
5.	1. 2.	1. 2.
6.	1. 2.	1. 2.
7.	1. 2. 3. 4.	1. 2. 3. 4.
8.	1. 2. 3.	1. 2. 3.
9.	1. 2.	1. 2.
10.	1. 2.	1. 2.
11.	1.	1.
12.	1. 2.	1. 2.
13.	1. 2.	1. 2.

Activity 4.1 (cont'd)

Commercial/Residential--Type III--Ordinary--Exercise #5

Structure: Three-story, 20 by 40 foot

Building Construction: Type III--ordinary

Roof Construction: 2- by 12-foot flat plywood with asphalt

Floors: 2- by 6-inch plywood flooring

Alarm System: Smoke detectors installed

Sprinklers: Kitchen cooking area

Occupants: Eight employees
Eight diners

Special Concerns: Two commercial kitchens--first and second floors

Situation Report:

Fire Building:

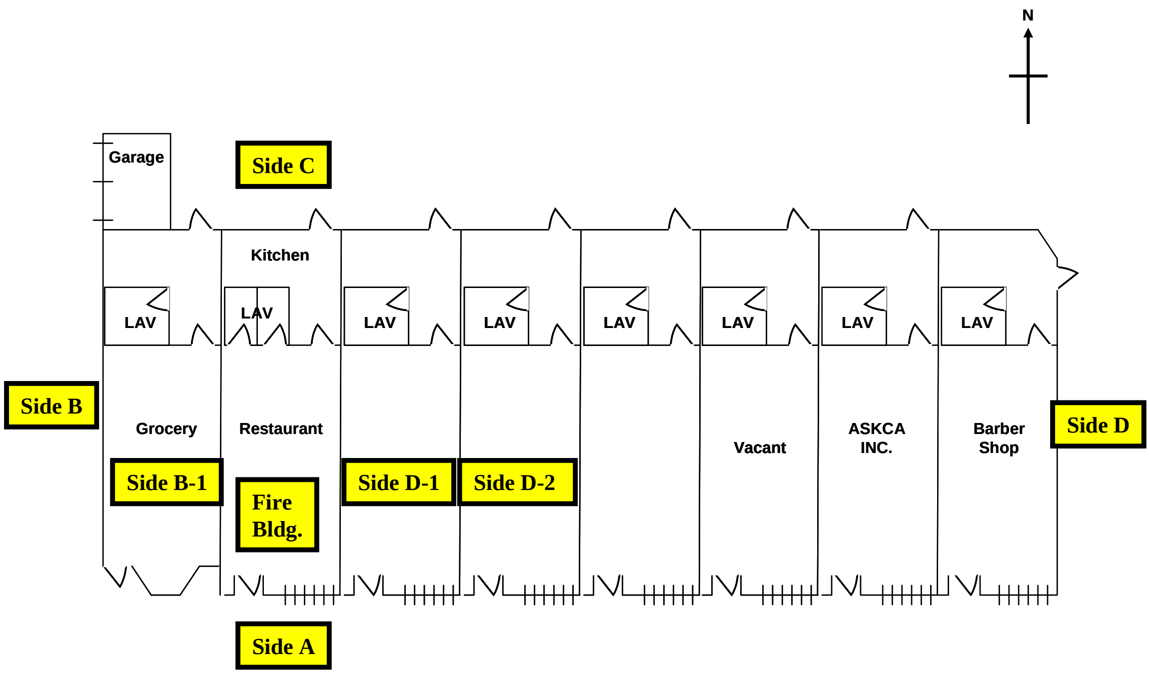
It is April 1, 1830 hours, temperature 40 °F (4 °C), wind from southwest at 23 mph. Upon arrival, the manager of Tim's Restaurant reports that a candle fell from a table on a second floor dining room igniting the fire. All diners and six employees are accounted for, but two cooks from the second floor kitchen area are unaccounted for. He further stated that he did not think anyone was on the third floor at the time of the fire, but was not sure.

Exposure Building:

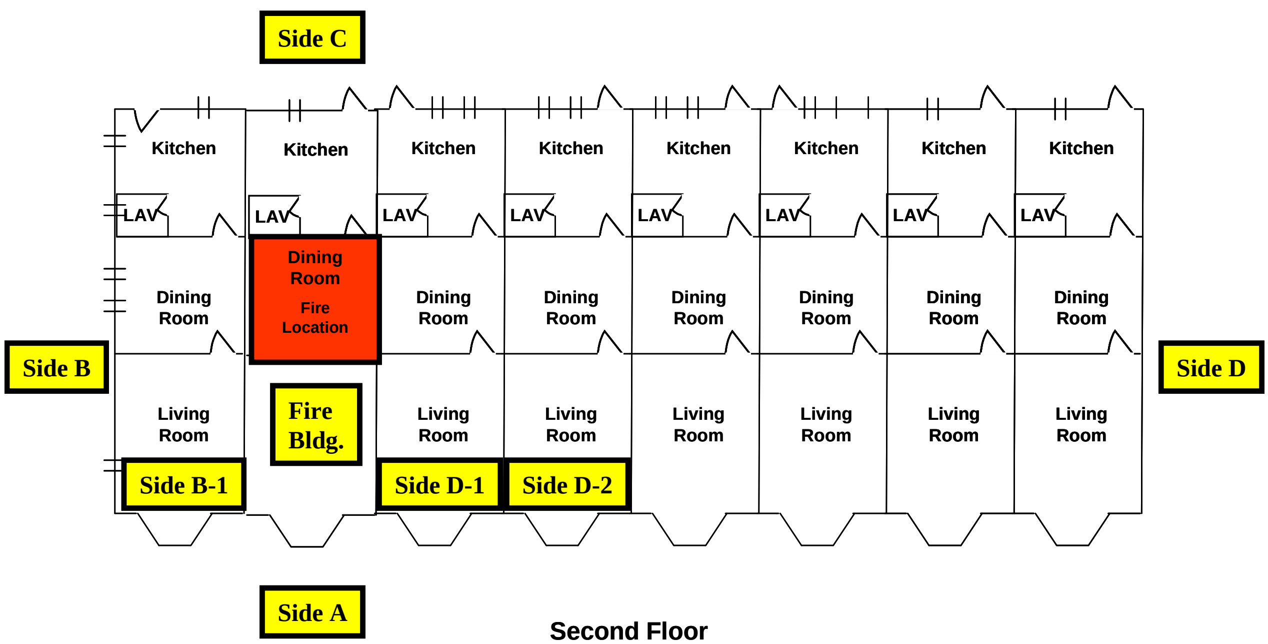
Exposure buildings are similar commercial/residential occupancies, first floor commercial, second and third floors residential. Status of occupants unknown upon arrival.

Activity 4.1 (cont'd)

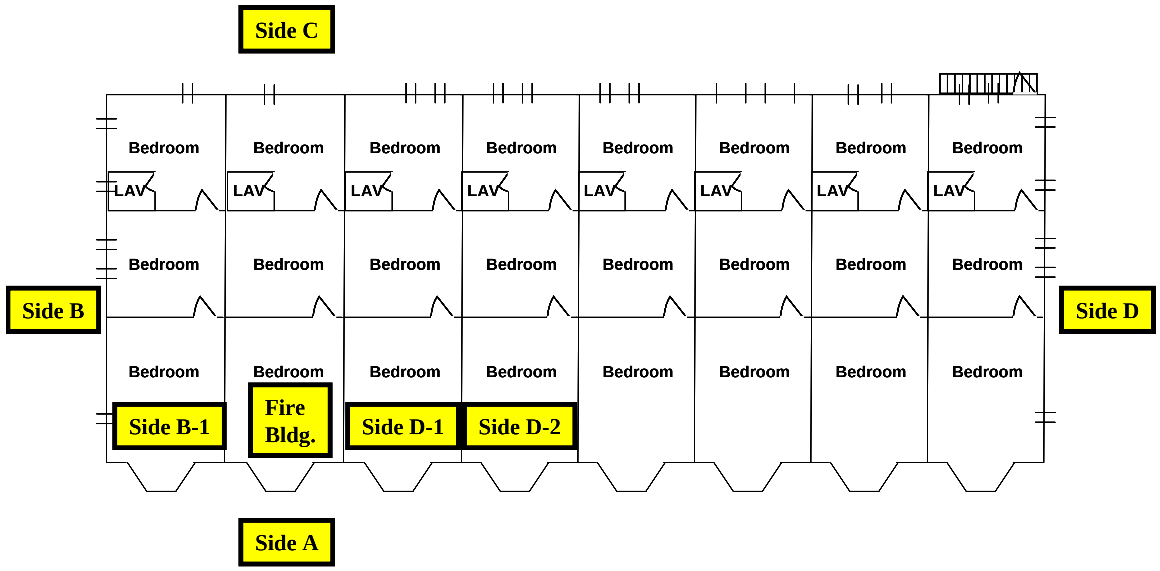
Exercise #5 Plot Plans



First Floor



Second Floor


Side C
Bedroom
Bedroom
Bedroom
Bedroom
Bedroom
Bedroom
Bedroom
Bedroom
LAV
LAV
LAV
LAV
LAV
LAV
LAV
LAV
Bedroom
Bedroom
Bedroom
Bedroom
Bedroom
Bedroom
Bedroom
Bedroom
Side B
Side D
Bedroom
Bedroom
Bedroom
Bedroom
Bedroom
Bedroom
Bedroom
Bedroom
Side B-1
Fire Bldg.
Side D-1
Side D-2
Side A

Third Floor

Activity 4.1 (cont'd)

Primary Factors Exercise Chart

Pertinent Primary Factors	Pertinent Subfactors	Pertinent Precautions To Be Taken
1.	**1.** **2.**	**1.** **2.**
2.	**1.** **2.** **3.**	**1.** **2.** **3.**
3.	**1.** **2.**	**1.** **2.**
4.	**1.** **2.**	**1.** **2.**
5.	**1.** **2.**	**1.** **2.**
6.	**1.** **2.**	**1.** **2.**
7.	**1.** **2.** **3.** **4.**	**1.** **2.** **3.** **4.**
8.	**1.** **2.** **3.**	**1.** **2.** **3.**
9.	**1.** **2.**	**1.** **2.**
10.	**1.** **2.**	**1.** **2.**
11.	**1.**	**1.**
12.	**1.** **2.**	**1.** **2.**
13.	**1.** **2.**	**1.** **2.**

Activity 4.2

Objectives-Strategy-Tactics Chart Exercise

Purpose

To identify objectives, strategy(ies), and tactics at an incident scenario.

Directions

1. You will be placed into groups of five or six.

2. Your instructor will review the Primary Factors Chart Exercise and the Primary Factors Chart.

3. You will be given Central City Resource Handouts for initial 1st Alarm Assignment.

4. Your groups will develop an Objectives-Strategy-Tactics Chart report for their assigned scenario.

    a. Column 1--identify the 1st Operational Period Objectives for the scenario.

    b. Column 2--identify the 1st Operational Period Strategies for each objective.

    c. Column 3--identify the 1st Operational Period Tactics for each strategy.

    d. Column 4--assign companies to perform tactics.

    e. Each group shall select a spokesperson to report Objectives-Strategy-Tactics Chart findings to class.

Activity 4.2 (cont'd)

Central City Fire/EMS Dispatch Criteria

Assignment	Alarm Type	Engine	Ladder	Squad	Battalion Chief	EMS Unit	RIT	Safety Officer	Air Cascade
1st Alarm	Structural	3	1			1 BLS			
Working Incident	Structural	2		1	1		1	1	1
1st Alarm	Target Hazard	3	2	1	1	1 BLS			
Working Incident	Target Hazard	2				1 ALS	1	1	1
2nd Alarm	Structural/ Target Hazard	2	1		1	1 EMS		1	1
3rd Alarm	Structural/ Target Hazard	2	1			1 EMS			
4th Alarm	Structural/ Target Hazard	2	1		1				

Activity 4.2 (cont'd)

Objectives-Strategy-Tactics Chart

Objectives	Strategy(ies)	Tactics	Assigned to:
Objective #1	**1.**	**1.** **2.** **3.**	**1.** **2.** **3.**
	2.	**1.** **2.** **3.**	**1.** **2.** **3.**
	3.	**1.** **2.** **3.**	**1.** **2.** **3.**
Objective #2	**1.**	**1.** **2.** **3.**	**1.** **2.** **3.**
	2.	**1.** **2.** **3.**	**1.** **2.** **3.**
	3.	**1.** **2.** **3.**	**1.** **2.** **3.**
Objective #3	**1.**	**1.** **2.** **3.**	**1.** **2.** **3.**
	2.	**1.** **2.** **3.**	**1.** **2.** **3.**
	3.	**1.** **2.** **3.**	**1.** **2.** **3.**

UNIT 5: BUILDING CONSTRUCTION TYPES

OBJECTIVES

The students will:

1. *List ways to collect data and manage information.*
2. *List and describe the five types of building construction.*
3. *Identify the strengths, weaknesses, characteristics, and collapse potential for each of the five methods of building construction.*
4. *Identify special safety concerns.*
5. *Given a scenario, identify strengths and weaknesses in building construction types.*

INTRODUCTION

An awareness of the different classifications of building construction improves the ability of responders to control and effectively extinguish a structure fire. Many facts and factors must be considered. Knowledge of building construction means more than combustible or non-combustible features. In order to improve the safety record of firefighters it is essential that information be collected on burn time, construction types, and structural integrity. These are critical to emergency scene decision making.

MANAGEMENT OF INFORMATION

Code enforcement inspections, regular preincident planning, and ongoing scene sizeup are essential to successfully confining a structural fire or searching a structure after a natural disaster. Knowing the basic types of building construction is vital. Each type of structure reacts differently during response and recovery efforts. How buildings are constructed and maintained is the basis for ordering resources, selection of strategy, implementation of tactics, positioning of apparatus, and use of special equipment. Each type of construction has positive and negative features that can affect all-risk/all-hazards operations. Understanding the "weaknesses" in a building reduces the likelihood of operational mistakes that result in serious or fatal injuries.

In reality, renovations take place after a structure is occupied. Buildings become a hybrid of materials. After a few decades most buildings will result in a mixture of structural framing and finishes to meet the tenant's needs. These buildings create a dangerous environment with special safety concerns for first responders.

Once on the fireground the initial action by all responders is the identification of potential problems. An accurate sizeup of structural characteristics will greatly assist in this endeavor. During the sizeup phase structural integrity, paths for fire spread, and energy efficient features are a few of the primary factors to be considered. It is often stated that the degree of compartmentation in a structure will determine the appropriate course of action in relation to a responder's risk. The success of an Incident Commander (IC), Incident Safety Officer (ISO) and Division/Group Supervisor hinges on making quick operational decisions. Architectural designs, building materials, and construction methods are critical components in selecting the proper mode of operation.

Just like a military commander knows how to use every part of a battlefield to the best advantage, so, too, must the code enforcement officials and field commanders possess an understanding of each "standard" type of building construction. Structural stability is the cornerstone foundation for effective and safe use of resources. A working knowledge by the first-arriving fire officer of the old and new concepts in building construction can save precious time and lives at the incident scene.

TYPES OF CONSTRUCTION

The fire service has different ways of classifying buildings. In North America the most popular method is by general construction categories. The National Fire Protection Association (NFPA) system can be used to predict how a building most likely will react during a fire. By having an awareness of the various types of building construction, first responders can gain a better understanding of strengths, weaknesses, characteristics, hazards, collapse potential, and overall risks.

The NFPA 220, *Standard on Types of Building Construction* addresses building construction and firefighting. History has shown that the type of building construction has a significant influence on fire suppression, ventilation, and search activities. The most commonly used model building codes subdivide construction into five basic types:

1. Type I--Fire-Resistive Construction.

2. Type II--Noncombustible/Limited Combustible Construction.

3. Type III--Ordinary Construction.

4. Type IV--Heavy Timber/Mill Construction.

5. Type V--Wood-Frame Construction.

TYPE I--FIRE-RESISTIVE CONSTRUCTION

Type I--Fire-Resistive Construction has protected structural elements. It is the most fire-resistive category of all building constructions. Noncombustible fire-rated materials are coated or encased with protection against normal fire conditions. Key structural elements are commonly encased in concrete or fire-rated drywall, or sprayed with a fire-rated material so that the framing materials are not immediately exposed to any direct flame impingement. The protective materials used in this category will not ignite, burn, support combustion, or release flammable vapors when subject to predictable heat conditions. Data collected from concrete or steel skeleton-framed buildings with properly applied fire-resistive materials have shown that Type I structures can withstand complete devastation of the contents and still remain structurally sound. The weakness of Type I construction is that smoke and flames may spread from floor to floor. Central air-conditioning may penetrate all parts of these buildings. Toxic gases can be circulated by the heating, ventilating, and air conditioning (HVAC) system or travel in ducts without properly maintained self-closing dampers.

A common method of fire spreads is autoexposure caused by fire lapping out the windows and up the side of the structure and entering the floors above through windows. Also, fire can extend to the floors above through the perimeter where the outer wall of the building attaches to the floor. Newer Type I buildings are designed with curtain walls that create a space between the steel frame and the outer prefabricated wall. This space that is created is called a safing gap. In the older Type I constructed buildings this space was often filled with loose insulation that over time failed to properly seal this area to prevent fire extension. Today's codes are quite specific on the proper method and materials required to protect this space. This opening still may be compromised during repairs and renovations occurring after occupancy of the building.

Other operational challenges for firefighters in Type I construction might include large open floors, poke-through construction that negates fire stops, and the generation of high heat levels with limited ventilation points.

TYPE II--NONCOMBUSTIBLE/LIMITED COMBUSTIBLE CONSTRUCTION

Type II--Noncombustible/Limited Combustible Construction has building materials that will not directly contribute to the development of fire or any flame spread. This type of building offers little fire-resistive qualities susceptible to early failure, yet is very popular in industrial and commercial facilities because of the reduced construction costs. The height of exterior bearing walls which is normally only one or two stories is of a noncombustible or limited combustible material. The structural framework is made of steel that is bolted, riveted, or welded in place and can be configured into many shapes. Typically, walls are made from metal or concrete block. Large area, single-story prefabricated metal clad buildings are becoming more popular.

The metal deck roof can be flat or peaked. The flat roof is often constructed and supported with a steel bar joists. A peaked roof is often supported on a metal-framed truss consisting of small-dimensional angle iron and a roof surface of corrugated metal. The Type II building can be seriously negated by the use of combustible material during the construction or renovation phase. This includes the installation of wood paneling in an office area or decorative flammable wall covering. Automatic sprinklers should be used to protect combustible or valuable contents. The strength of this construction is the load carrying capacity and the ability to span long areas with or without columns. However, the unprotected steel will expand and begin to lose strength at 1,100 °F (593 °C). At 1,500 °F (816 °C), steel will not even support its own weight. As steel warms up during a fire it has the capacity to twist and distort. This movement can drop structural members being supported or push a wall to the point of collapse.

Although the structural elements do not add fuel to the fire, they are unprotected under fire conditions and likely to fail. Responders must be concerned with the potential for early collapse dangers and clearly establish collapse zones based on the height of the structure.

TYPE III--ORDINARY CONSTRUCTION

Type III--Ordinary Construction has a combination of combustible and noncombustible features. Because of its popularity, this architectural style has been termed Main Street USA. The exterior walls are protected by a noncombustible material and the fire resistance of the interior depends on the age of the building. It is common to have parapet walls between adjoining properties, decorative cornices, and even a marquee in business districts. Type III buildings can be divided into older and newer construction features. Combustible walls and ceilings are protected with plaster, plasterboard, or drywall. These materials will assist in containing a fire for a reasonable period of time. Once flames or high heat enter the interconnecting combustible voids behind a partition, it will necessitate companies and crews to open walls and ceilings to ensure complete extinguishment. The use of thermal imaging cameras (TICs) can assist firefighters in finding areas of hidden fire that will need to be opened to ensure complete extinguishment.

The structural floor and roof members, in older construction, have solid joists and rafters that can be 3-inches wide and 10-inches deep. At times columns were added to provide additional support. The size of rooms is limited by the span of the supporting element.

Floor joists are commonly fire cut on each end. The fire cut is an approximately 30° cut on each end of the solid beam. The longer end of the cut is placed downward and rests in the bearing wall. The fire cut allows the floor to collapse down into the building without pushing the masonry wall outward. The danger of a fire cut is the increased risk of a collapse to fire companies and crews operating on the interior of the building.

Older buildings have combustible floors that can consist of tongue and groove boards while the flooring in newer construction can consist of plywood, oriented stand board (OSB), laminated veneer lumber (LVL) and parallel stand lumber (PSL), lightweight wooden trusses, and wooden "I" beams.

In Type III construction, the roof assembly can be viewed by older and newer techniques. Commonly in an older building, 1- to 1-1/4-inch thick wooden planks are used as roofing material. Contemporary construction techniques will use lightweight materials and evolving methods. Roof coverings such as tar and gravel, asphalt shingles, rolled asphalts, and rubber covering are likely to be found with this type of construction. Peaked roof structures commonly have an accessible area of various dimensions called an attic. In a flat roof building, there is a smaller void that is not accessible and normally free of storage. This concealed space is referred to as a cockloft and is open path for fire and smoke spread.

A drawback of Type III construction is that the structural elements will burn, while the exterior load bearing and nonload bearing walls will be of a fire-resistive material. Firefighters must be trained to carefully recognize and fully evaluate the presence of void spaces that are very typical in this category of construction. Experience has shown that through the decades, these buildings have had extensive modernization. Often interior walls are altered to create an open contemporary appearance. Suspended ceilings are added. Channels for new HVAC equipment and shafts for plumbing fixtures can rapidly spread the fire. Numerous voids and open spaces can be found anywhere in the structure creating a "deadly ambush" for unsuspecting firefighters.

TYPE IV--HEAVY TIMBER/MILL CONSTRUCTION

Type IV--Heavy Timber Construction is also called Mill Construction because of the substantial size of the wooden structural elements. These buildings can be found in many parts of the Nation. This type of structure, when properly maintained, is not prone to early collapse. The large-cross-sectional lumber used in walls, ceilings, floors, and roof assemblies makes it very sturdy. The masonry exterior walls can range up to 60 to 80 feet. Depending on the height of the structure, the extra thick walls can be 36 inches at the foundation. Often the large interior is divided by firewalls and a self-closing fire door. The firewall is distinguishable by its thickness. It is wider than an ordinary wall and does not bear the weight of the building. The large open floors, constructed of solid wood planks, were built to handle heavy loads, and was accomplished by the installation of, at a minimum, 8-inch thick columns or solid timber trusses. Interior modifications to these structures can change some of the inherent qualities of the original construction. In Type IV construction the interior walls and ceilings are not finished. This leaves masonry walls exposed and relatively few concealed spaces. Recently, factories and warehouse occupancies have been converted into retail or wholesale outlets. Other heavy timber buildings have been converted into energy efficient multiuse occupancies such as restaurants, small shops, galleries, vertical malls, apartments, and condominiums.

Historically fires that get beyond the incipient stage generate the potential for a tremendous amount of radiant heat and will require several operational periods to contain and control. First-arriving responders must anticipate rapid fire spread and recognize hazards created by the many original openings for freight elevators, stairs, beltways, and utility shafts. Key strategic considerations will be needed for the proper placement of apparatus and the quick identification of all available water supplies with reliable pressure for the use of many master streams. The ability of a fire department to dispatch and deploy a sufficient amount of resources can mean the difference between containment and conflagration.

TYPE V--WOOD-FRAME CONSTRUCTION

Type V--Wood-Frame Construction has a support system that consists of wood or a similar material. This is the most prevalent type of construction used today. Model building codes are frequently being adjusted and energy efficiency techniques are always being evaluated for residential and commercial properties. These changes can greatly assist or seriously impair responders in their quest to contain and control a small fire. To prevent weather-related damage the wooden exterior framing system is commonly covered. In older construction, wood siding, hard asbestos shingles, or flexible asphalt wrapping are common. In newer construction, combustible coverings like aluminum and vinyl are used and will add to the fuel load. Stone, stucco, and brick veneer are noncombustible materials that can be used to protect the structural components without adding any fire load.

The structural elements will vary. The older wood-frame construction was assembled from solid lumber with nail connectors, while newer construction relies on predetermined engineered lumber and lightweight fasteners. Since the bearing walls are made out of combustibles, as they burn, there is a significant loss in the load-carrying capacity.

Different Eras Resulted in Different Styles of Wood-Frame Construction

Balloon frame was very popular until the mid-1900s when long structural materials were readily available from nearby lumber mills. This framing system has exterior walls assembled with wood studs that are a continuous inner cavity from the basement into the roof area. Compartmentation was lacking and the adequate fire stopping was an operational concern. This open flue created the potential for rapid fire extension.

Platform frame is an open style of construction that has been popular since the late 1940s. The sidewalls are erected on the floor deck. After the wall studs are in place, the floor joists and flooring for the next level are set onto the studs or sill plate. This construction method reduces the path for fire that can extend to upper levels because of the amount of extensive materials that must burn.

Post-and-beam frame is another framing system that uses posts as the vertical supporting member and beams as the horizontal members. This technique has joists that are used to tightly connect the building. A modern version of post-and-beam frame can be found where large pressure-treated poles are firmly set into the ground and the framework of the structure is hung from the supporting elements.

Log frame is another framing system where wooden logs are interlocked by notching each end. In this style of construction the exterior walls will supply an abundant amount of fuel to a fire. This log cabin design can be found in several regions of the country.

WHAT ARE THE FIREFIGHTING SAFETY CONCERNS?

In this era of significant changes in the building industry progressive fire departments have a unique opportunity to have input. In reality, the only reasonable way a firefighter can become familiar with the types of construction that exist in the community is to get out of the fire station and see what is occurring in his/her local district. Tours of new and existing buildings will provide an opportunity to see construction changes, examine modern materials, share ideas on "new wave" building methods, and review the training tips from an all-hazards perspective. Technology has, and will continue, to change many aspects of emergency response. Economically driven trends in the use of lightweight construction materials such as laminated long span composition lumber (e.g., "I" beams made of saw dust and glue), cold formed steel (C-joist) on aluminum hangers all have made interior firefighting, search, and rescue operations more dangerous than ever. Fortunately, new equipment like the thermal imaging camera (TIC) will assist responders in the identification of building features that may be invisible in heavy smoke conditions.

WHAT IS THE BRIEF INITIAL REPORT?

The Brief Initial Report (BIR), often called the Status Report, is critical information that is transmitted by the first-arriving unit at an incident. Simply stating **"working fire"** or **"fully involved"** is insufficient. The BIR should be a concise sizeup report of the fireground conditions.

Giving effective information in a standard format increases the ability of later-arriving companies and chiefs to be prepared mentally to assist the first-arriving unit quickly.

Initial Report

The initial report is to be given immediately upon arrival on location. The first-arriving officer should state the exact location and conditions as observed.

- Nothing showing.
- Size of structure--stories and dimensions--type of construction--occupied or vacant.
- Smoke/Fire--location and density.
- Status of occupants, if known.
- Exposures--Sides A, B, C, D or other.
- Engine ___ is establishing ___ Street Command.

The recommended format:

- Engine ___ arrived location Side ___ (state Side of the facility) of (describe the facility briefly).
- (Describe the situation specifically and the mode of operation.)
- Engine ___ crew is (describe what your crew as been assigned to do and where).
- Captain Engine ___ is Command on Side ___ (state Side).

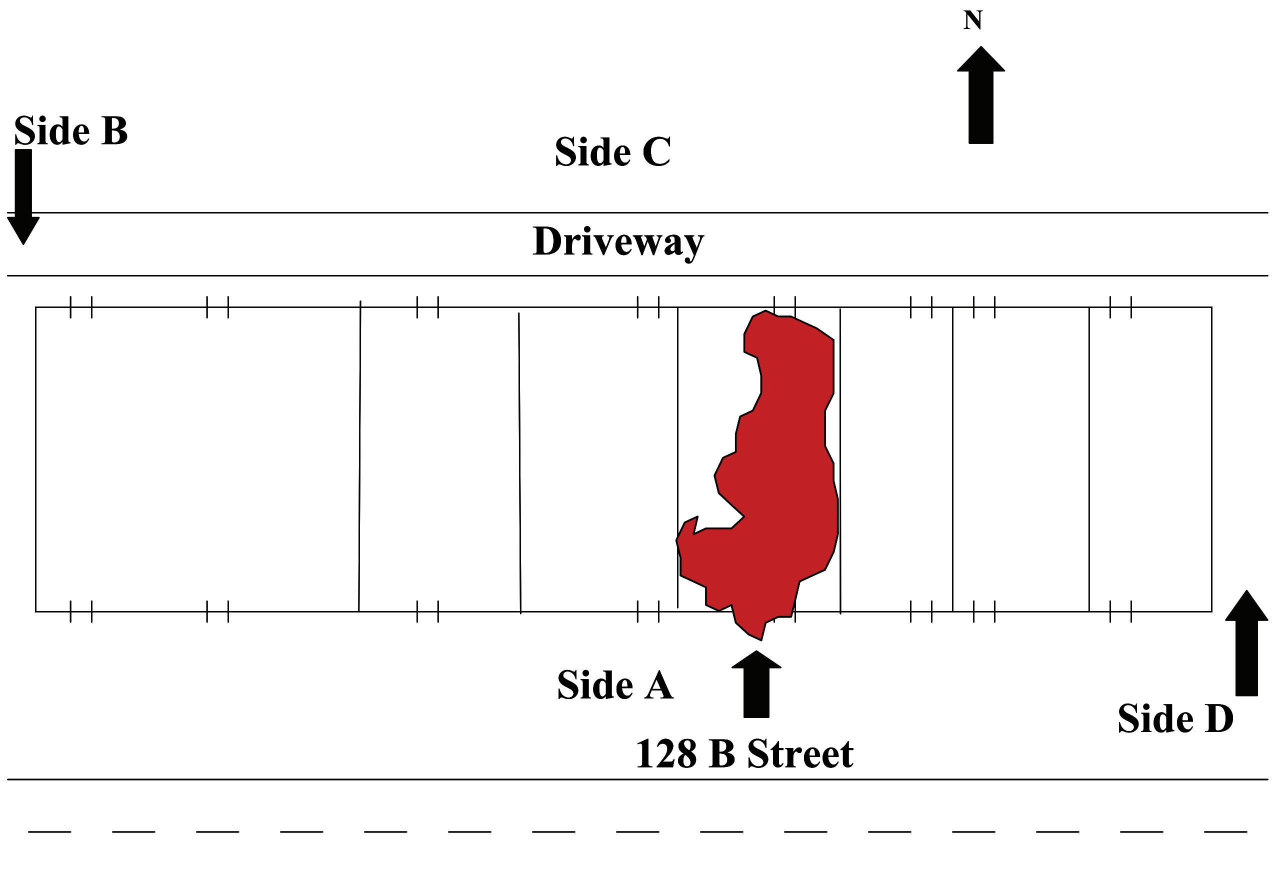
Subsequent Report

The subsequent report will contain information not immediately reported and/or information developed upon investigation.

The subsequent report is to be given as soon as possible or within 5 minutes.

Progress Reports

Progress reports are to be given by the IC every 10 minutes until fire is under control.



Example Sizeup Report

- On location at 128 B Street, one-story strip store.
- Type III--Ordinary Construction, 20' x 45', occupied as a furniture store.
- Heavy fire and smoke, Side A.
- All occupants have been removed.
- Exposures B-1 and D-1 similar type stores, medium smoke showing.

SUMMARY

Ensuring strict compliance with building codes, creating meaningful preincident plans, and performing ongoing sizeup steps at the scene will affect the lives of many present and future first responders. Conducting inspections gives local responders a perfect opportunity to not only gather the support of the people in the community, but to learn what hazardous conditions are waiting to injure or kill firefighters.

There are five major types of building construction. Each has distinguishing characteristics. Building modification can create special safety concerns. Familiarity with the various types of construction in one's response district along with training is critical to understanding the strengths, weaknesses, and potential for fire spread and collapse of each type of building construction. When leaders in the fire service encourage inspections and planning, Command Officers are able to project and deploy resources in an effective manner.

ICs must act decisively in the selection of an operating mode based on the type of building construction. Incident Safety Officers (ISOs) must monitor burn time and Company Officers (COs) must have a practical plan of action (POA) for an emergency evacuation. All responders must follow a risk versus benefit approach from response to termination. First responders must never simply guess on structural integrity; lives depend on recognizing and evaluating various types of building construction.

UNIT 6:
BURN TIME CONSIDERATIONS AND LINE-OF-DUTY DEATHS FROM COLLAPSE INCIDENTS

OBJECTIVES

The students will:

1. *Given examples of different types of structures and different fire loads, predict the time of collapse.*

2. *Discuss the impact of the primary factor, construction, on line-of-duty deaths (LODDs).*

WOOD FRAME

ABSTRACT

A series of fire tests were conducted in Phoenix, Arizona to collect data for a project examining the feasibility of predicting structural collapse. The fire test scenario was selected as part of a training video being prepared by the Phoenix, Arizona Fire Department. Multiple fires were started in each structure to facilitate collapse; the fires were not intended to test the fire endurance of the structures.

Four structures with different roof constructions were used for the fire tests. Temperatures were measured as a function of time in four locations within each structure. Furniture items were placed in the front and back of each structure to simulate living room and bedroom areas. The living room and bedroom areas of each structure were ignited simultaneously using electric matches.

Peak temperatures obtained during the tests ranged from approximately 800 °C (1500 °F) to 1000 °C (1800 °F). The roof of each structure collapsed approximately 17 minutes after ignition. In addition to the full scale tests, the plywood and oriented strand board (OSB) roofing materials were tested using a cone calorimeter to characterize the fire properties of the materials.

INTRODUCTION

Every year, approximately 100 firefighters die in the line-of-duty, and 90,000 to 100,000 are injured. In 1999, the United States Fire Administration (USFA) estimated that slightly more than 30% of the firefighter fatalities occurring on the fireground resulted from something other than stress and heart attacks. Stress and heart attacks, which accounting for almost half of the firefighter fatalities, remain the leading cause of death.

The categorization of statistics does not lend itself to easy identification of those deaths that occurred due to structural issues, including failure and collapse. Examination of specific incidents in 1999 indicates that 18 firefighters, or 16%, died as a result of being trapped in a structure or involved in a collapse. Based on data obtained from 1979 through 1988, a report prepared by the National Fire Protection Association (NFPA) for the Federal Emergency Management Agency (FEMA) indicates that 93 of the 474 firefighters who were killed at structure fires died as a result of structural collapse. Of these firefighters killed due to structural collapse, 60% were caught or trapped in the collapse while 40 % were struck by collapsing walls or sections of walls. A subsequent report examined 1150 firefighter fatalities that occurred during the period from 1983 through 1992. Of the 390 deaths that occurred at structure fires, 2 - died as a result of being caught or trapped and 26 firefighters were struck and killed by debris from the collapse. In a 2002 report, Dr. Fahy of NFPA indicated that the rate of deaths due to heart attacks at structural fire is decreasing while the rate of deaths due to traumatic injuries is increasing. Structural collapse is identified as one of the major causes of these traumatic injuries.

A recent National Institute of Standards and Technology (NIST) report indicated that deaths resulting from structural collapse have decreased overall during the last 23 years. However, the percentage of those deaths occurring at residential fires has been increasing. As part of a project funded by the USFA, the Building and Fire Research Laboratory (BFRL) at NIST is exploring the feasibility of developing a system for use by firefighters to predict structural collapse during fireground operations. Predicting a potential structural collapse is one of the most challenging tasks facing an Incident Commander at a fire scene. Usually the lack of information on the construction of the building, fire size, fire location, fire burn time, condition of the building, fuel load, etc., makes the task nearly impossible.

The fire department in the Phoenix, Arizona conducted a series of live fire training exercises in various structures in an effort to better educate firefighters about structural collapse. While some of the structures in this ongoing series of training exercises were scheduled for demolition, other structures such as those described in this training exercise were built specifically for the fire tests. Each structure was allowed to burn until some portion of the structure collapsed.

In collaboration with the Phoenix Fire Department, researchers from NIST provided measurement support during the fire tests. Using video and data obtained from two different fire test series, the Fire Department developed a set of three videotapes dealing with fireground command and collapse issues. This report presents the results obtained from a set of tests that were conducted in single story wood frame residential structures. These structures were constructed for test experiments in order to examine several issues related to firefighter health and safety.

The first goal of the tests was to obtain temperature data from a burning structure during a collapse. Second, various techniques and tools were being evaluated for the use in predicting structural collapse. Specifically, the use of thermal imaging techniques was examined as a means to predict collapse. In addition, the exterior of the building was observed prior to and during collapse to identify any visual indicators of impending collapse. Subsequent reports will provide additional analysis of these fires and will also assess the effectiveness of various methodologies for predicting the onset of structural collapse.

These tests were not designed to evaluate the fire endurance of wood trusses, gypsum wallboard, wood studs, or any other structural elements used in the construction of the four structures. The fire scenario used in this study was designed to reach flashover conditions rapidly to force a partial or complete collapse of the structure. Many factors influence the failure of structural elements including the load on the element, protection of the element, fire intensity, and fire duration. More or less time may be available before failure of the element depending on the particular fire scenario. Kenneth E. Bland provides a review of, and expert procedure for, predicting the failure of wood assemblies when exposed to fire. Using the Component Additive Method (CAM) procedures presented in his report, the fire resistance rating of a wood roof assembly consisting of wood trusses, spaced 0.6 m (24") on center and protected by a 12.7 mm (½") thick layer of gypsum board would be at least 20 min. The CAM procedures assume the gypsum board is continuous, unlike the Phoenix fire tests where an attic access hole was located directly above the couch.

The fire resistance and ability of a structural member to maintain its load during an actual fire are influenced by a number of factors. Many of these factors can vary significantly depending on the specific fire scenario. Fire resistance ratings and measured or predicted times to failure or collapse should not be relied upon as absolute indicators of time available for operating on, or within, a burning structure. Each structure must be evaluated and reevaluated during the fire to determine whether or not it is safe for firefighters to remain within any potential collapse zone.

EXPERIMENTAL CONFIGURATION

The Phoenix Fire Department built four single story wood frame residential type structures for this series of tests. These structures were identical except for the roof construction. One structure had a roof consisting of asphalt shingles on ½" five-ply plywood while a second structure had asphalt shingles on ½" oriented strand board (OSB). Both structures had a layer of 15 lb felt paper between the asphalt shingles and plywood or OSB. The other two structures used tile over either plywood or OSB as the roof construction. The cementatious tile roofs had two layers of 30 lb felt over the plywood or OSB and nominally 1" by 2" boards to hold the tile in place. The measurements for the materials used to construct the test structures described in this report are approximate nominal dimensions.

Each structure consisted of two rooms and an attic space. The rooms were separated by a wall constructed of 2" x 4" wood studs with a layer of ½" gypsum board nailed to each side. There was a doorway, 2.9' wide and 6.5' high, in the wall between the two rooms with its centerline located 14.9' from one exterior wall and 2.4' from the other exterior wall.

The exterior walls of the structures were composed of 2" x 4" wood studs on 1.3' centers nailed to a single sole plate and a double top plate. The exterior surfaces of the walls were covered with 5/8 in T-1-11 wood siding using galvanized nails. Interior walls and ceilings had ½" gypsum board nailed to the studs. All of the joints between boards were taped, and the taped joints and nails were covered with joint compound. In addition, the four walls in the back room (bedroom) and the two walls in the front room (living room) were covered with 1/8" pressboard paneling attached using construction adhesive and small brads.

The front wall of the living room had a doorway, approximately 2.9' wide and 6.7' high, located with its centerline 1.9' from one wall and 14.8' from the opposite wall. A hollow core wood door was mounted in the doorway opening. In the living room of each structure, the walls adjacent to the front wall each had an approximately 4' wide by 3' high section removed to let air into the room. One wall in the bedroom had a 4' wide by 3' high section removed, and the rear wall had a 3' by 3' window with glass. Each of the three cutout sections of wall had a piece of plywood on a slide track allowing it to be moved back and forth to regulate the flow of air into the room.

The roof system was built with manufactured trusses on 2' centers. The gable ends were studded with 2" by 3" lumber and covered with ½" high density fiberboard. The trusses were nailed on each end and attached to the top plate with metal hurricane ties. All structures had 2" x 6" boards nailed to the truss tails which were cut off at 1.7'. The outside rafts were nailed to 2" x 4" boards and attached to the second truss at 4' intervals.

A 5' long base cabinet made of particle board and a counter top were placed along the front wall of the living room. A second 5' long cabinet was nailed to the wall above the first cabinet.

Electrical outlet boxes were installed in the walls at various locations throughout the two rooms. A 0.8' by 0.8' hole was cut in the center of the ceiling in the living room and covered with a plastic grill to simulate a vent. The location of this vent was selected to facilitate fire spread into the attic space. A 2' by 2.5' hole was cut in the ceiling of the living room to allow access to the attic space. This opening was covered with a ½" piece of drywall which was held in place using wood molding strips. Identical pieces of furniture, typical of a residential occupancy, were placed in each of the four structures. The living room contained a couch, a love seat, and two chairs consisting of wood frames with polyurethane foam cushioning material. Two wood night tables, a wood coffee table, and two table lamps were also placed in the living room. The bedroom contained two sets of foam mattresses and box springs on metal frames. Wood night tables were placed adjacent to each bed. Two wood dressers were located in the room. One dresser was located along the wall opposite the ends of the two beds, while the second dresser was adjacent to the side of the second bed. Finally, a chair with polyurethane padding on a wood frame was positioned in the bedroom diagonally opposite the end corner of the first bed.

Table lamps were placed on top of the two bed tables. Both rooms in each structure had nylon wall-to-wall carpet laid on the floor over 3 lb pad.

Two mannequins outfitted in firefighter turnout gear with self-contained breathing apparatuses were placed on the roof of each structure during the test. Each firefighter mannequin had a mass of approximately 280 lb with gear, and they were positioned on the roof using metal stands. One firefighter was placed in a bending position while the second stood upright. Thermocouples were located in contact with the roof surface under the left and right boot of each firefighter mannequin. Tiles were removed from under the mannequins' boots for tests 3 and 4. A roof mounted air conditioning unit was also placed on the roof of each structure.

Each air conditioning unit had an approximate mass of 500 lb and was placed on the sloped portion of the roof opposite the firefighter mannequin locations. Each test was documented using standard video, infrared cameras, and still photographs. Two separate infrared cameras monitoring different portions of the electromagnetic band were used during the tests. One of the infrared imagers, Camera A provided less quantitative temperature data, but was representative of infrared cameras typically used by fire departments. The other infrared imager, Camera B, provided significantly more resolution in temperature data, different measurement ranges, emissivity factors, adjustable sensing spans, and calibration capability, but was not designed for firefighter use. The video and infrared cameras were mounted on a fire department ladder truck. During each fire test, the ladder with the standard video and two infrared cameras was elevated to provide an overhead view of each structure for the three cameras.

EXPERIMENTS

Full Scale Fire Tests

Two fires were ignited simultaneously in each structure using electric matches. Electric matches are matchbooks with a short length of Ni-Chrome wire wrapped around the match heads. When a small electric current passes through the wire, the wire heats up and ignites the matchbook. One electric match was placed in a slit in the couch in the front room and covered with paper towels and newspaper. A second electric match was positioned in a slit in the chair, located in the back room, and covered with paper towels and newspaper. The fires were ignited in each room simultaneously and allowed to grow to flashover. Flashover occurs when multiple combustible items in a room ignite as a result of being heated by intense thermal radiation from the hot upper layer. At flashover, the room environment is characterized as well stirred, with temperatures throughout the space being relatively uniform. Gas temperatures in the room typically exceed 600 °C (1110 °F). During this test series, the fire ultimately spread into the attic space and eventually caused collapse of a portion of the roof structure. For this test series, collapse was assumed to occur when the portion of the roof supporting the firefighter mannequins failed and allowed fire to envelope the mannequins. As the roof structure collapsed, the firefighter mannequins were removed using a fire department crane. Once the mannequins were removed, the fire was extinguished using water or a combination of water and a fire suppression foam agent.

Test No. 1 was conducted using the structure with a roof composed of asphalt shingles over plywood. For the first test, smoke became visible from the structure approximately 60 seconds after ignition. At approximately 3 min after ignition, the living room reached flashover temperatures. The bedroom reached flashover temperatures about 6 ½ min after ignition. After approximately 1 min, the temperatures in the living room dropped to a relatively uniform 500 °C (930 °F). The bedroom temperatures remained near 600 °C (1110 °F). The fire appears to have penetrated into the attic space at about 7 ½ min after ignition. At 14 min, portions of the roof began to burn. Collapse of a portion of the roof and removal of the firefighter mannequins occurred 17 ½ min after ignition. Fire suppression was initiated at 18 min 40 s.

Test No. 2 was conducted using the structure a roof composed of asphalt shingles over oriented strand board. In the second test, smoke became visible from the structure approximately 52 seconds after ignition. At approximately 3 ½ min after ignition, the living room temperatures briefly exceeded flashover temperatures. Temperatures in the bedroom area never exceeded the 600 °C (1110 °F) flashover threshold until near the end of the test. The living room maintained peak temperatures in excess of 500 °C (930 ºF) while the temperatures in the bedroom remained between 400 °C (750 ºF) and 600 °C (1110 ºF). The fire appears to have penetrated into the attic space at about 8 min after ignition. Flames began lapping the roof 13 min after ignition and at this time the front door failed. At 14 min, portions of the roof began to burn. Collapse of a portion of the roof and removal of the firefighter mannequins occurred 17 min after ignition. Suppression was initiated at 17 min 45 seconds.

Test No. 3 was conducted using the structure with a roof composed of cementitious tile over plywood. During the third test, smoke became visible from the structure approximately 1 min 20 seconds after ignition. At approximately 3 min after ignition, the living room reached flashover temperatures of approximately 600 °C (1110 ºF). The living room continued to maintain temperatures in excess of 600 °C (1110 ºF) for most of the test period. Temperatures in the bedroom remained below flashover temperatures until 11 min after ignition. The fire appears to have penetrated into the attic space again at 8 min after ignition. Collapse of a portion of the roof and removal of the firefighter mannequins occurred 16 min after ignition. Suppression was initiated at 17 min. White smoke was observed coming from the structure at 19 min 40 seconds.

Test No. 4 was conducted using the structure with a roof composed of cementitious tile over oriented strand board. For the fourth test, smoke was first visible at approximately 56 seconds after ignition. Flashover temperatures were reached in the living room 4 min after ignition while the bedroom remained below flashover temperatures until almost 8 min after ignition. The fire penetrated into the attic space at about 8 min after ignition. Collapse of a portion of the roof and removal of the firefighter mannequins occurred 17 min 10 s after ignition. Suppression was initiated at 18 min.

RESULTS - FULL SCALE FIRE TESTS

Temperature Data

First Test:
As the fire in the living room grows to flashover, the stratified fire environment is evident from the distinct temperature histories obtained at the eight sampling locations. At about 200 seconds, the temperature plots indicate a "well stirred environment" with an average temperature of about 500 °C (930 °F). The fire in the bedroom takes longer to reach flashover temperatures; it reaches the flashover point at about 420 seconds. At this point, the environment becomes well mixed with a temperature of about 600 °C (1100 °F). Both the north and south thermocouple arrays in the attic indicate a stratified environment until about 700 seconds. The two peaks, one at about 180 seconds and the second at 200 seconds to 250 seconds, are most likely the result of periodic flame penetration into the attic space through the ceiling penetrations. At about 700 seconds, flashover appears to have occurred in the attic with the environment becoming well mixed at an average temperature of 750 to 800 °C (1380 to 1470 °F).

The temperature plots suggest that some portions of the ceiling begin failing at about 800 seconds. In addition, the front door failed at about 840 seconds. The roof begins to collapse at 1050 seconds and suppression is started at 1120 seconds. Once flashover occurs in the attic at about 700 seconds, the temperatures under the boots increase rapidly to 800 °C (1470 °F), approximately the temperature within the attic space. Subsequently, the temperatures decrease correspondingly with decreasing temperatures within the attic space, possibly the result of failure of the ceiling. The temperatures gradually increase until roof collapse at which point the mannequins become surrounded by flames until their removal.

Second Test:
In the living room, the fire grows to a temperature indicative of impending flashover, approximately 600 °C (1100 °F) within 180 seconds after ignition. After this initial period, the fire environment becomes stratified with a temperature gradient of 300 °C (570 °F) to 550 °C (1020 °F) for a period of about 180 seconds. At approximately 350 seconds after ignition, the entire living room area appears to flashover with a peak temperature of 700 °C (1300 °F). At this point, the environment in the living room becomes well mixed with a uniform temperature throughout most of the remainder of the test. The decrease in temperature occurring at approximately 400 seconds is the result of failure of some portion of the living room ceiling. After the fire begins spreading into the attic area, temperatures in the living room begin a steady climb to a peak of 1200 °C (2200 °F). The front door fails at about 840 seconds leading to a reduction in living room temperatures. Except for a few brief moments, the temperatures in the bedroom area never exceed 600 °C (1110 °F). With the exception of the point at which the roof section collapsed at 1020 seconds, the environment in the bedroom remains stratified throughout the duration of the test.

The first peak at 180 seconds is most likely the result of flames--momentarily extending into the attic area through the ceiling ventilation louvers. The attic access panel and possibly a portion of the ceiling near the ignition location failed at 400 s. The brief peak at 725 seconds is probably the ignition of plastic light boxes in the ceiling. The attic area reaches a flashover condition at about 900 seconds. A portion of the roof under the firefighter mannequins collapses approximately 4 min after flashover in the attic area. As the attic space approaches flashover conditions at about 800 seconds, the temperatures under the boots increase to 750 °C (1380 °F). At approximately 1020 seconds, the roof structure begins to collapse.

Third Test:
As with the other tests, the temperatures in the living room rise rapidly at the start of the third test. At approximately 120 seconds, the space reaches temperatures indicative of flashover. After flashover, the environment becomes stratified with temperatures ranging from 300 °C (570 °F) to 600°C (1110 °F). At about 550 seconds, the temperatures in the lower part of the living room increase producing an almost uniform environment of between 550 °C (1020 °F) and 600 °C (1110 °F). Just prior to a portion of the ceiling collapsing at about 700 seconds, the temperatures in the living room increase to about 700 °C (1290 °F). After collapse of a portion of the ceiling, the temperatures initially decrease then increase to 700 °C (1290 °F) to 800 °C (1470 °F). Collapse of a portion of the roof occurs at about 960 seconds. Prior to collapse of a portion of the ceiling, the bedroom temperatures remain well below 600 °C (1110 °F). For the first 400 seconds of the test, the temperatures in both the north and south portions of the attic grow slowly to a peak of about 150 °C (300 °F). The temperature spikes during this period are indicative of flames momentarily extending into the attic area through the louvers and other ceiling penetrations. Once materials located in the attic start burning, the temperatures increase reaching a sustained maximum of 550 °C (1020°F) with a momentary peak above 600°C (1110 °F). When the roof collapses at 960 seconds, the attic temperatures initially increase then decrease rapidly as suppression is initiated. The temperatures under the firefighter mannequins' boots remain close to ambient until the roof collapses at 960 seconds when the mannequins are enveloped in flame and removed.

Fourth Test:
The temperature data obtained in the living room indicates that the fire grew rapidly producing temperatures in excess of 600 °C (1110 °F). The environment in the living room remains well mixed at flashover temperatures until about the time of roof collapse.

The environment in the bedroom remains stratified with a peak temperature of 420 °C (790 °F) until some portion of the ceiling fails at 450 seconds. After ceiling failure, the temperatures become somewhat erratic varying between 400 °C (750 °F) and almost 800 °C (1470 °F). At approximately 800 seconds, the temperatures in the bedroom become uniform and decrease, rapidly increase, and decrease again. The most likely cause of this phenomenon is failure of additional portions of the ceiling as a result of flashover in the attic space. Temperature increases in both the north and south parts of the attic is relatively continuous with only slight discontinuities at about 450 seconds and 850 seconds. These discontinuities indicate ignition of materials in the attic space and failure of the ceiling membrane between the living room/bedroom area and the attic. Once the attic space has flashed over at 900 seconds, the temperatures become uniform at approximately 750°C (1380°F) until collapse at 1030 seconds. Very little temperature increase is evident on the underside of the firefighter boots until the roof collapses at 1030 seconds.

CONCLUSIONS

In all four tests, some portions in the living room reach flashover temperatures (approximately 600 °C (1110 °F)) within 180 seconds after ignition. With the exception of test 3, the living room temperatures remained at or above 600 °C (1110 °F) until roof collapse. Temperatures in excess of 600 °C (1110 °F) were seldom sustained in the bedroom until after apparent ignition of combustibles in the attic area. Combustible materials in the attic space appeared to ignite 400 seconds to 450 seconds after ignition during each test. With the exception of the first test, roof collapse appears to be preceded by flashover in the attic space. Even though the noncombustible tile was removed from beneath the firefighter mannequins' boots, no temperature changes were measured under the boots until collapse of the roof during the third and fourth tests. The increased temperatures obtained during the first and second tests could be the result of burning of portions of the combustible roof structure remote from the magnetic radiation as a result of electron motion associated with the internal energy of the material. This internal energy is a strong function of the temperature of the substance.

For all four tests, the maximum temperatures in the living room and bedroom areas reached between 540 °C (1000 °F) and 815 °C (1500 °F). Flashover occurred in the living room spaces approximately 3 to 4 minutes after ignition. Prior to collapse, peak temperatures in the attic spaces were approximately 500 °C (930 °F). The fires spread into the attic spaces between 6 minutes and 8 minutes after ignition. In all of the tests, collapse occurred approximately 17 minutes after ignition. Flashover in the attic spaces occurred approximately 5 ½ minutes after the fire spread to the ceiling or 12 minutes after ignition. As the attic space approaches flashover, temperatures under the roof rapidly change (on the order of a few seconds) from near ambient 37 °C (100 °F) to 540 °C (1000 °F).

The temperature of the roof surface under the firefighter mannequins' boots did not increase significantly prior to collapse. Temperature measurements obtained under firefighter boots would probably not be a useful indicator of potential collapse. Unfortunately, the firefighter mannequins did not move. Therefore, the influence of impact or dynamic loading from walking on the roof could not be evaluated. Impact loads on these roof structures could result in significantly less time to collapse.

Each of the roofs collapsed between approximately 16 ¾ min and 17 ½ min. This limited set of full-scale tests does not demonstrate a significant difference between the performance of the plywood and OSB sheathing. No differences were observed between the asphalt shingles and the cementitious tiles. The other temperature data obtained during the tests did not indicate any difference in performance between the plywood and OSB. OSB releases energy faster, and more of its total energy when exposed to high radiant heat fluxes in the cone calorimeter. While it is heat flux dependent, both materials ignite after about the same exposure time. This limited set of burn tests indicated that infrared cameras may not be a viable tool for predicting structural collapse in residential structures. The thermal signature of the fire coming through the roof is washed out by radiation from smoke or fire plumes or was obscured by water spray or rain. Since one typically expects hot smoke or fire plumes as well as water sprays to be present at residential fire scenes, thermal images do not appear to be an adequate indicator of pending structural collapse.

ACKNOWLEDGEMENTS

This information was taken from: Structural Collapse Fire Tests: Single Story Wood Frame Structures
David W. Stroup, Nelson P. Bryner, Jack Lee,
Jay McElroy, Gary Roadarmel, and William H. Twilley

STRUCTURAL COLLAPSE FIRE TESTS: SINGLE STORY, ORDINARY CONSTRUCTION WAREHOUSE

OVERVIEW

Two fire tests were conducted in a warehouse located in Phoenix, Arizona to develop data for evaluation of a methodology for predicting structural collapse. A firewall was constructed to divide the warehouse into two fire compartments. Temperatures were measured as a function of time in three locations during the first test and in two locations during the second test. In addition, the volume fraction of carbon monoxide was measured at selected locations during each test. Stacks of wood pallets were used as the primary fuel source and were ignited using paper and electric matches. Some combustible debris and building structural elements provided the remainder of the fuel load. Peak temperatures obtained at different elevations ranged from approximately 300 °C (570 °F) to 800 °C (1470 °F). Peak carbon monoxide volume fraction reached 4% in the first test and 5% during the second test. The front half of the structure's roof burned through approximately 18 min after ignition of the fire for the first test. The back half of the structure's roof burned through approximately 15 min after the start of the second test.

INTRODUCTION

Every year, approximately 100 firefighters die in the line-of-duty, and 90,000 to 100,000 are injured. For calendar year 1999, the United States Fire Administration estimated that slightly more than 30% of the firefighter fatalities occurring on the fireground resulted from something other than heart attacks. The categorization of the statistics does not lend itself to easy identification of those deaths that occurred due to structural issues.

Examination of specific incidents in 1999 indicates that 18 firefighters, or 16%, died as a result of being trapped in a structure or involved in a collapse. As part of a project funded by USFA, the Building and Fire Research Laboratory (BFRL) at the National Institute of Standards and Technology (NIST) is exploring the feasibility of developing a system for use by firefighters to predict structural - collapse during fireground operations. Predicting a potential structural collapse is one of the most challenging tasks facing an IC at a fire scene. Usually the lack of information on the construction of the building, fire size, fire location, fire burn time, condition of building, fuel load, etc., makes the task nearly impossible.]

The fire department in Phoenix, Arizona conducted a series of live fire training exercises in various structures in an effort to better educate firefighters about structural collapse. Some of these structures were built specifically for the fire tests while others were existing structures scheduled for demolition. Each structure was allowed to burn until some portion of the structure collapsed. At the invitation of the Phoenix Fire Department, researchers from NIST provided measurement support during the fire tests.

This training exercise presents the results obtained from one set of tests. This test series was conducted to examine several issues related to firefighter health and safety. The first goal of the tests was to obtain temperature data from a burning structure during a collapse. Second, various techniques and tools were evaluated for use in predicting structural collapse. Specifically, researchers from Harvey Mudd College, through a NIST funded grant, measured the building vibrations as a means to predict collapse. In addition, the exterior of the building was observed prior to and during collapse to identify any visual indicators of impending collapse. Finally, carbon monoxide volume fractions were measured at selected locations to obtain information regarding the survivability of conditions within the structure prior to collapse.

EXPERIMENTAL CONFIGURATION

For this series of tests, the Phoenix Fire Department obtained a 135' by 50' warehouse that was scheduled for demolition. The building was a single story with a peaked roof composed of rolled roofing material laid over 2" by 8" boards supported on wood trusses. The warehouse was separated into two halves with a wall constructed of 2" x 4" wood studs with ½" plywood nailed to one side. The plywood was covered with two layers of 5/8" fire rated gypsum board. The separation wall was built along a truss 90' from the front of the building.

The trusses used 2" x 12" lumber for the top and bottom chords and various lumber sizes for the web members. The trusses were spaced 15' apart and oriented perpendicular to the long dimension of the building. The peak of the roof was 18' above the floor with the bottom chord of the truss located 10' above the floor. The trusses rested on bearing walls composed of brick and block.

Overall, the front half of the building was 50' wide and 90' long. This area was subdivided into several smaller areas. The primary separation was a wall composed of gypsum on wood studs, and was located along the truss 60' from the front of the building. This wall went only to the underside of the bottom chord of the truss. A door, 7.5' high and 6' wide, was located in this wall 12' from the east wall. In addition, there were several 0.79' by 1.5' holes cut through the wall at a height of about 10'. Two small rooms were also located along the east wall. These rooms were located on either side of the wall dividing the front room. The larger room was 24' long and 10' wide and apparently served as an office. There was a door, 3' wide and 6.8' high, in the west wall of the office and a small opening, 3'by 2' in the north wall. The smaller room was 5' by 6' and served as a restroom. It had a single door opening with dimensions of 3 ft wide by 6.8 ft high. The front wall of the warehouse structure had a doorway, approximately 6 ft wide and 10.5' high, located 13' from the east wall. There were two glass doors in this doorway. A glass window 7.7' high and 28' wide was located in the front wall approximate 1' from the east wall. The sill of the window was 2.3' high.

The **second burn** area was 45' by 50' with a single doorway in the east wall. The doorway was 8' wide and 8' high. It was located 96' from the front wall of the building and 6' from the separation wall.

The fuel load for the **first test**, conducted in the front part of the warehouse, consisted of four stacks of ten wood pallets. Each stack of pallets had a mass of approximately 360 lb. Three of the stacks were arranged in a triangle in the front half of the space. A fourth stack of pallets was placed in the center of the second section of the building. Newspaper was placed among the three stacks of pallets, and an electric match was positioned in the newspapers as the ignition source.

For the **second test**, three stacks of ten pallets each were arranged in a triangle in the center of the second section of the building. An electric match and newspaper were again used as the ignition source.

EXPERIMENTS

A fire was ignited in the newspaper among the three stacks of pallets in the front room of the first test area. Electric matches are matchbooks with a winding of nichrome wire that heats and ignites the matches when an electric current passes through the wire. The fire was allowed to grow to involve a significant portion of the roof structure north of the fire area separation wall. After approximately 25 min, the Phoenix Fire Department extinguished the fire.

For the **first test,** the flames reached the top of the pallet stacks 40 seconds after ignition. Smoke became visible coming from a rooftop ventilator approximately 60 seconds after ignition. At approximately 1 ½ min after ignition, flames had reached the ceiling and started spreading along the underside. The entire array of pallets in the front half of the first burn area was involved in fire within 2 min. Adjacent items began igniting due to radiant energy 2 ½ min after ignition. At 3 min after ignition, flames were observed coming from the rooftop ventilator. The roof area around the ventilator started burning at 4 min. At about this time, the interior picture became obscured in smoke and the camera was removed at the 4 min mark. At approximately 4 ½ min after ignition, the heavy smoke coming from the structure began to diminish, and the roof fires were mostly out by 5 min after the start of the test. As the test measurements indicated, the fire became oxygen deficient and the glass in the front door was removed at 8 min to provide additional oxygen for the fire.

Within 2 min after removing the front door glass, various fires had reignited on the roof. 11 min after the start of the test, the northwest portion of the roof was burning and appeared to have burned through in spots. Due to loss of some data signals and possible collapse, the thermocouple and volume fraction measurements were terminated at 13 min. At 14 min, approximately ¼ of the roof, primarily the northwest portion, was burning. The entire west side was burning by 17 min, and portions collapsed at about 18 min after ignition. The northeast part of the **roof collapsed at 18 min 20 seconds**. By 18 min 35 seconds, all of the plywood covering the front windows had started burning and had fallen out of the windows. One minute later, the upper portion of the front wall collapsed into the street. At 23 min, the east section of the roof between the trusses 60' and 75' from the front wall collapsed. The test was terminated approximately 25 min after ignition.

In the second test, a fire was again ignited in newspaper among three stacks of pallets placed in the center of the second fire test area. The fire was allowed to grow to involve the entire roof over the second test area. After approximately 30 min, monitoring of test conditions was terminated.

For the second test, the flames reached the top of the pallet stacks 45 seconds after ignition. The entire array of pallets was involved in fire within 2 ½ min. At approximately 3 min after ignition, flames had reached the ceiling and started spreading across it. Smoke started coming out of the open doorway at approximately 3 ¼ min. Adjacent items began igniting due to radiant energy 3 min 20 s after ignition. The smoke layer appeared to reach the top of the pallet stack at 4 min. At 5 min, the interior picture became obscured in smoke and the camera was removed. Flames started coming out of the doorway at 6 ½ min. At 9 min, various edges of the roof started to burn. The roll-up door collapsed at 13 ½ min and partially blocked the open doorway. Data collection was terminated at 14 min.

Significant portions of the roof were burning at the 14 min mark. **A partial collapse of the roof occurred at 15 min and 20 seconds.** At 16 ½ min, additional portions of the roof collapsed, with the roof being mostly destroyed by 19 ½ min. An unused door in the southwest portion of the west wall had been sealed with a single course of cinder blocks. These blocks collapsed into the street 24 min after ignition. The upper portion of the rear wall collapsed at 29 min and further monitoring was terminated.

RESULTS

The temperature histories indicate a relatively well mixed flashover environment. Approximately 200 seconds into the first test, the fire became oxygen starved. Opening the front door at about 480 seconds into the test produced the second set of peaks. In addition to allowing the fire to resume it's growth, opening the front door lead to the development of a stratified upper layer, as indicated by the divergence of the temperature histories after the 500 second mark. The lower temperatures at the ceiling and 0.6 m positions indicate the possibility of roof failure in this location allowing cold air to flow into the building. The sudden decrease of temperature histories after approximately 650 seconds indicates additional significant roof collapse in the area of this thermocouple tree.

The temperatures decrease when the door is opened at approximately 500 seconds. The temperatures begin to increase, but not as rapidly as the ones closer to the door. The dip in the temperature profiles at approximately 650 seconds is another indication of a partial roof collapse. Additional roof failure beyond 700 seconds leads to further temperature reductions. The temperature histories were obtained in the second third of the first section of the warehouse. This part of the warehouse was separated from the other part by a wall that went from the floor to the suspended ceiling. The temperature histories obtained in this area are more stratified than in other parts of the warehouse. The stratification becomes more significant after the front door is opened. In addition, the roof failures occurring in the front part of the warehouse continue to produce increasing temperatures in this area. The concentrations decrease and the temperatures increase after the door is opened.

At this point, flames were observed coming from the open door suggesting a lack of oxygen within the warehouse in the vicinity of the fire near the thermocouples. Initially, the temperature at the ceiling, 19' above the floor, is lower than some of the upper level locations. This effect may be the result of the wood trusses that support the roof and obstruct the flow of hot gases across the ceiling. The carbon monoxide volume fractions correspond with the fire becoming somewhat oxygen starved. Equipment and personnel were evacuated from the area. Unfortunately, data acquisition had to be stopped prior to complete collapse. Further work will evaluate the potential for use of sensors with radio output to allow continued monitoring through the collapse phase of the research activity.

For both tests, the maximum temperatures in the area prior to collapse were 800 °C (1470 °F). Gas temperatures in the second test remained between about 600 °C (1110 °F) and 800 °C (1470 °F) throughout the test. The carbon monoxide volume fractions in the first test exceeded 3% approximately 5 min after ignition. In the second test, the carbon monoxide volume fraction exceeded 5% approximately 7 min after ignition. The volume fractions at the 25 mm and 0.9 m locations varied from 0.1% to a 0.5%. Variation was greater in the first test than in the second test.

The results presented in this report are subject to some uncertainties. Error in gas temperature measurements resulting from radiation effects can be as high as 25% during the very early stages of the fire.

CONCLUSIONS

Two fire tests were conducted by the NIST in cooperation with the Phoenix, AZ Fire Department in an ordinary construction, single story warehouse. These fire tests were part of a series of tests being conducted to identify potential methodologies for predicting structural collapse. If technology were available to provide a reliable assessment of structural stability or timely warning of impending collapse, then interior fire fighting operations could be conducted with greater safety. The data obtained from these tests is being used to evaluate the applicability of various fire models for predicting structural collapse. In addition, the test data are useful for investigating the use of new measurement technologies in the fire environment. These investigations include the use of infrared cameras to measure temperature, lasers and sonar to measure displacement, and vibration to predict a change in structural integrity. Specifically, these experiments included sensors for obtaining vibration measurements [4].

The results from the vibration studies will be presented in a future report. While work is continuing to evaluate these technologies for use by the fire service, there are some useful conclusions that can be drawn from these two tests.

According to the 2nd edition of the SFPE Handbook of Fire Protection Engineering, exposure of a person involved in light work, such as walking, to a carbon monoxide level of 1% for approximately 3 min is sufficient to cause unconsciousness while a carbon monoxide level of 4% for less than 1 min will cause death [5]. Within about 5 min after ignition, the carbon monoxide levels in both tests rapidly increased to lethal levels. Very similar carbon monoxide volume fractions were measured at the 25 mm and 0.9 m locations during both tests.

The temperature measurements at the two locations were not as similar. The temperatures obtained at the two locations during the first test varied from 50 °C (120 F) to as much as 150 °C (300 °F). During the second test, the temperature variation between the two locations was as high as 250 °C (480 °F). For reference, unprotected people can tolerate temperatures of 100 °C (212 °F) for approximately 10 min and temperatures of 150 °C (300 °F) for about 5 min when exposed to convected heat [6]. Flashover, as indicated by gas temperatures in excess of 600 °C (1100 °F), is reached during both tests about 4 min after ignition. After flashover, temperatures - 8 - during the first test decrease but remain about approximately 200 °C (390 °F) throughout the test. Temperatures remain above 400 °C (750 °F) at head height through the second test.

The ability of firefighters to withstand the extreme temperatures associated with typical building fires is directly related to the thermal performance of their protective clothing and equipment.

The National Fire Protection Association standard for interior structural fire fighting clothing requires a minimum Thermal Protective Performance (TPP) rating of 35 [7]. When exposed to a flashover fire, firefighters wearing garments with a TPP rating of 35 have from 10 to 20 seconds to escape before receiving serious burns [8, 9].

Some indication of potential collapse became evident during the tests. Some of these signs have been documented previously in building construction and collapse related textbooks written specifically for the fire service.

For example, one text describes signs of potential wall collapse that can be seen in the bricks and mortar of the exterior walls. Eventually, a portion of the wall did collapse. The smoke from a building fire has been suggested as a possible cue to the collapse potential. Early during the first test smoke and then flames were observed coming from a roof top ventilator. As the fire progressed, the ventilator collapsed, the flames disappeared, and only smoke could be seen coming from the ventilator Depending on the stage of the fire, initial exterior appearances can be deceiving.

ACKNOWLEDGEMENTS

This information was taken from: Structural Collapse Fire Tests: Single Story, Ordinary Construction Warehouse
David W. Stroup, Daniel Madrzykowski,
William D. Walton, and William Twilley

LINE-OF-DUTY DEATHS 1994-2002

OVERVIEW

As part of a project funded by USFA, BRFL, and NIST are exploring the feasibility of developing a system for use by firefighters to predict structural collapse during fireground operations.

Predicting a potential structural collapse is one of the most challenging tasks facing an IC at a fire scene.

Usually the lack of information on the construction of the building, fire size, fire location, fire burn time, condition of building, fuel load, etc., makes the task nearly impossible.

They examined records to determine if there were any trends or patterns that could be detected in firefighter fatalities due to structural collapse.

If so, these trends could be brought immediately to the attention of training officers and the IC, and investigated further to determine probable causes.

This study examined data from structural collapse incidents that occurred from 1994 to 2002 involving one or more firefighter fatalities where a fire weakened and caused the failure of structural members in a building. This failure resulted in the complete or partial collapse of any part of the structure, excluding the cases described above.

Several data parameters were analyzed for each incident, including

- the time of the incident;
- the property type of the structure;
- the firefighter's age;
- years of experience;
- status (i.e., career or volunteer);
- nature and cause of death; and
- activity at the time of death.

In the case of rank, individuals ranked higher than captain were designated chief officers. **Any dual-trained firefighter (e.g., firefighter/paramedic) was designated as firefighter.**

The 1994-2002 data were also compared to results reported in two earlier NFPA reports addressing firefighter fatalities due to structural collapse. These reports analyzed data from incidents that occurred from 1979-1988 and 1983-1992, respectively. The raw data from these reports were not available. In order to make comparisons, several categories of the data were restructured for the more recent data in order to fit the criteria established in the NFPA reports. For instance, in the historical reports, the category for cause of death only had the two parameters "Caught or Trapped" and "Struck by/ Contact with Object."

Data collected for the years 1994-2002 included "Exposure" and "Fell or jumped" as additional causes of death (as designated by the USFA Memorial database). Cases that belonged to the latter two categories were realigned with the criteria established in the NFPA reports. For example, the cause of death of a firefighter who fell through a floor during a fire attack and was unable to escape or be rescued would be designated in the USFA database as "Fell or jumped". Comparing this case to the NFPA reports, the cause of death would be reassigned to **"Caught or Trapped."**

Between the years 1979 and 2002 there were over 180 firefighter fatalities due to structural collapse, not including those firefighters lost in 2001 in the collapse of the World Trade Center Towers. Structural collapse is an insidious problem within the fire fighting community. It often occurs without warning and can easily cause multiple fatalities.

Between the years 1994 and 2002 there were 63 deaths caused by structural collapse in a total of 47 fires.

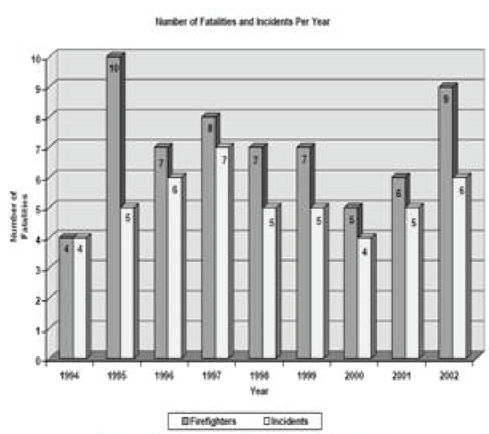


Figure 1- Fatalities and Incidents per Year (1994- 2002)

Of these deaths, over two-thirds occurred within the first six months of the year and over one-half occurred in the first three months

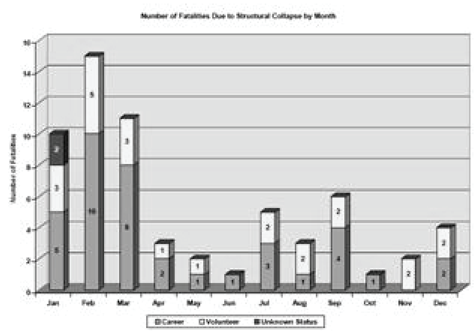


Figure 2 - Fatalities by Month

Over 42% of deaths with known incident times occurred in the first eight hours of the day (12:00 A.M. – 7:59 A.M.).

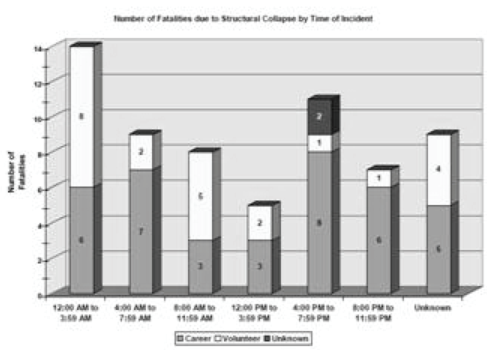


Figure 3 - Fatalities by Time of Incident

Victims of structural collapse were part of several age groups, experience levels, and ranks and were involved in several activities.

Fatalities by Age

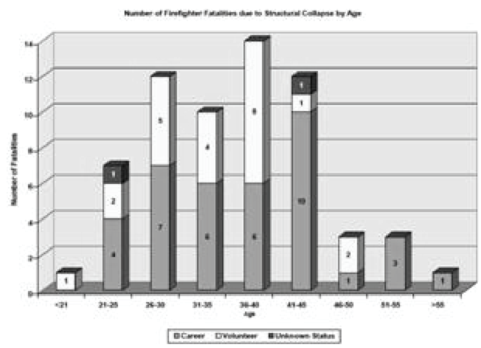


Figure 4 - Fatalities by Age

Fatalities by Years of Experience

Over 44% of deaths involved career firefighters with six or more years of experience.

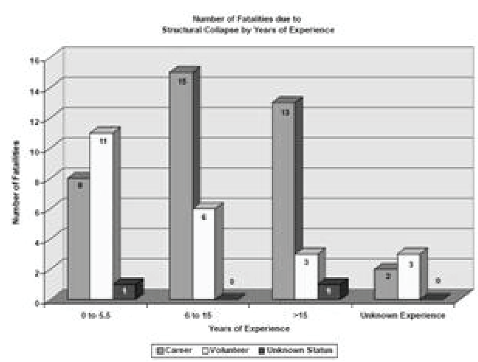


Figure 5 - Fatalities by Years of Experience

Fatalities by Rank

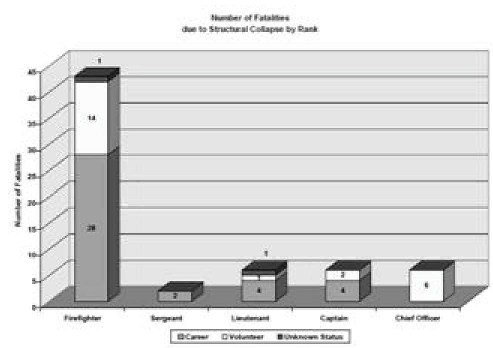


Figure 6 - Fatalities by Rank

Fatalities by Activity

A majority of the victims (over 65%) were involved in a fire attack or advancing hose.

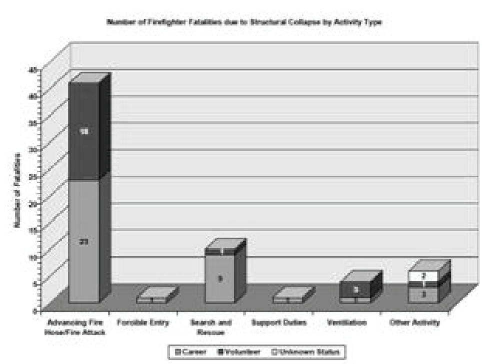


Figure 7 - Fatalities by Activity

Fatalities by Nature of Death

The nature of firefighter deaths in collapsed structures is categorized as asphyxiation, burns, internal trauma, and other causes.

Over 42% of fatalities (27 deaths) were by asphyxiation.

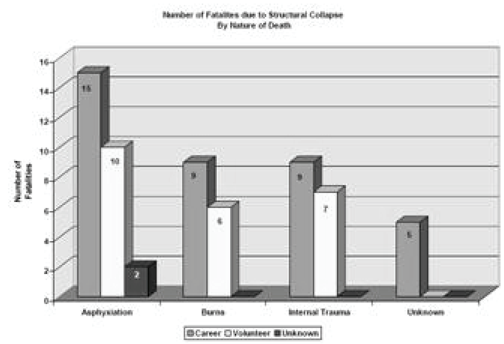


Figure 8 - Fatalities by Nature of Death

Fatalities by Activity and Duty Type

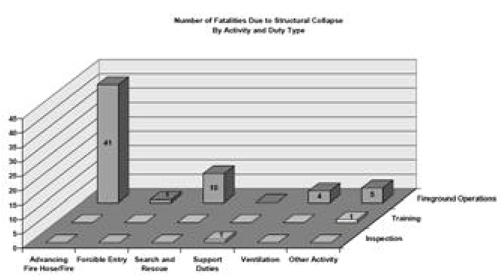


Figure 9 - Fatalities By Activity and Duty Type

Number of Fatalities Due to Structural Collapse
By Cause of Death and Duty Type

Fatalities by Cause of Death and Duty Death

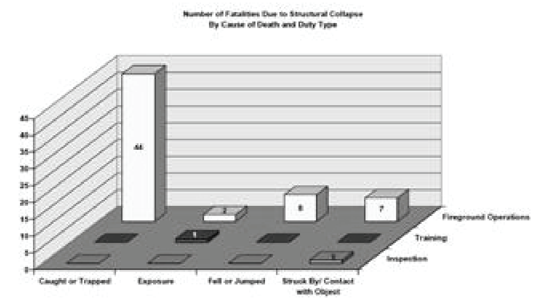


Figure 10 - Fatalities by Cause of Death and Duty Type

Fatalities by Month and Rank

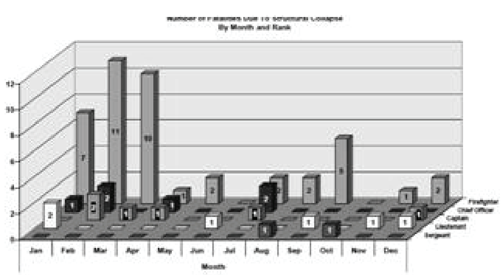


Figure 11 - Fatalities By Month and Rank

Fatalities by Activity and Cause of Death

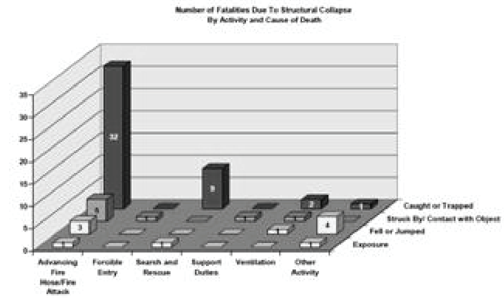


Figure 12 - Fatalities By Activity and Cause of Death

Fatalities by Cause of Death and Property Type

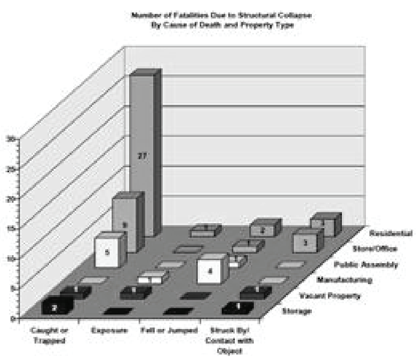


Figure 13 - Fatalities By Cause of Death and Property Type

Fatalities by Cause of Death and Nature of Death

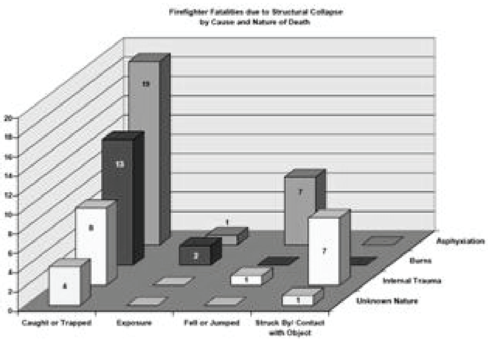


Figure 14 - Fatalities by Cause of Death and Nature of Death

Fatalities by Property Type and Status

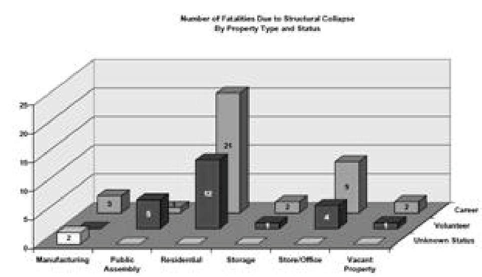


Figure 15 - Fatalities By Property Type and Status

Fatalities by Activities and Status

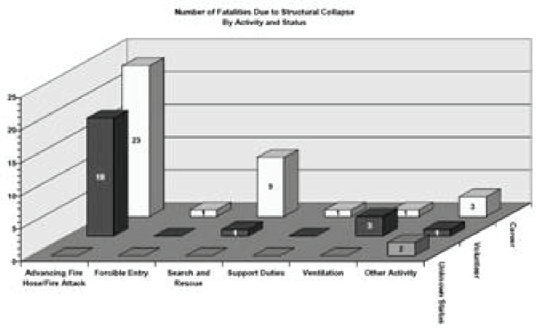


Figure 16 - Fatalities By Activity and Status

Fatalities by Activity and Property Type

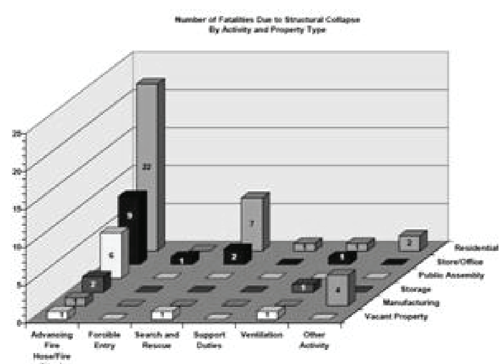


Figure 17 - Fatalities By Activity and Property Type

Fatalities by Month and Nature of Death

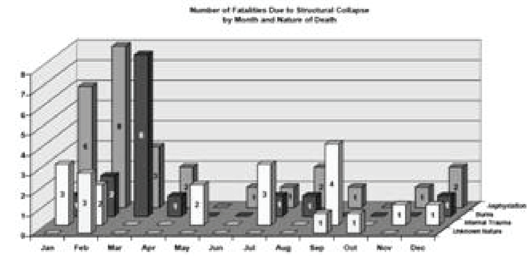


Figure 18 - Fatalities By Month and Nature of Death

Fatalities Due to structural Collapse per Year (1979-2002)

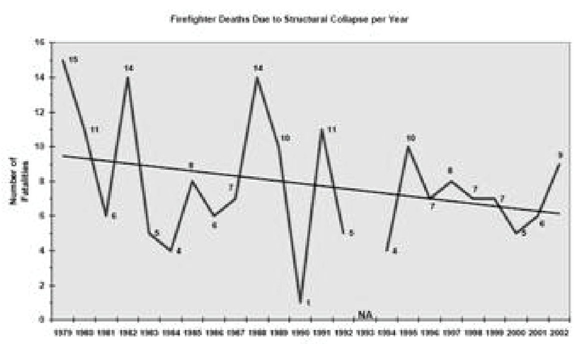
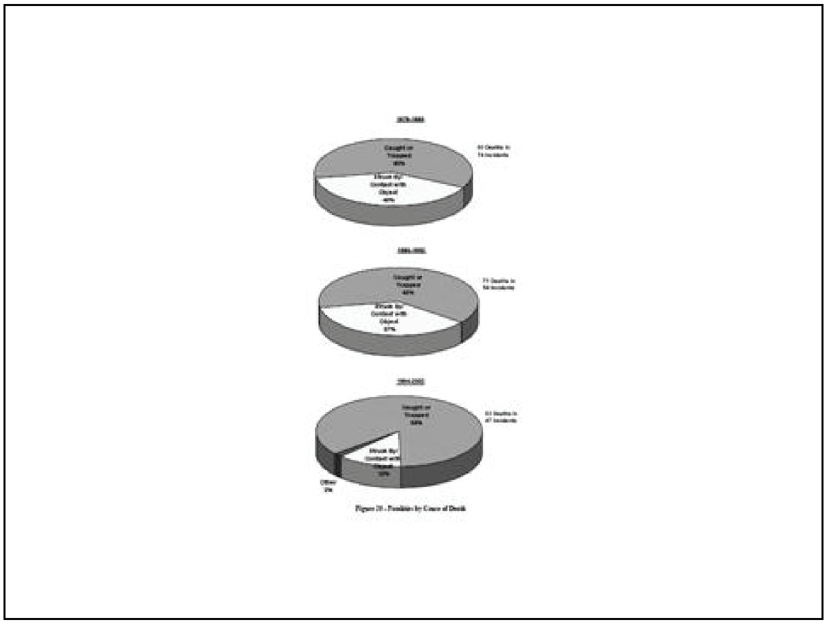


Figure 19 - Fatalities Due to Structural Collapse per Year (1979-2002)

Fatalities by Cause of Death



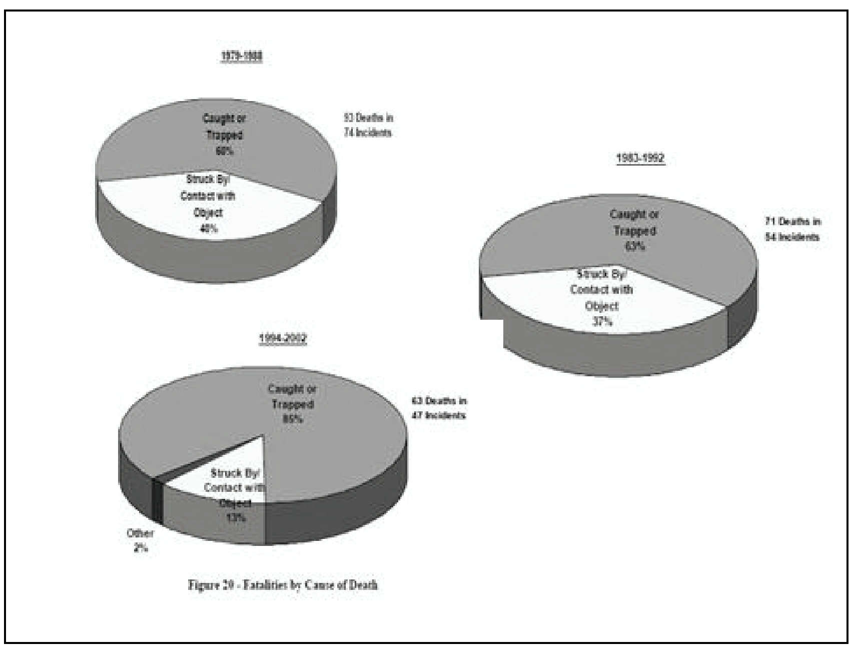


Figure 20 - Fatalities by Cause of Death

Fatalities by Fixed Property Type

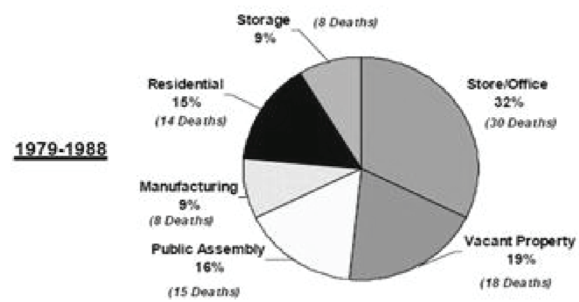


Figure 21 - Fatalities by Fixed Property Type

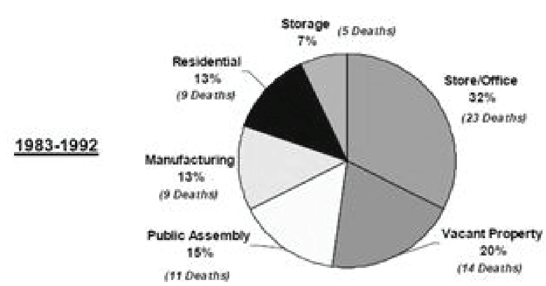


Figure 21 - Fatalities by Fixed Property Type

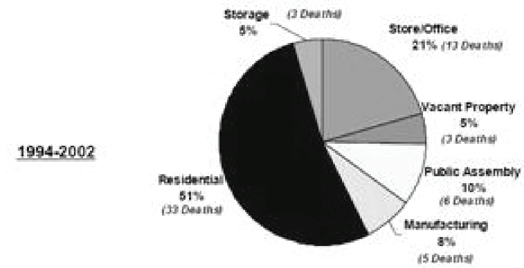


Figure 21 - Fatalities by Fixed Property Type

ACKNOWLEDGMENTS

This information was taken from: Trends in Firefighter Fatalities Due to Structural Collapse, 1979-2002

UNIT 7: FIREGROUND DECISION MAKING EXERCISES

OBJECTIVES

The students will:

1. *State the objectives when confronted with a Type I, II, III, IV, or V occupancy when conducting an analytical sizeup of the structure.*

2. *State the strategies when confronted with a Type I, II, III, IV, or V occupancy when conducting an analytical sizeup of the structure.*

3. *State the tactics when confronted with a Type I, II, III, IV, or V occupancy when conducting an analytical sizeup of the structure.*

4. *Identify and write the findings from the walkaround in Columns 1, 2, and 3 of the Primary Factors Chart.*

5. *As a group, prepare a briefing of the findings from the Initial Company Officer (ICO), the Initial Company Officer Assistant (ICOA), the Initial Incident Safety Officer (IISO), Initial Planning Section, and Initial Logistics Section.*

6. *Given a simulated incident where building construction is a critical issue, develop a sizeup report of fireground conditions, complete the Primary Factors Chart, and document progress using the Command Sequence Tactical Chart.*

BUILDING CONSTRUCTION CLASSIFICATIONS

Basic knowledge of how buildings are constructed and how they will react when subjected to fire is of vital importance to every Company Officer (CO). A building that is on fire is physically being destroyed. The mission of the CO is to determine if it is possible to enter the structure, how long the structure can last under fire conditions, what strengths the building can offer, or what weaknesses may exist. Each type of building will react differently under fire conditions, and certain predictions can be made. As an example, a wood-frame building with a lightweight roof structure of truss rafters can be expected to lose its structural strength faster than a building with a roof structure of standard rafter and ridge board design.

Construction Classifications

Generally, it is not possible to distinguish construction classifications from the exterior of a building. Most often, even the experienced observer must look at the bearing members (wall, floor, and roof assemblies) in order to tell the construction classification. At the end of each section describing different construction classifications we will provide a brief summary describing cues and rules of thumb that correspond with that classification.

Fire Resistive

Fire resistive is a method of construction where all key structural elements that hold the building up will withstand normal fire conditions for a minimum of 3 hours. The structural elements generally will be reinforced concrete or steel with a fire protection covering applied. In addition, the floors will be fire resistive and designed to limit fire spread. This type of structure has demonstrated fire after fire that it can withstand complete devastation of the contents and still remain structurally sound. While the structural components are a very positive feature, there may be some concerns that a CO should be aware of. As an example, fire in many buildings may spread from floor to floor at the area where the outer wall of the building attaches to the floor segments. Many designs provide for a space between the floor and the wall. This area may be closed off with insulation or may be totally open. In addition, the windows are very often the vehicle for fire spread with fire leaping from floor to floor. To manage this problem some architects have staggered the windows or placed eyebrows over the tops of the windows.

Fire-resistive cues: Bearing members are either reinforced, poured, or prestressed concrete assemblies or skeletal steel with the steel protected by sufficient layers of drywall or a sprayed-on, fire-resistive coating. Special fire suppression problems for COs would include open floor plans that have large open areas without separations or compartmentation; limited opportunities for ventilating; and high heat levels inside the structure.

Noncombustible

Noncombustible is a method of construction where the structural components will not burn, but may be susceptible to early collapse under fire conditions. The walls may be constructed of steel or masonry with steel floor and roof structure. This steel will be unprotected from the products of combustion and may be vulnerable to early failure. This method of construction is very popular in commercial or industrial structures. While the structural elements will not contribute to the fuel load, unprotected steel will expand as it warms and eventually it will not be able to support itself. As it expands, it has the capacity to push walls or to twist and collapse, and may drop the structural members that it was supporting.

The strength of this construction is in the load-carrying capacity and the long areas that it can span without support posts. It is an easily constructed type of building with large steel beams or trusses put in place with cranes. Steel is attached easily to other components by bolting, riveting, or welding, and a frame can be assembled quickly. The weakness of this construction is in the reaction to fire conditions, where the steel expands and weakens with the potential for collapse. This building generally is considered a candidate for early deterioration under fire conditions. A CO must pay close attention to this classification in order to ensure the safety of firefighters.

Noncombustible cues: Bearing members are made of noncombustible materials such as metal, concrete, stone, etc. Most often these buildings are skeletal steel assemblies where the steel is exposed and unprotected from the effects of fire.

Heavy Timber

Heavy timber (mill) is a method of construction using substantial wood structural elements for floor and roof supports and with masonry exterior walls. This method was used heavily in the northeastern United States to construct mills. The mills often would be built near natural sources of waterpower, and would be constructed up to six stories in height. As the exterior walls were masonry, they would be wider at the bottom than at the top. As the walls rise, they diminish in size, since they will be carrying less load. In many of these structures the walls at the ground floor could be up to 36-inches thick. The structural timber would be a minimum of 8 by 8 inches, and they were spaced based upon the load they would be supporting. Under fire conditions, the floors and support timbers burn slowly and remain strong for a considerable time. In many of these structures the floors were several inches thick to support heavy machinery and goods. To minimize water damage to floors below, the floors would be equipped with scuppers.

The strength of this type of building is in the size of the wooden structural members that held the floor and roof in place, in addition to the masonry walls. While these buildings often had firewalls with fire doors, they also posed massive fire problems due to large open areas with heavy fire loads, oil-soaked floors, and large quantities of combustible stock. In general, this classification is considered a strong building to work in during fire conditions, but one in which fire can quickly surpass a fire department's ability to suppress.

Heavy-timber (mill) cues: These buildings have masonry walls. The floors and roof assemblies are wood. The wooden members are much larger than nominal lumber sizes. Look for a minimum of 4- by 6-inch wood joists, 6- by 8-inch wood columns, and thick floor decking.

Ordinary

Ordinary construction has been termed "Main Street USA." This type of building also gained the name "taxpayer" because often the owner would operate a store on the first floor and live on the second floor. The business would pay the taxes on the property and the utilities, while the owner lived in the building virtually free. This building has masonry exterior walls, and the floors and roof are wood joist. The structural members for floor joists and roof rafters were often 3 by 10 inches and typically would span 12 to 14 feet, supported by a post-and-beam arrangement for interior walls. Since many of the streets on which these buildings were constructed were narrow, an effort had to be made to limit collapse of the masonry wall. A technique called "fire cut" would be used, where the end of the floor joist or rafter going into a bearing wall would be cut on an angle so that the bottom of the rafter or joist would be longer than the top. The idea was that when the wood member burned off on the inner portion of the structure it would pull out of the wall and fall into the structure, rather than lifting the wall directly above it and pushing the masonry wall into the street. Through the years these buildings typically were renovated several times with ceilings dropped, new voids created for new plumbing fixtures, and walls removed between occupancies in order to expand floor space.

The strength of these structures is in the masonry walls and the full-dimension lumber used to construct the floor and roof components. In addition, the floor and roof elements were installed with a fire cut so that they could drop out of the walls without bringing the walls into the street. The number of renovations that the building has had often will cause unexpected fire travel and multiple-floor involvement.

Ordinary (masonry/wood joist) cues: These buildings have masonry walls. The floor and roof assemblies are wooden. The floor joists often sit in the masonry walls in sockets that hold the joist ends. To determine whether or not the joists have been fire cut, normally one must go to the basement level and examine the first floor joists where they sit in the wall sockets.

Wood Frame

Wood frame is a method of construction where the structural components are framed out of wood. The use of a combustible structural element poses a special concern as it will lose its load-carrying capacity as it burns; eventually gravity will take over and pull whatever it was supporting to the ground.

Post and beam is a method of wood-frame construction and typically is used in barn construction. A modern method is called "pole barn" construction, where large pressure-treated poles are set into the ground and the framework of the building is hung from these poles. The poles themselves will last considerably longer under fire conditions than the materials used for the roof or walls.

Balloon is a method of wood-frame construction that was popular when long structural materials were available. The common characteristic of this type of building is that the wall studs extend from the foundation of the structure to the roof. When it was time to attach the second floor, the floor joists were simply nailed to the wall studs. This created an open area the entire length of the wall's studs, and across the floors to the opposite side of the building as well. If a fire got into the walls, ceiling, or floor space it was free to go wherever it pleased. Firefighters often tell of being inside the basements of these buildings and shining a light at the foundation with a fellow firefighter in the attic reporting that he/she saw the light shining through. Generally, the interior walls were constructed of wood lath over wood studs with plaster attached; the lath was said to resemble kindling, and was arranged in a very desirable manner for rapid fire extension up through a stud channel. This structure typically used full-dimension lumber and had close spacing of structural elements. If a CO was not reading the building correctly, he could become fooled quickly as the fire worked the building in all directions. Extension must be checked aggressively in this type of structure.

Platform is an open method of construction that has been popular since the late 1940s. The structure is built one floor or story at a time. Each floor has a floor deck, sill plate, wall studs, and a plate at the top of the wall. For a fire to travel from one floor to another through the walls, it has a great deal of material in its path to burn through. More often a fire will find another route of extension. Fire may extend via ventilation shafts for dryer, bathroom, and kitchen vents. Areas around plumbing pipes or heating ducts also will be vulnerable to fire extension. Generally the interior wall construction will use drywall material, which is inherently fire resistive and provides for compartmentation of a fire. The weak components most often will be the floor or roof.

Lightweight methods of construction have become popular, with truss construction or a sandwich-beam method of floor or roof support. Generally wooden trusses will be made of smaller dimension lumber, and are held together with metal gusset plate fasteners. Under fire conditions the plates may loosen and the structural integrity of the entire component may be lost. Another technique in use today is the process of ripping a 3/8- or 1/2-inch groove into a 2 by 4 and inserting a piece of 3/8- or 1/2-inch plywood. The size of the plywood is dependent upon the area to be spanned. These are commonly found in floor joists or as rafters on a flat or limited pitch roof, and are even becoming popular in strip mall construction. The strength of this method of construction is the floor-by-floor method of building. A weakness may very well be the lightweight floor or roof design.

Wood-frame cues: Wood-frame buildings normally have a masonry foundation with all floor, wall, and roof assemblies composed of nominal-sized lumber. The great percentage of private, detached dwellings are wood-frame construction.

FIRE BEHAVIOR FACTORS

An important part of your job will be the ability to make an accurate fire behavior prediction. Understanding fire behavior factors will assist you greatly in determining what is happening and what is likely to happen. They will have an impact on safety, strategy, and the use of resources.

Those factors are

- heat release;
- thermal stratification;
- rollover;
- flashover; and
- backdraft.

Heat Release

Heat is described in several ways, all of which bear a definite relationship to each other. In order to better understand the concept of heat, the following definitions are necessary:

- British thermal unit (Btu): One Btu is the amount of heat required to raise the temperature of 1 pound of water 1 °F (-17.2 °C) (when the measurement is performed at 60 °F (15.6 °C)).

- Heat of combustion: the amount of heat that will be released by a substance when it is completely consumed by fire.

A number of variables influence the output of heat from burning materials:

- the amount of area of solid combustibles exposed to heat and oxygen (the state of subdivision);
- the area of free surface of the liquid (in case of flammable substances, to give off vapor pressure); and
- the conductivity of solids (wood, etc.), which can influence the amount of heat given off when materials burn.

Knowledge of the types of materials present in a given fire situation and their heat values is important, and can assist you in determining the amount of water to apply, as well as the behavior of other materials within the environment.

Even though the heat values (in Btus) of various materials are not precise, they provide us with necessary information for developing the concepts of "fireloading" and the heat absorption qualities of water. Some examples of the heat of combustion values of various materials are shown in the following table.

Materials	Btu/lb.
Asphalt	17,150
Cotton batting	7,000
Gasoline	19,250
Paper	7,900
Polystyrene	18,000
Polyvinyl chloride	7,500 to 9,500
Wood	7,500 to 9,050

Thermal Stratification

Thermal stratification is the layering of heat in a given enclosed area. The ceiling or upper area will be a higher temperature. Floor covering materials are potentially less hazardous than ceiling or wall surfaces.

In the prefire inspection, you should not ignore the degree of combustibility of materials used throughout the occupancy. In the MGM Grand Hotel fire, the use of plastic materials in ceiling areas dramatically affected the fire behavior.

The introduction of water through a nozzle will change the thermal stratification of the enclosed area rapidly. In most cases, a thermal balance will occur following the introduction of water. The temperature in the room will equalize.

If the thermal balance is disturbed, temperatures can be raised beyond the point where any victims trapped inside would have a chance of surviving. Wide fogs applied into a room can turn into superheated steam, endangering both potential victims and firefighters. Full protective clothing and self-contained breathing apparatus (SCBA) are a must for firefighters.

Rollover

The term rollover is used to describe the fire or flame front that often is observed rolling along in front of the materials that are actually burning. As a combustible gas is produced and liberated from combustible materials it must mix with air (oxygen) in order to burn. Since the material that is burning consumes tremendous amounts of air (oxygen) there may be a limited amount of air (oxygen) in the upper levels of the room to support combustion of all the fuel being produced. This fuel-rich atmosphere will be pushed in front of the fire by the thermal column of heat from the fire and may not come within its flammable limits until several feet away from the main body of the fire. This is especially true in confined areas such as hallways. Often fire seems to be rolling along at ceiling level at a distance up to 10 to 20 feet ahead of the main fire. What actually is being witnessed is a fuel-rich mixture being pushed well ahead of the fire; when it comes into its flammable limits (mixture of air and fuel gas) it burns. This is often described as the fire rolling over.

Flashover

A very basic definition of flashover is the ignition of combustibles in an area heated by convection or radiation, or a combination of the two. The combustible substances in a room are heated to their ignition points and almost simultaneous combustion of the material occurs. In other words, the entire area is preheated to its ignition temperature and can become fully involved in fire in a matter of seconds.

Some of the warning signs of imminent flashover are intense heat, free-burning fire, unburned articles starting to smoke, and fog streams turning to steam a short distance from the nozzle.

To reduce the chance of flashover, temperatures need to be lowered quickly by ventilation and water application.

Backdraft

As a fire develops, the combustion process creates an atmosphere that is deficient in oxygen and can lead to the possibility of backdraft occurring. This also is referred to as a smoke explosion. The difference between flashover and backdraft is the amount of oxygen present. In flashover there is adequate oxygen available for combustion, and the fire is free-burning prior to flashover. In backdraft, there is insufficient oxygen for active burning, and the fire is smoldering. It is an oxygen-deficient atmosphere.

Normally, sufficient oxygen is present during most fires so that the conditions leading to backdraft are minimized. However, when oxygen is depleted and the fire begins to smolder, an oxygen-deficient atmosphere is created in the fire area. When conditions like this develop, gases such as carbon monoxide and carbonaceous-particle smoke or suspensions are produced. These are capable of reacting with oxygen.

This poses an explosion threat if oxygen is allowed to enter the structure improperly. The accumulated gases will ignite readily, spreading fire or causing a violent explosion. Due to temperatures in the room, the fuel is evolving into ignitable vapors at or above their ignition temperatures. All that is needed is oxygen to complete the fire triangle.

When backdraft conditions are present and oxygen is introduced before the inside pressure is relieved, the resultant explosion can eliminate firefighters and their hoses. The potential for backdraft exists in buildings, rooms, attics, or any other confined space. An indication of backdraft is when a fire has depleted the oxygen content in an area, yet has preheated that space above the ignition temperatures of the combustibles in it. Another indicator is hot, heavy smoke issuing from the building (smoke is sometimes described as lazy, or sick-looking). This may be accompanied by dark carbonization on the window glass. In this situation, the building may seem to be breathing (drawing smoke back in the opening followed by expelling smoke from the opening). Backdrafts may occur during the incipient phase as well as the smoldering phase.

Ventilation is the first priority and must precede fire attack under backdraft conditions.

FIRE TRAVEL PREDICTIONS

Heat and Smoke Travel

Checking fire extension requires a knowledge of how fire spreads, along with a knowledge of building construction features and the effects of concealed vertical and horizontal spaces. Whenever and wherever openings are made, hoselines should be ready. While every effort should be made to minimize damage to the building and its contents, openings have to be large enough for inspection, hose manipulation, and ventilation.

Until determined otherwise, it is a safe assumption that when a working fire exists inside a building, fire has entered concealed vertical channels.

Personnel should be looking for indicators such as blisters and discolorations on walls, smoke patterns at molding, walls hot to the touch, or smoke (or fire) showing around roof features, such as vent pipes, etc. If these are present, checking vertical extension is a must.

The tendency for most fire to travel vertically does not preclude horizontal travel. Fire will follow any path available: void spaces between ceilings and floors, over false or hanging ceilings, around utility conduits, etc. Extension occurs not only within the structure, but also from building to building. Here again, hoselines must be in place prior to opening up these areas. Most of the time, the indicators of fire in these areas are difficult to read, but look for some of the indicators present in vertical spread. These areas should not be overlooked and have been responsible for fatalities, as well as for fires getting out of control.

Tactical operations in large and complex occupancies will have to be coordinated carefully in order to accomplish a reduction or change in heat and smoke travel. Ventilation is a key tactical operation that will affect how, when, and where heat and smoke spread through a structure.

In your prefire inspections and plans, always look at all the possibilities of heat and smoke travel in a specific occupancy. The time of the fire is not the time to study heat and smoke probabilities.

Based on the fire behavior factors and resource capabilities, you must make a fire behavior prediction that answers the following questions:

- Where is the fire at this time?
- In what direction is it likely to spread?
- Is there a probability that flashover is imminent?
- Is there a probability that backdraft is imminent?
- Is collapse likely to occur within the time required for offensive operations?

Once you have the answers to these questions, you have identified the problems, and can have a much clearer idea of what the resource needs are.

How Fires Extend

The travel of fire in structures can be predicted based on a good understanding of building construction and fire behavior factors. Fire, smoke, and heat travel are dependent on many factors, such as void areas within the structure, the effect of the wind, and the positioning of hoselines.

The building layout and design can be an advantage or a disadvantage to your fire confinement and suppression efforts. Generally, fires in large open areas will be more difficult to confine than fires in a compartmented area. Fire load and built-in fire protection features will affect your efforts. Items such as firewalls, fire doors, and automatic sprinkler systems can play a major role in the amount of resources you will need and the efforts it will take.

Fires generally spread from room to room via open doorways or through lightweight doors that do not last more than a few minutes under fire conditions. Fires generally spread from floor to floor via open stairways, or open shafts and voids.

Predict Fire Travel

Fire travel predictions can be made by asking a few basic questions:

- Where is the fire now?
- Where is the smoke showing?
- What is in place to stop the spread of the fire and smoke to other areas of the structure, such as firewalls or other fire-resistant materials?
- What signs do I see, such as discoloration of paint, bubbling tar, or other building reactions, that will provide me with clues as to the fire travel?

The ability to predict fire travel will provide a CO accurate predictions that can lead to successful operations, realistic and proactive decisions, and adjustments as needed.

A good CO is an informed CO. An informed CO will be a well-trained CO. A well-trained CO will be a safe CO. Be careful out there!

Activity 7.1

Large Group Exercise #1: Frame Town House

Purpose

To allow you to demonstrate your knowledge, skills, and abilities (KSAs) you have gained as a result of attending this course. Conduct a walk-around of exposures A-B-C-D of the structures that will be seen in the exercise.

There can be up to seven structures used in the activity.

Directions

1. You will be working in small groups.

2. Each group will do each construction type. Exercise is designed to place the **ICO** as the Incident Commander (IC) until relieved by the next level of authority arriving at the incident. (This will be your instructor.)

3. For this simulation the **ICO** will have additional students assigned to Command and General Staff positions, which under normal field conditions would be the sole responsibility of the ICO.

4. Student group assignments for each group:

    a. ICO.

    b. ICOA--scribe.

    c. IISO.

    d. Initial Planning Section--Situation Unit.

    e. Initial Logistics Section--service and support.

5. Your group will record your predictions on an easel pad or paper.

6. Your group will select a spokesperson to explain to the class how fire would travel in this building.

7. Throughout the activity you will receive messages from the instructor.

8. In this portion of exercise your group is to concentrate on Column 1 Primary Factors Chart. You will have 10 minutes to complete this portion of the activity.

9. The ICOA-scribe shall develop a Primary Factors Exercise Chart on an easel pad for his/her assigned exercise scenario.

   a. Identify the most pertinent primary factors for each exercise scenario.

   b. Place findings on Column 1 of the Primary Factors Exercise Chart.

   c. Identify the most pertinent subfactors for each identified primary factor for exercise scenario. Place findings on Column 2 of the Primary Factors Exercise Chart.

   d. Identify pertinent precautions that will be taken to address each identified sub-factor for exercise scenario. Place findings on Column 3 of the Primary Factors Exercise Chart.

Activity 7.1 (cont'd)

Primary Factors Chart

Column #1 — Primary Factor - Situation Awareness- Chart

Primary Factors	(Check appropriate boxes) Pertinent Sub-Factors (P)	P
Life Hazard	Occupants	
	Firefighters	
Location/Fire	Fire Building on Arrival– Burn Time	
	Exposures On Arrival - Burn Time	
	Fire Spread Considerations Radiation/Conduction/Convection	
Construction	Fire Building – Type 1-2-3-4-5 (Lightweight Awareness)	
	Exposures – Type 1-2-3-4-5 (Lightweight Awareness)	
Occupancy (Contents)	Fire Building – (Fuel Load)	
	Exposures (Fuel Load)	
Height	Fire Building (Front-Rear)	
	Exposures (Front-Rear)	
Area	Fire Building/Configuration	
	Proximity of Exposures /Configuration	
Structural Collapse	Fire Building – Burn Clock After Arrival	
	Exposures – Burn Clock After Arrival	
	Collapse Zone – Safe Corridors	
	Apparatus Placement	
Weather	Visibility	
	Temperature/Humidity	
	Wind – Direction/Velocity	
Resource Requirement	Apparatus/Personnel/Equipment - RIT	
	Water Supply/Suppression Agent	
Auxiliary Appliances	Fire Building Supplied	
	Exposures Supplied	
Topography	Front-Rear	
Explosions/ Back Draft	Proper Ventilation Flash-Over Time Awareness	
Time	Time of Day Time of Year Duration of Incident	

Column #2 — Incident Objectives Attainable/ Measurable/ Flexible

Examples of Incident Objectives:

- Safe Removal of All Occupants within 10 minutes.
- Contain and Control Fire to Room/Building of Origin within 10 minutes
- Contain, Control and Limit Fire in Exposures within 10 minutes
- Other.

List Incident Objectives:

1. ______________________________
____
2. ______________________________
____
3. ______________________________
____
4. ______________________________
____
5. ______________________________
____

Column #3 — Activities (Strategies)

[R] Rescue
- Interior/Exterior/Both

[E] Exposure Protection
- Exposure Examination

[C/E] Confinement/Extinguishment
- Hose Line Placement

[O] Overhaul
- Expose Hidden Fire

[V] Ventilation
- Removal of Occupants
- Fire Control

[S] Salvage
- Water – Run-Off
- Apply Covers

Forcible Entry
- Location
- Method

Special Equipment
- Imaging Cameras

List Incident Strategies	Assign Tactics:
For Objective # 1:	
For Objective # 2:	:
For Objective # 3:	
For Objective # 4:	
For Objective # 5:	
____________________	

Column #4 — Evaluate Effect of Activities (Strategies) Every 10 Minutes

Effective	Ineffective

Identify alternative strategies for firefighter safety when occupant safety has been determined not to be a Primary Factor.

- ____________________
- ____________________
- ____________________
- ____________________
- ____________________
- ____________________
- ____________________

Activity 7.1 (cont'd)

Primary Factors Exercise Chart

Pertinent Primary Factor	Pertinent Subfactor	Pertinent Precautions To Be Taken
1.	1. 2.	1. 2.
2.	1. 2. 3.	1. 2. 3.
3.	1. 2.	1. 2.
4.	1. 2.	1. 2.
5.	1. 2.	1. 2.
6.	1. 2.	1. 2.
7.	1. 2. 3. 4.	1. 2. 3. 4.
8.	1. 2. 3.	1. 2. 3.
9.	1. 2.	1. 2.
10.	1. 2.	1. 2.
11.	1.	1.
12.	1. 2.	1. 2.
13.	1. 2.	1. 2.

LARGE EXERCISE #1
Vital Building Information
Situation Report

RESIDENTIAL--TYPE V--BALLOON FRAME

Structure:	Two-story--18 by 40 foot town houses Five town house units
Building Construction:	Type V--balloon frame
Roof Construction:	2- by 6-inch truss roof support system
Floors:	2- by 6-inch plywood flooring system
Alarm System:	No smoke detectors installed
Occupants:	Two adult occupants per occupancy Units 1, 3, and 5 each have one young child
Special Concerns:	Unit 2 has two senior citizen occupants

Situation Report:

Fire Building:

It is January 30, 0730 hours, temperature is 23 °F (-5 °C), wind from west at 10 miles per hour (mph).

Upon arrival, four adults and two children are outside of the town houses. Occupants report two adults and one child are unaccounted for from Unit 3 and two occupants each from Units 2 and 4 are unaccounted for.

Exposures:

Each occupancy has attic storage. Attic access is located in middle bedrooms on second floor.

Activity 7.1 (cont'd)

Objectives-Strategy-Tactics Chart

1. Use the enlarged Objectives-Strategy-Tactics Chart or easel pad.

2. Refer back the Primary Factors Exercise materials in Unit 4: The Analytical Sizeup Process if necessary.

3. Place Slide Iteration #2 for Sides A-B-C-D for each scenario chosen.

4. Receive and act on Exercise Message #2 and Plot Plan #2.

5. Concentrate on Columns 2 and 3 and develop the Objectives-Strategy-Tactics for the scenario.

6. ICOA scribe shall develop an easel pad for Objectives-Strategy-Tactics for assigned exercise scenario. (You have 20 minutes to complete.)

   a. Column 1: Identify the first operational period objectives for the scenario.

   b. Column 2: Identify the first operational period strategies for each objective.

   c. Column 3: Identify the first operational period tactics for each strategy.

   d. Column 4: Assign companies to perform tactics.

Each scenario has first alarm structural resources available at start of exercise:

- Engine 1
- Engine 2
- Engine 3
- Ladder 1
- Basic Life Support (BLS) 1

Each scenario will have working incident structural resources arrive 10 minutes into incident.

- **Engine 5**
- Engine 6
- **Squad 1**
- Engine 6 (Rapid Intervention Crew (RIC))
- Air Cascade-1 FF
- Safety Officer

Central City Fire EMS Dispatch Criteria

Assignment	Alarm Type	Engine	Ladder	Squad	Battalion Chief	EMS Unit	RIC	Safety Officer	Air Cascade
First Alarm	Structural	3	1			1 BLS			
Working Incident	Structural	2		1	1		1	1	1
First Alarm	Target Hazard	3	2	1	1	1 BLS			
Working Incident	Target Hazard	2				1 ALS	1	1	1
Second Alarm	Structural/ Target Hazard	2	1		1	1EMS		1	1
Third Alarm	Structural/ Target Hazard	2	1			1 MS			
Fourth Alarm	Structural/ Target Hazard	2	1		1				

Central City Fire/EMS Staffing:

- **Engine-Ladder-Squad Company--1 Officer--3 Firefighters**
- **Rapid Intervention Crew (RIC)--One Engine Company**
- **EMS BLS Unit--2 EMT Basic**
- **EMS ALS Unit--2 EMT Paramedic**
- **Air Cascade - 1 Firefighter**

A second alarm may be requested but will not arrive on scene before end of exercise.

Activity 7.1 (cont'd)

Objectives-Strategy-Tactics Chart

Objectives	Strategy (s)	Tactics	Assigned to:
Objective #1	**1.**	**1.** **2.** **3.**	**1.** **2.** **3.**
	2.	**1.** **2.** **3.**	**1.** **2.** **3.**
	3.	**1.** **2.** **3.**	**1.** **2.** **3.**
Objective #2	**1.**	**1.** **2.** **3.**	**1.** **2.** **3.**
	2.	**1.** **2.** **3.**	**1.** **2.** **3.**
	3.	**1.** **2.** **3.**	**1.** **2.** **3.**
Objective #3	**1.**	**1.** **2.** **3.**	**1.** **2.** **3.**
	2.	**1.** **2.** **3.**	**1.** **2.** **3.**
	3.	**1.** **2.** **3.**	**1.** **2.** **3.**

Activity 7.1 (cont'd)

ICS Form 201, *Incident Debriefing* and ICS Form 214, *Unit Log*

1. Use the enlarged ICS Form 214, *Unit Log* or easel pad.

2. The ICOA will maintain ICS Form 214 for all tactical decisions made by the ICO along with other pertinent messages and decisions made by the ICO during the exercise. Entries should be recorded under Time and Major Events columns.

3. Distribute ICS Form 214.

   a. IISO.

   b. Initial Planning Section (Situation Unit).

   c. Initial Logistics Section (Service and Support).

4. Distribute ICS Form 201, *Incident Debriefing* (enlarged to 11 by 17).

   a. Initial Planning Section (Situation Unit).

   b. Initial Logistics Section (Service and Support).

5. Begin exercise scenario message distribution.

6. Follow message distribution time frames until all messages have been distributed. (You have 30 minutes.)

Activity 7.1 (cont'd)

Preparing for Exercise Debriefing

You have 15 minutes for each group to prepare their debriefing materials for presentation.

1. ICO.
    a. Primary Factors Chart.
    b. Objectives-Strategy-Tactics Chart.
2. Initial Company Officer Assistant--ICS Form 214.
3. Initial Safety Officer--ICS Form 214.
4. Initial Planning Section.
5. Initial Logistics Section--ICS Form 201.

Activity 7.1 (cont'd)

ICS Form 214, *Unit Log*

UNIT LOG	1. Incident Name	2. Date Prepared	3. Time Prepared
4. Unit Name/Designators	5. Unit Leader (Name and Position)		6. Operational Period

7. Personnel Roster Assigned

Name	ICS Position	Home Base

8. Activity Log

Time	Major Events

9. Prepared by (Name and Position)

Instructions for completing the Unit Log (ICS Form 214)

ITEM NUMBER	ITEM TITLE	INSTRUCTIONS
1.	Incident Name	Print the name assigned to the incident.
2.	Date Prepared	Enter date prepared (month, day, year).
3.	Time Prepared	Enter time prepared (24-hour clock).
4.	Unit Name	Enter the title of the organizational unit or resource designator (Engine 1 - Safety Officer, Situation Unit – Logistics Section).
5.	Unit Leader	Enter the name of the individual in charge of the Unit.
6.	Operational Period	Enter the time span covered by the log (e.g., 1800 Oct. 12 to 0600 Oct. 13).
7.	Personnel Roster	List the name, position, and home base of each member assigned to the unit during the operational period.
8.	Activity Log	Enter the time and briefly describe each significant occurrence or event (e.g., task assignments, task completions, injuries, difficulties encountered, etc.).
9.	Prepared By	Enter the name and title of the person approving the log. Provide log to immediate supervisor at the end of each operational period.

Activity 7.1 (cont'd)

ICS Form 201, *Incident Debriefing*

INCIDENT DEBRIEFING	1. INCIDENT NAME	2. DATE PREPARED	3. TIME PREPARED
4. MAP SKETCH			
ICS 201 (12/93) **NFES1325**	PAGE 1	5. PREPARED BY (NAME AND POSITION)	

6. SUMMARY OF CURRENT ACTIONS		
ICS 201	PAGE 2	

7. CURRENT ORGANIZATION		
ICS 201 (12/93) **NFES1325**	PAGE 3	

8. RESOURCES SUMMARY				
RESOURCES ORDERED	**RESOURCE IDENTIFICATION**	**ETA**	**ON SCENE √**	**LOCATION/ASSIGNMENT**

ICS 201 (12/93) **NFES 1325**	PAGE 4	

Instructions for completing the Incident Briefing (ICS Form 201)

ITEM NUMBER	ITEM TITLE	INSTRUCTIONS
1.	Incident Name	Print the name assigned to the incident.
2.	Date Prepared	Enter date prepared (month, day, year).
3.	Time Prepared	Enter time prepared (24-hour clock).
4.	Map Sketch	Show perimeter and control lines, resources assignments, incident facilities, and other special information on a sketch map or attached to the topographic or orthophoto map.
5.	Resources Summary	Enter the following information about the resources allocated to the incident. Enter the number and type of resource ordered.
	Resources Ordered	Enter the number and type of resource ordered.
	Resource Identification	Enter the agency three-letter designator, S/T, Kind/ Type and resource designator.
	ETA/On Scene	Enter the estimated arrival time and place the arrival time or a checkmark in the "on scene" column upon arrival.
	Location/ Assignment	Enter the assigned location of the resource and/or the actual assignment.
6.	Current Organization	Enter on the organization chart the names of the individuals assigned to each position. Modify the chart as necessary.
7.	Summary of Current Actions	Enter the strategy and tactics used on the incident and note any specific problem areas.
8.	Prepared By	Enter the name and position of the person completing the form.
*Note		Additional pages may be added to ICS Form 201 if needed.

Activity 7.1 (cont'd)

Debriefing Procedures

1. The instructor will debrief exercise scenarios with each group.

2. The instructor will display the slides for your group's scenario when debriefing.

3. Assigned ICO for each group shall present the following:

    a. Primary Factors Chart.

    b. Objectives-Strategy-Tactics Chart.

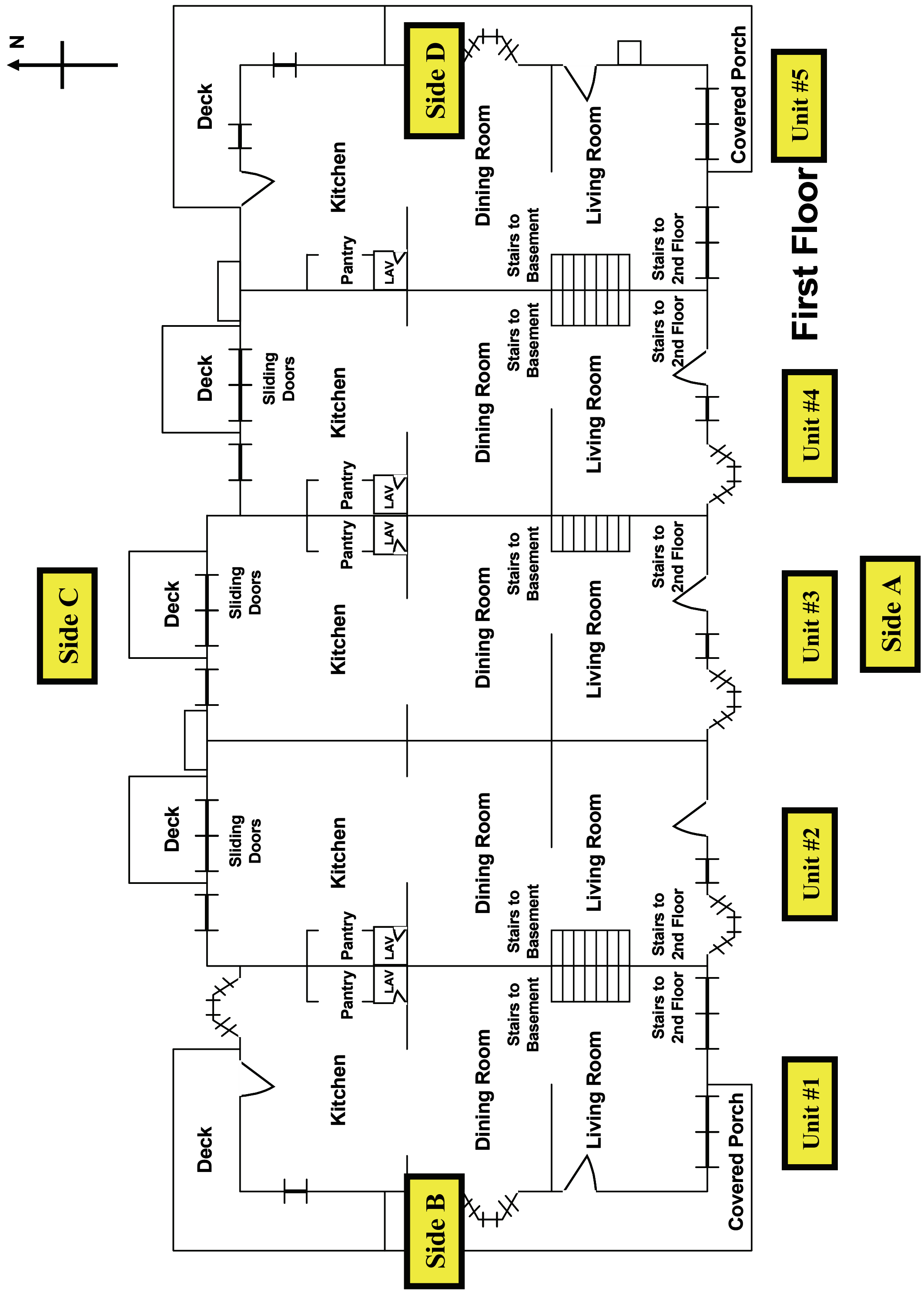
    c. ICS Form 214.

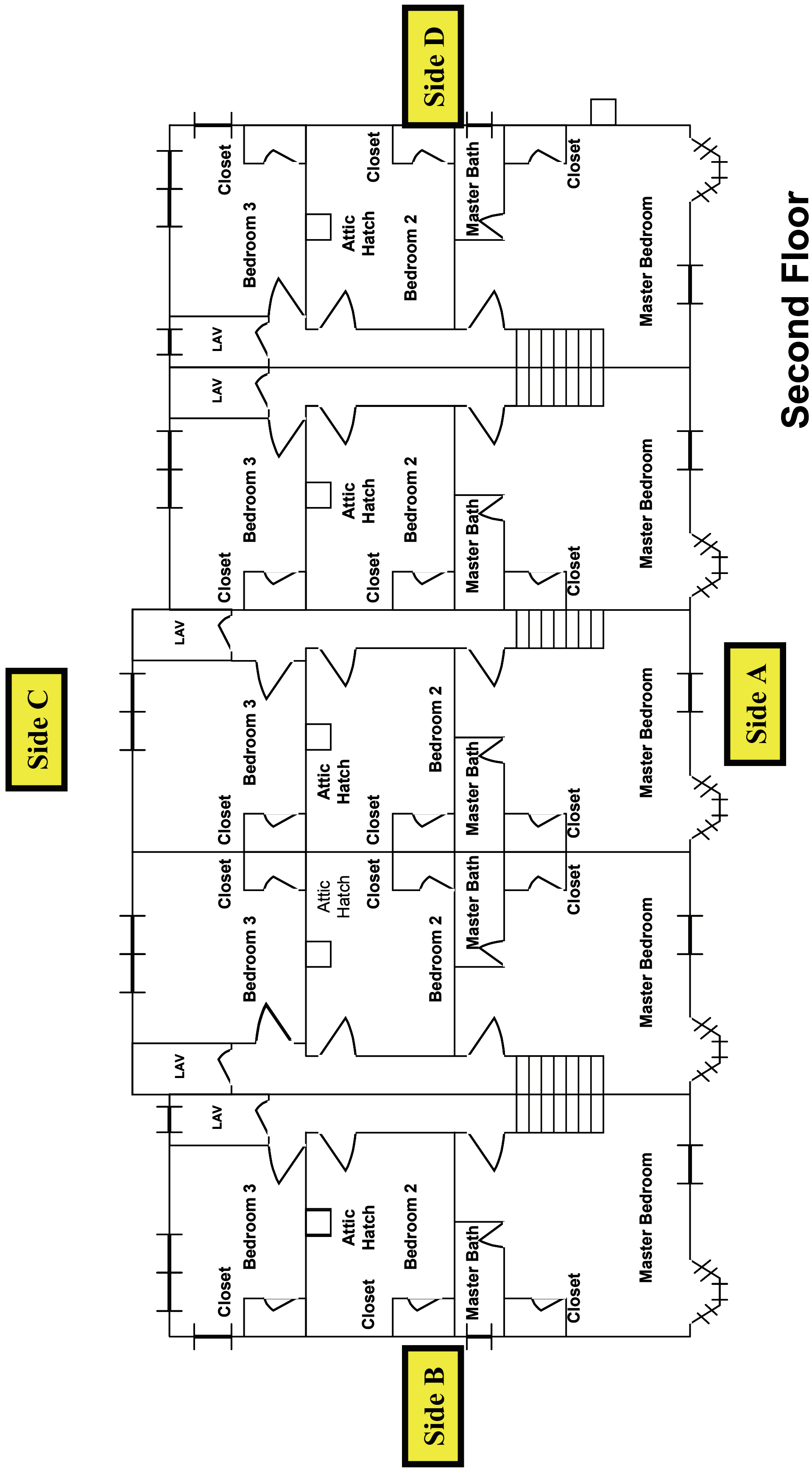
4. Each group will have 15 minutes to debrief.

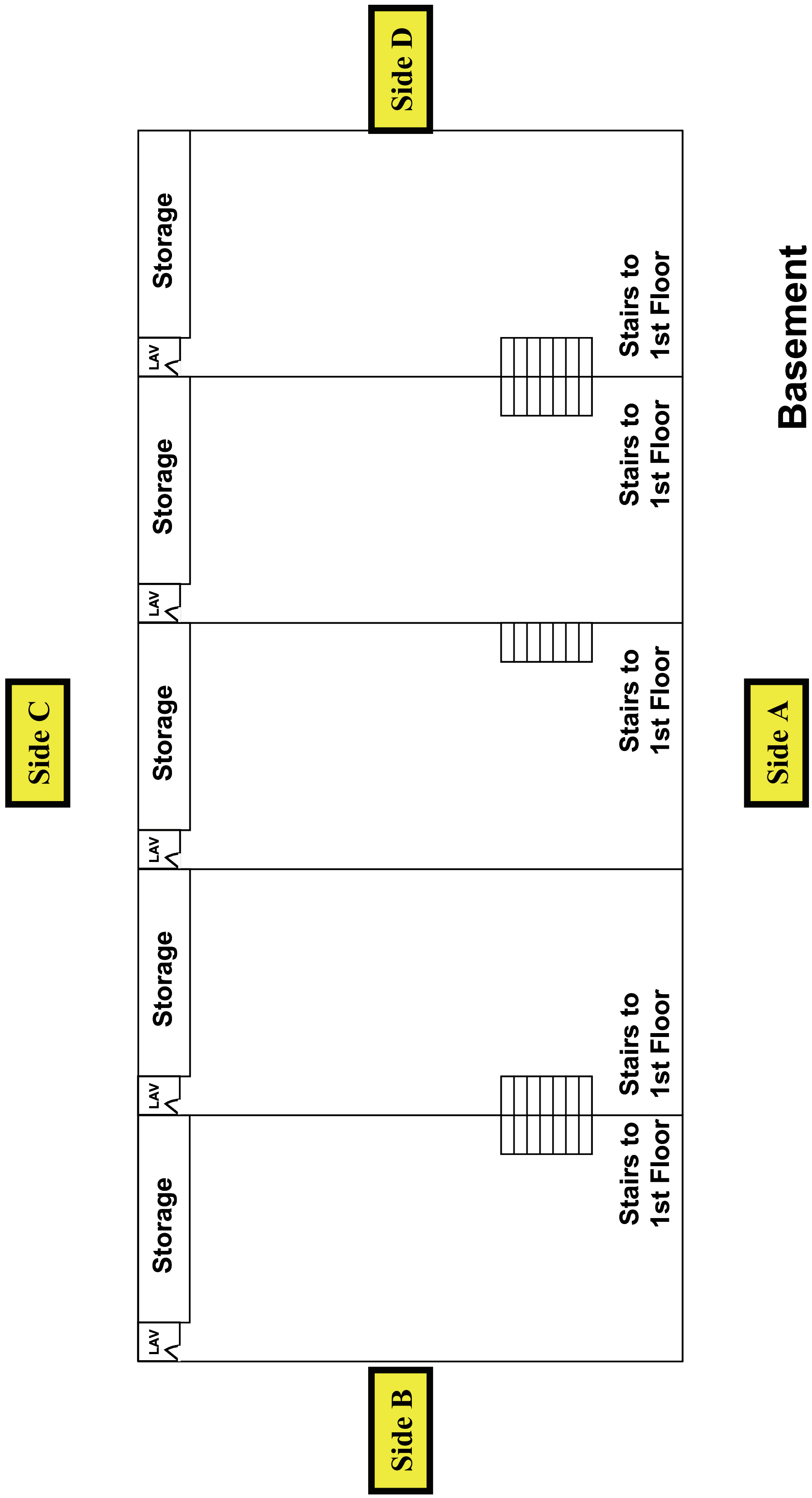
5. The instructor will address any specific issues that were omitted from charts and identify issues where improvement is required.

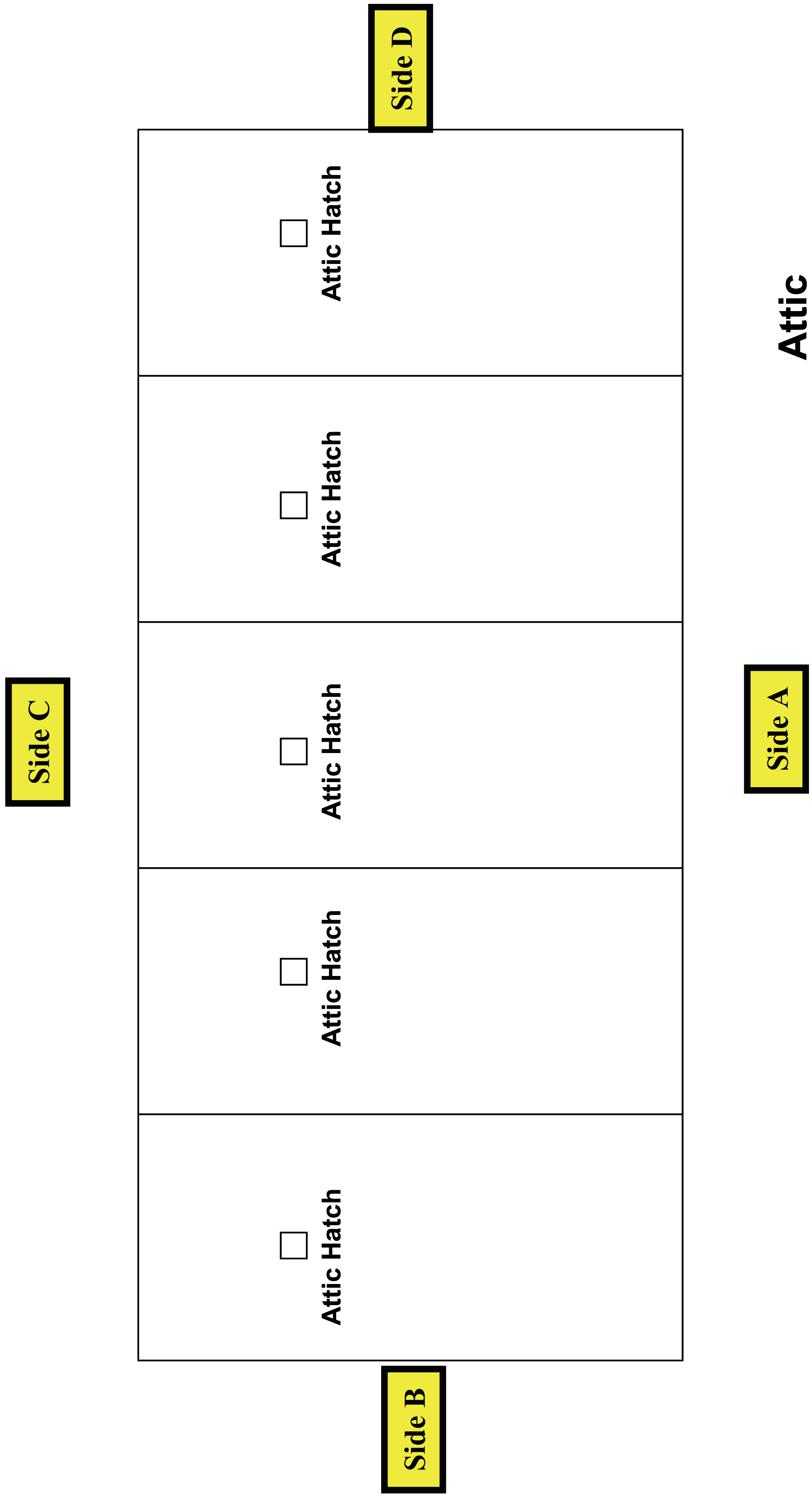
Activity 7.1 (cont'd)
Plot Plans
Exercise #1

Frame Town House--Walkaround

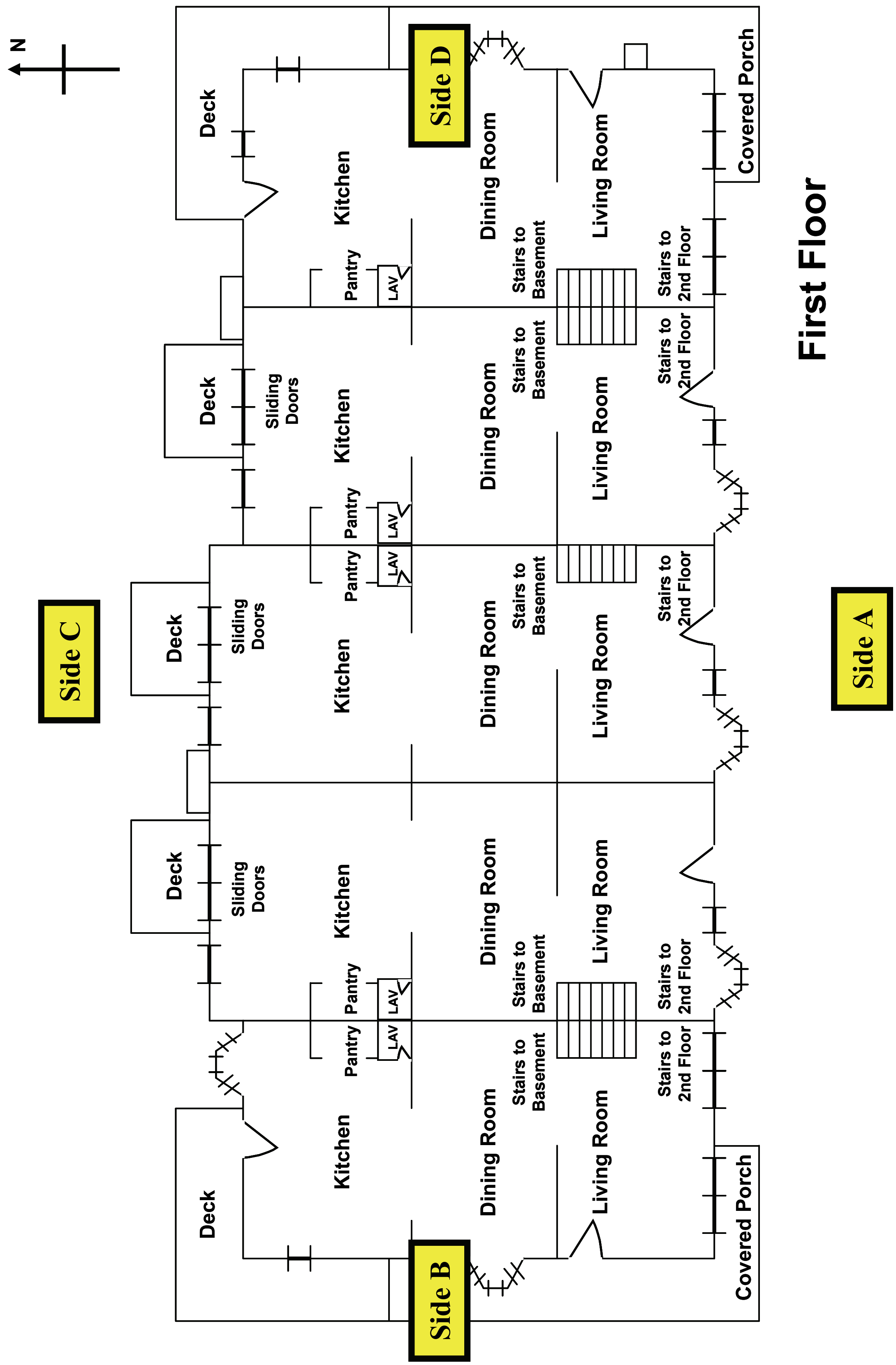


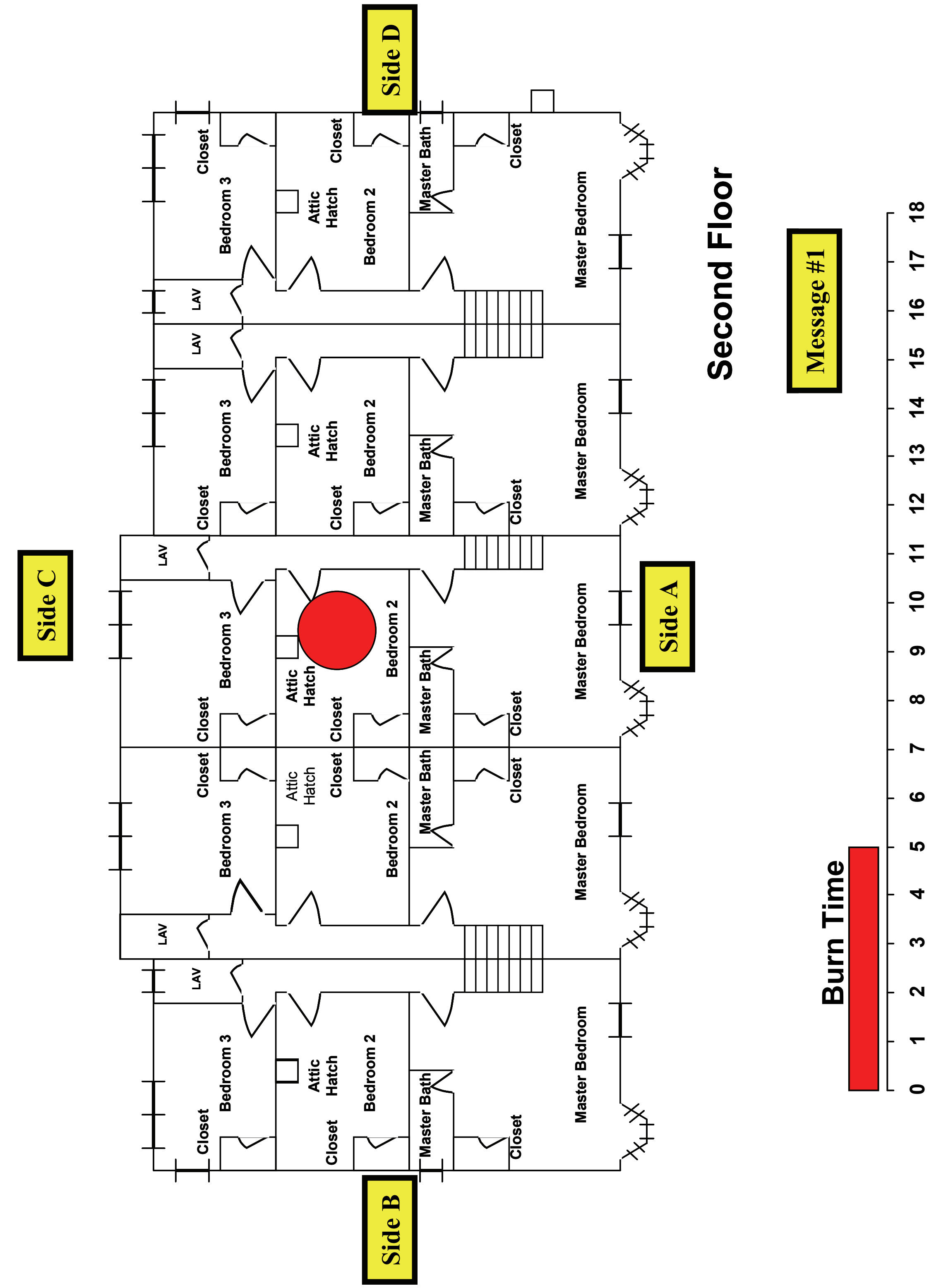

Second Floor
Side A
Side B
Side C
Side D
Master Bedroom
Master Bath
Closet
Bedroom 2
Bedroom 3
Attic Hatch
LAV

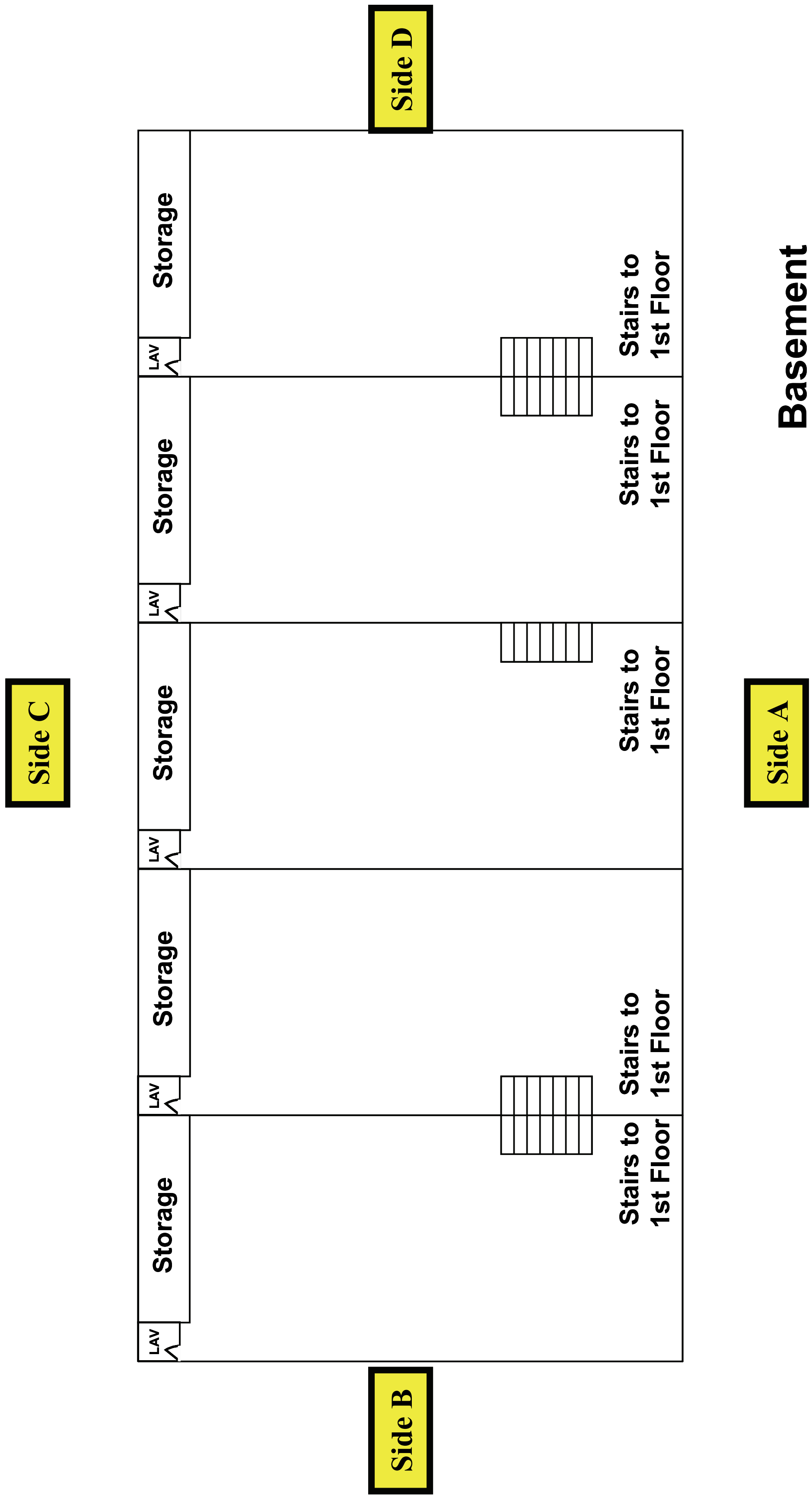

Basement
Side A
Side B
Side C
Side D
Storage
LAV
Stairs to 1st Floor
Storage
LAV
Stairs to 1st Floor
Storage
LAV
Stairs to 1st Floor
Storage
LAV
Stairs to 1st Floor
Storage
LAV
Stairs to 1st Floor

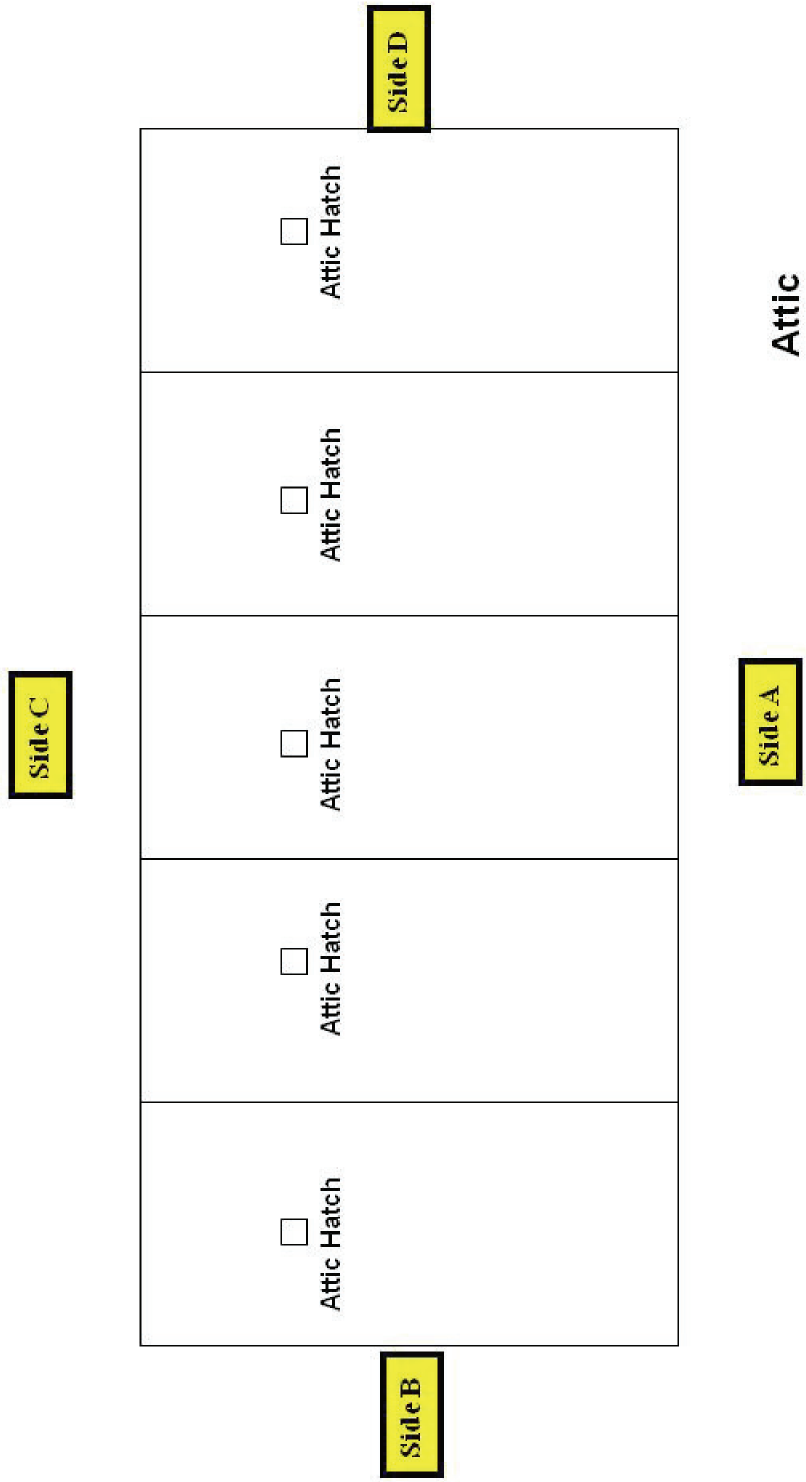

Side D
Attic Hatch
Attic Hatch
Attic Hatch
Attic Hatch
Attic Hatch
Attic
Side C
Side A
Side B

Iteration 1--Message 1

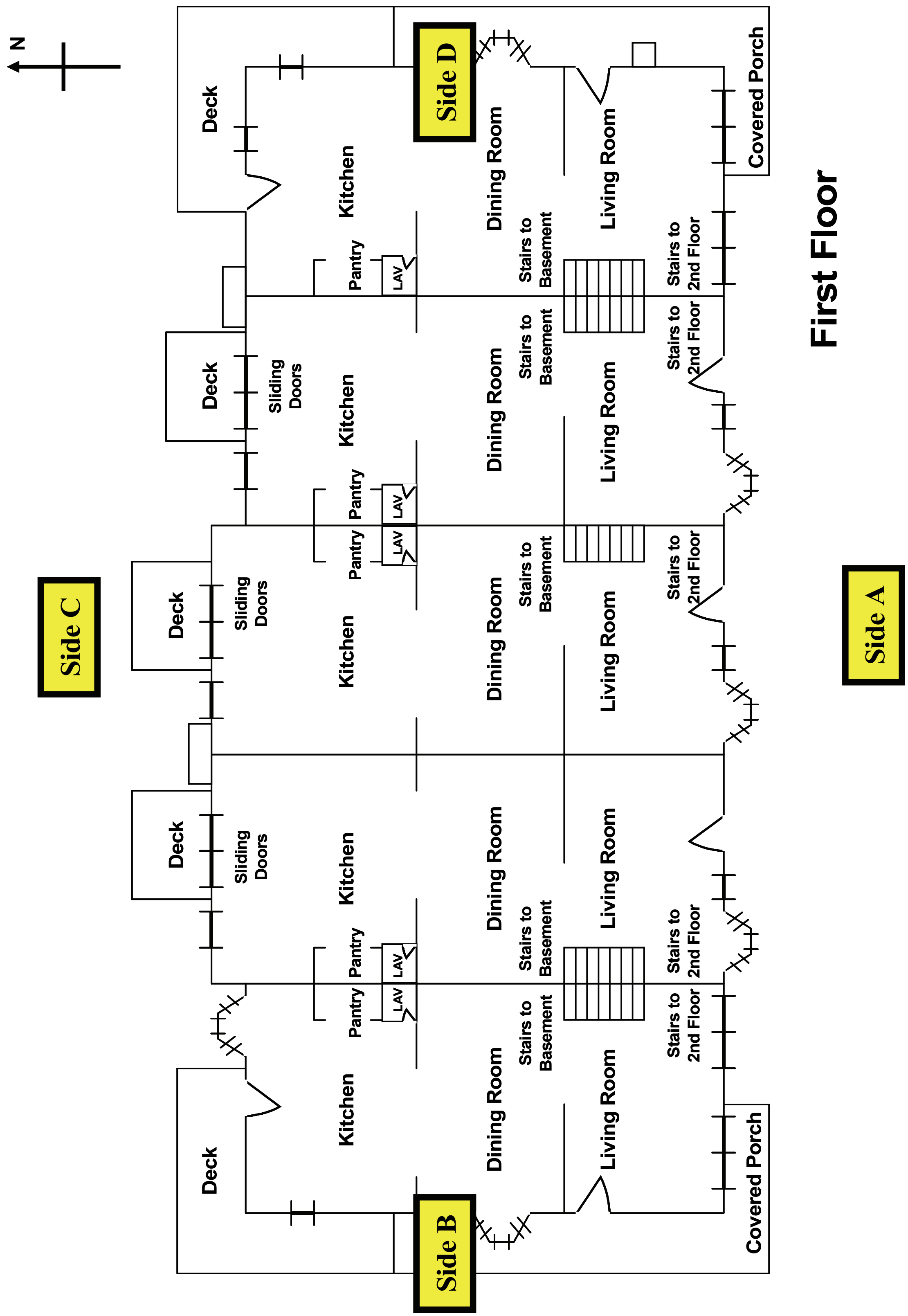


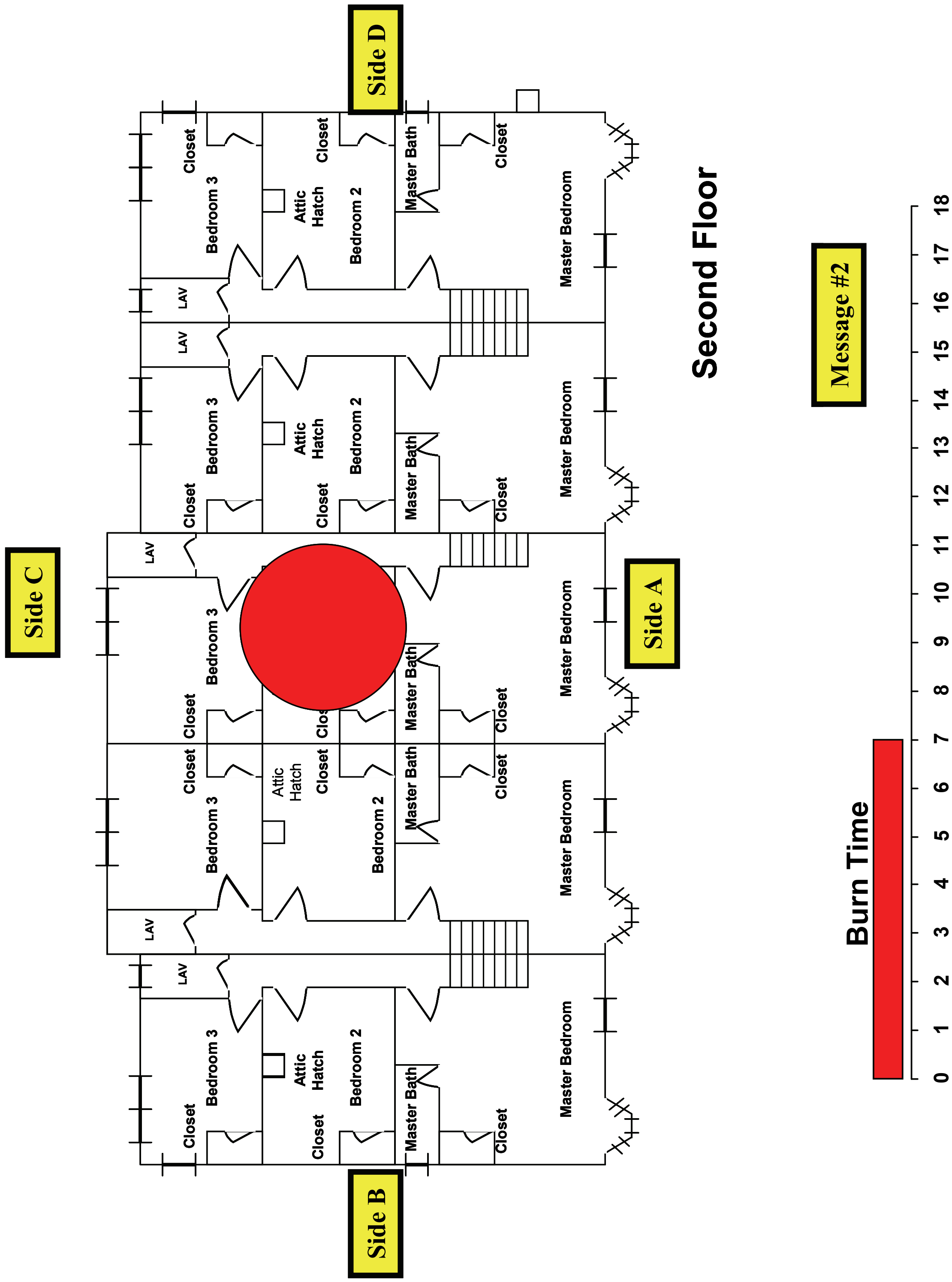

Side D
Side C
Side A
Side B
Second Floor
Message #1
Burn Time
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
Closet
Bedroom 3
Attic Hatch
Bedroom 2
Master Bath
Master Bedroom
LAV

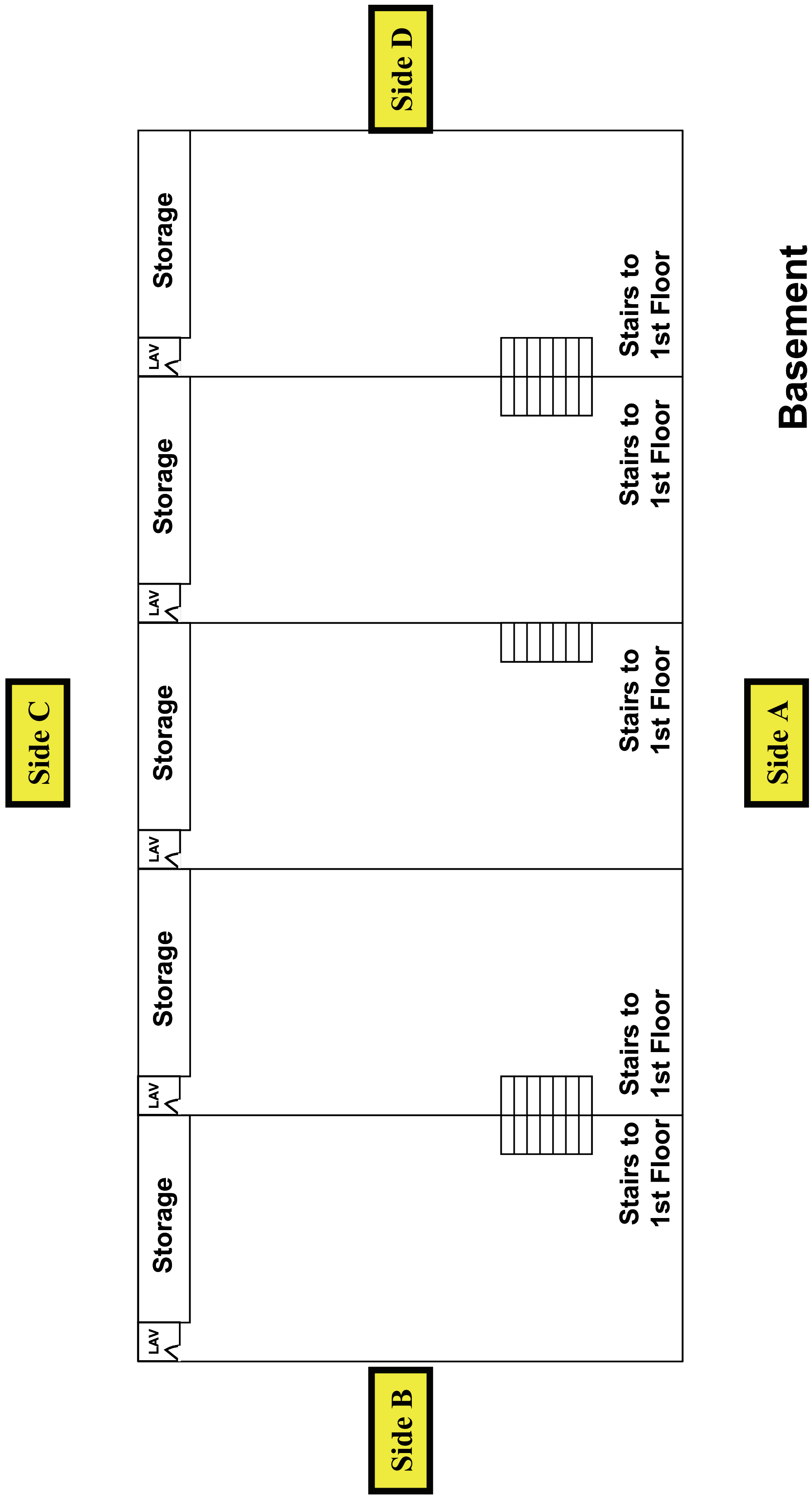

Side D
Storage
LAV
Stairs to 1st Floor
Storage
LAV
Stairs to 1st Floor
Storage
LAV
Stairs to 1st Floor
Storage
LAV
Stairs to 1st Floor
Storage
LAV
Stairs to 1st Floor
Side C
Side A
Side B
Basement

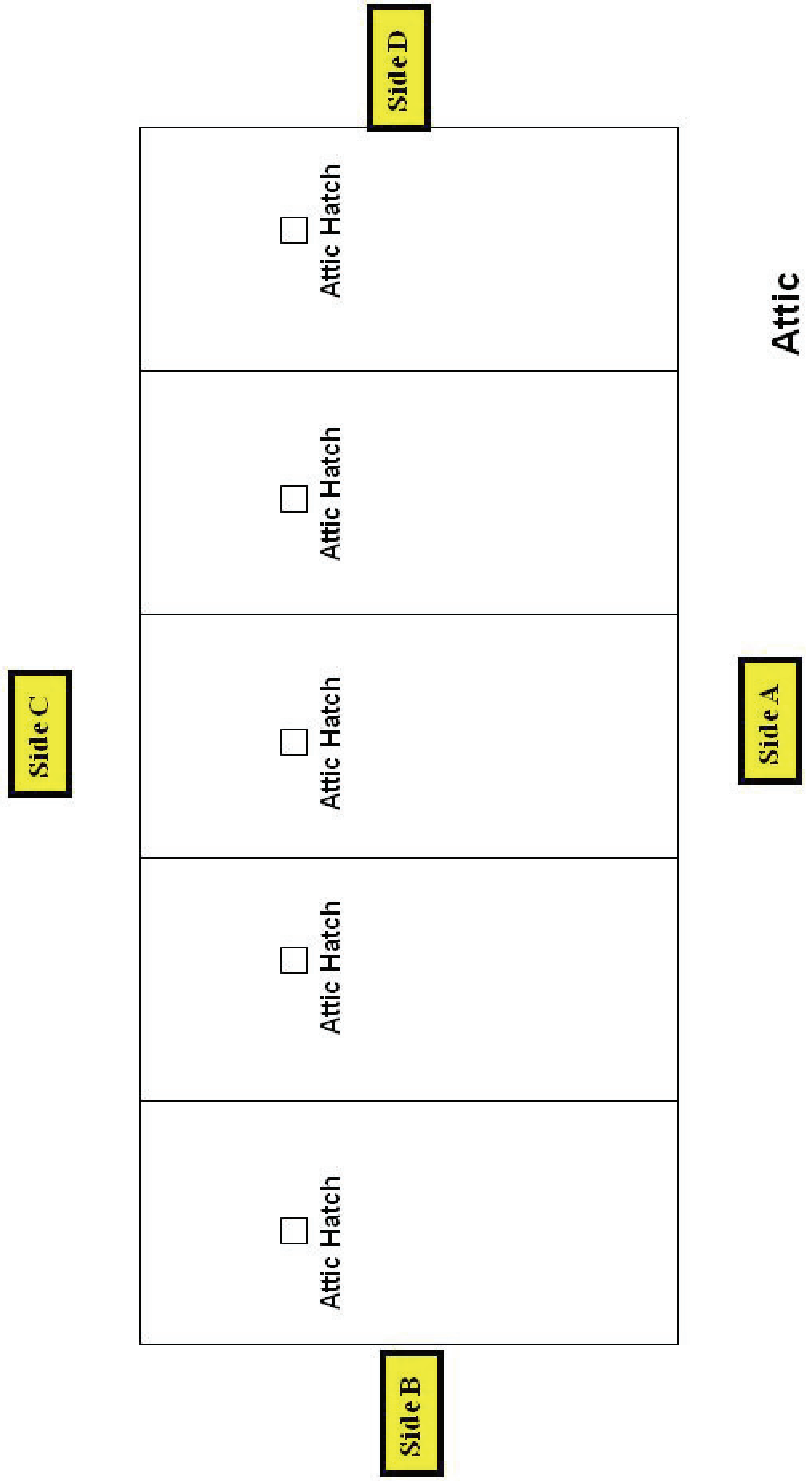

Side D
Attic Hatch
Attic Hatch
Attic Hatch
Attic Hatch
Attic Hatch
Attic
Side C
Side A
Side B

Iteration 2--Message 2

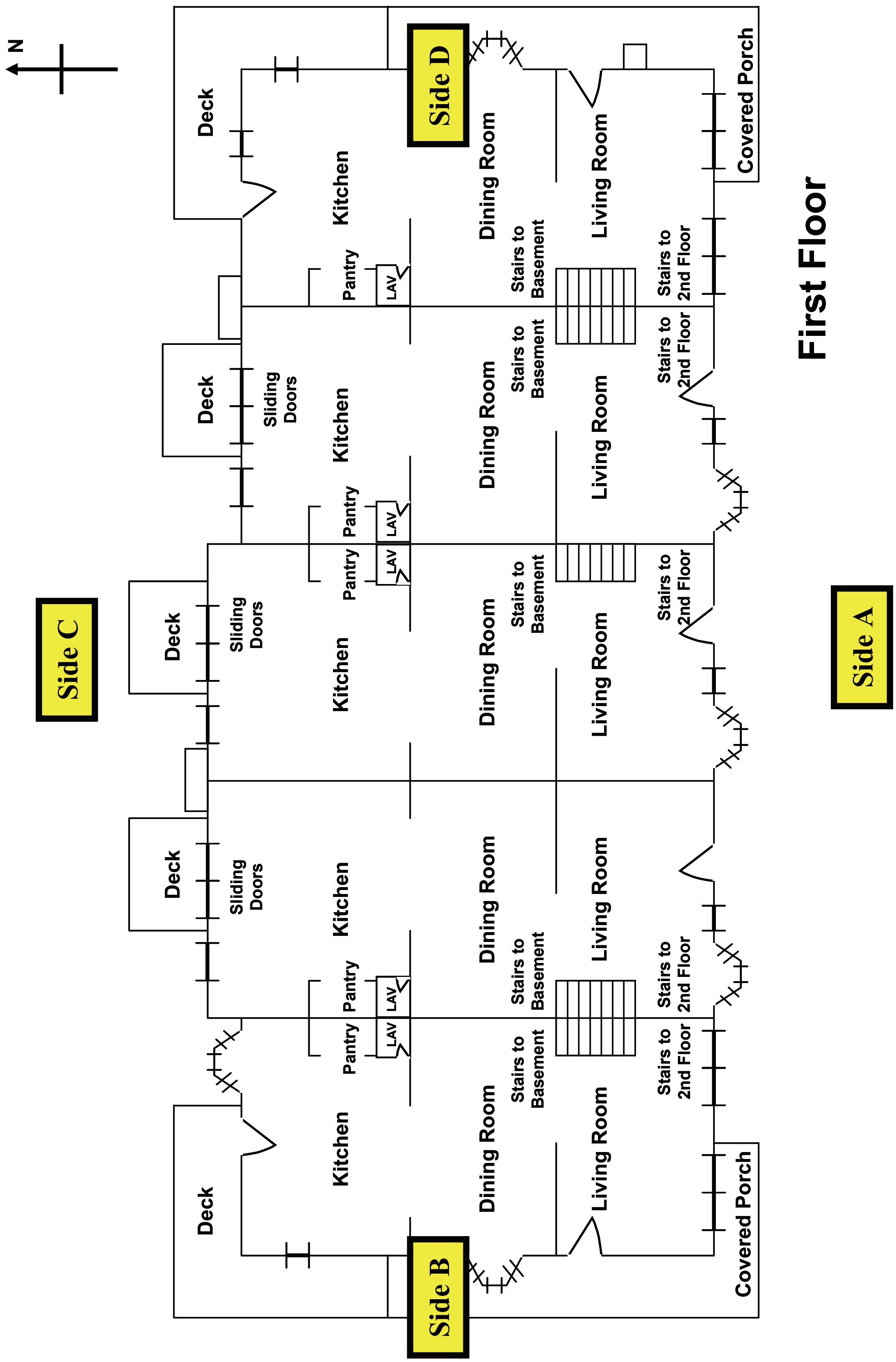


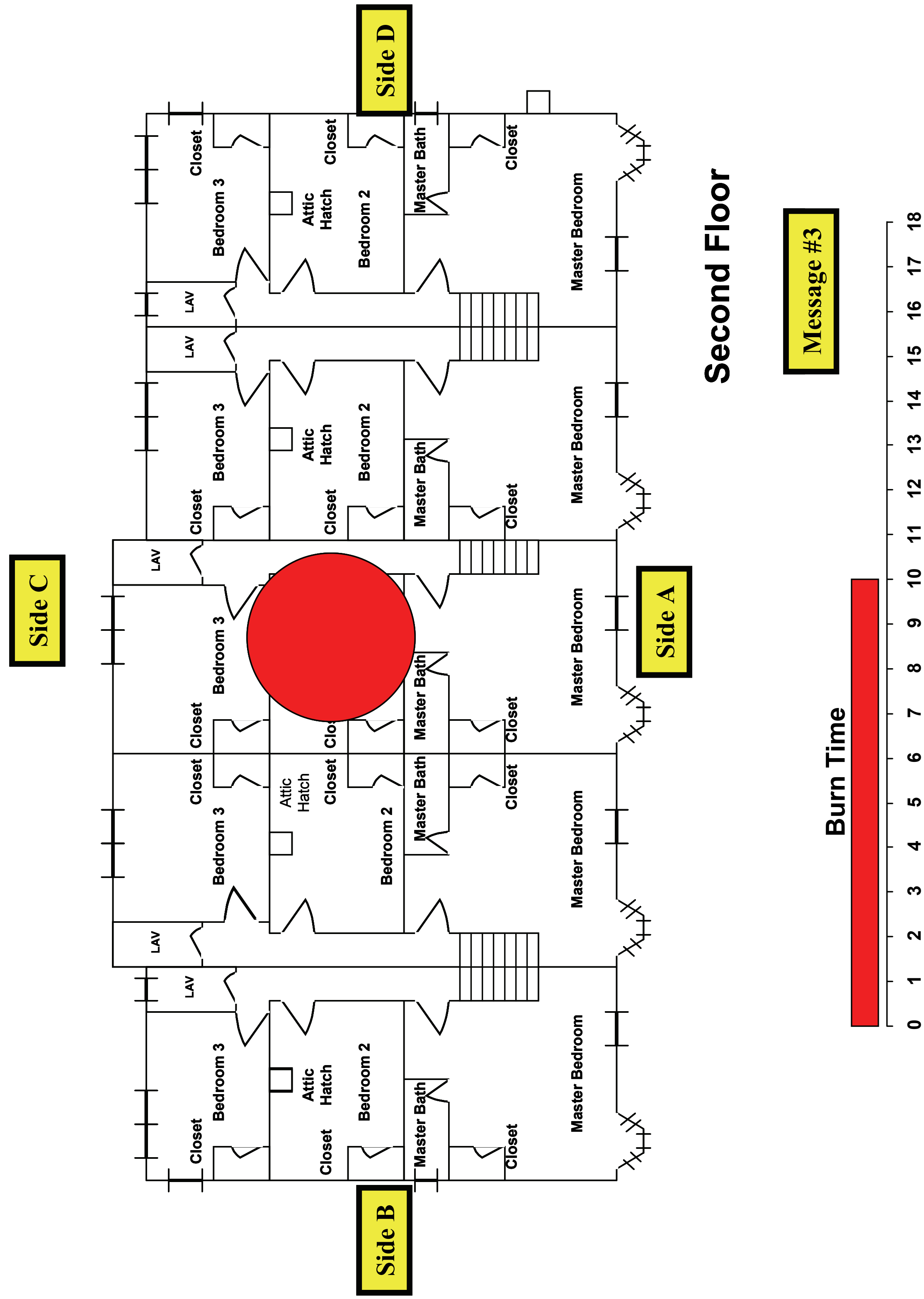

Side A
Side B
Side C
Side D
Second Floor
Message #2
Burn Time
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
Master Bedroom
Master Bath
Closet
Bedroom 2
Bedroom 3
Attic Hatch
LAV

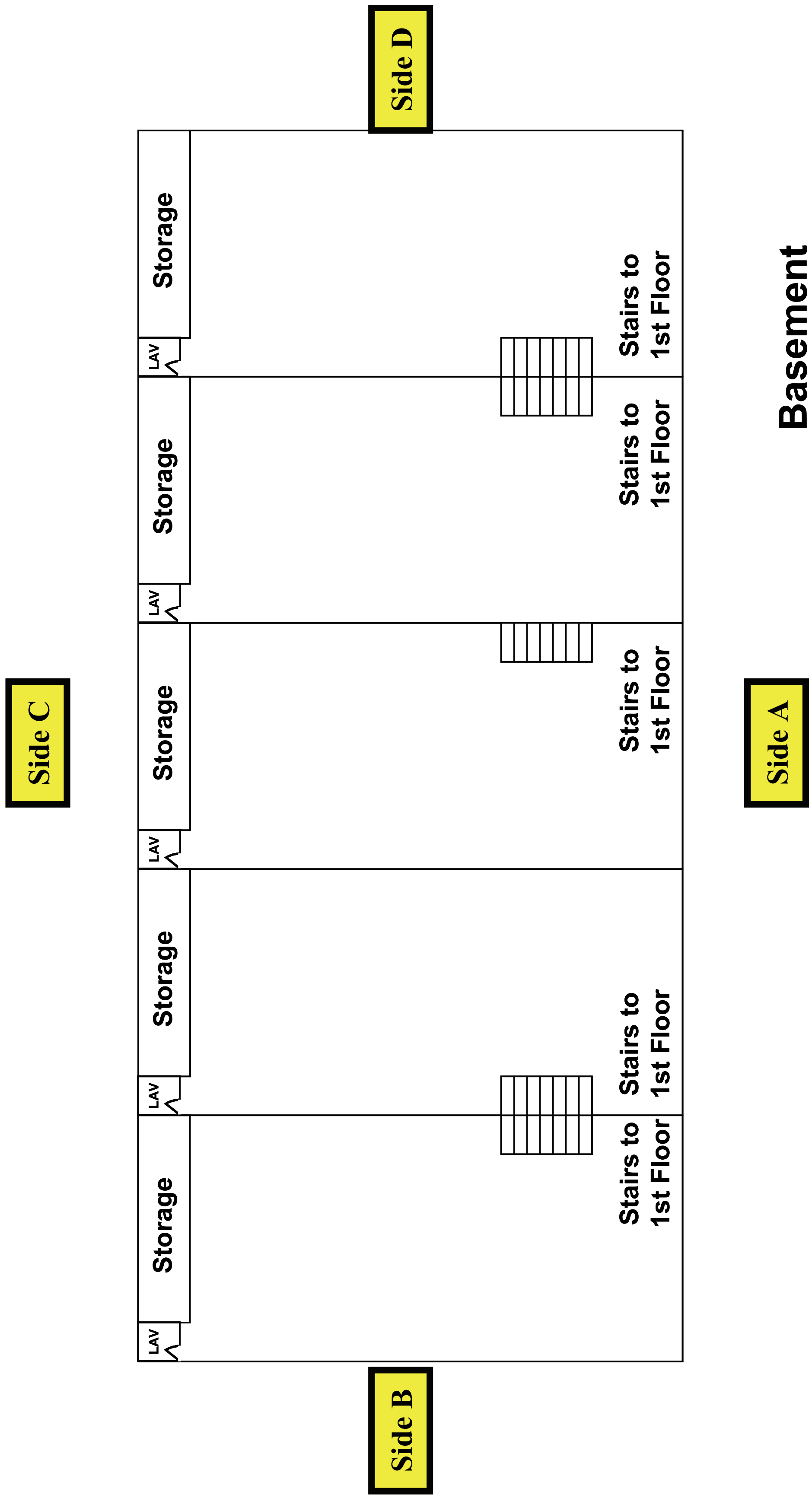

Side D
Side C
Side A
Side B
Storage
LAV
Storage
LAV
Storage
LAV
Storage
LAV
Storage
LAV
Stairs to 1st Floor
Stairs to 1st Floor
Stairs to 1st Floor
Stairs to 1st Floor
Stairs to 1st Floor
Basement

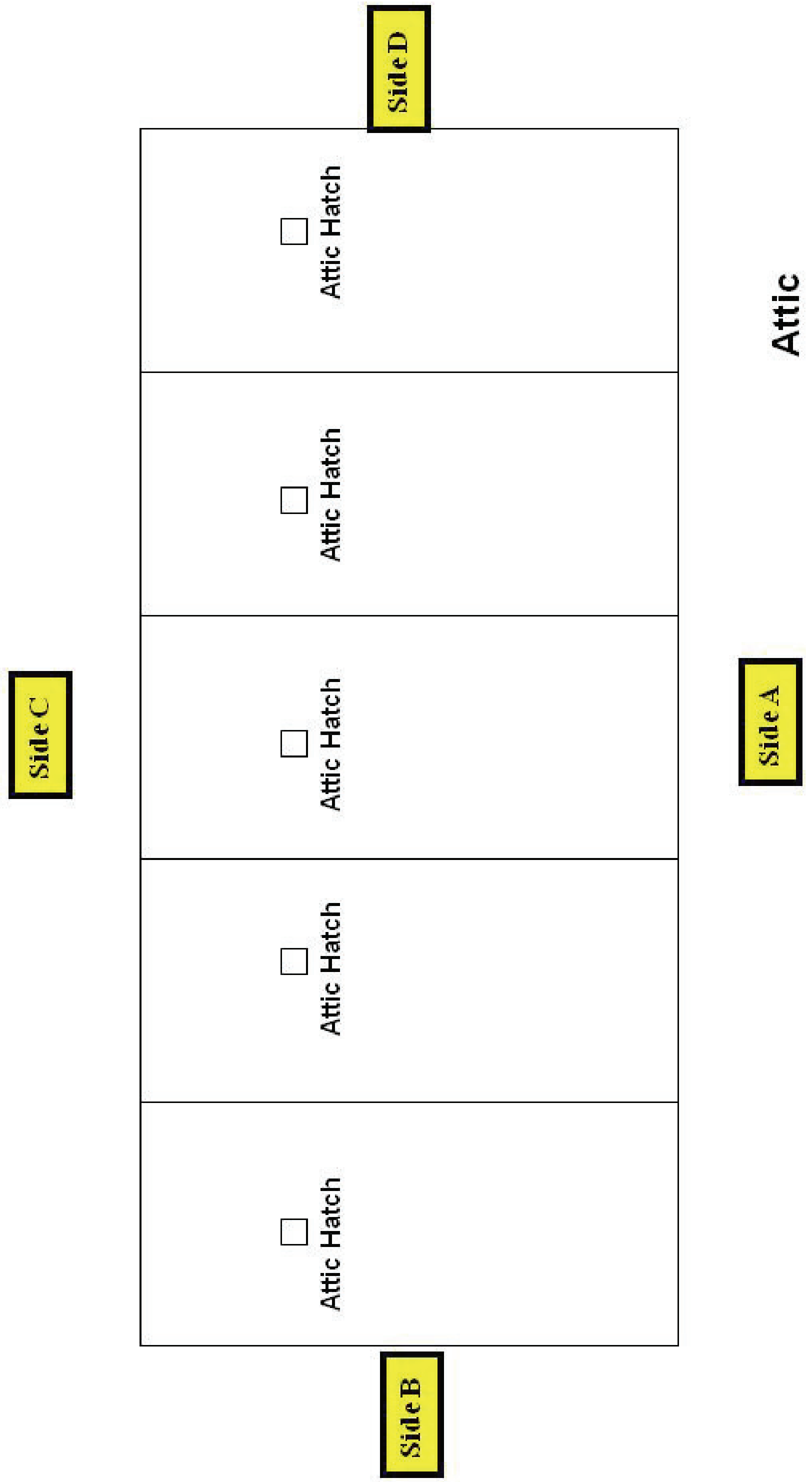

Attic
Side A
Side B
Side C
Side D
Attic Hatch
Attic Hatch
Attic Hatch
Attic Hatch
Attic Hatch

Iteration 2--Message 3

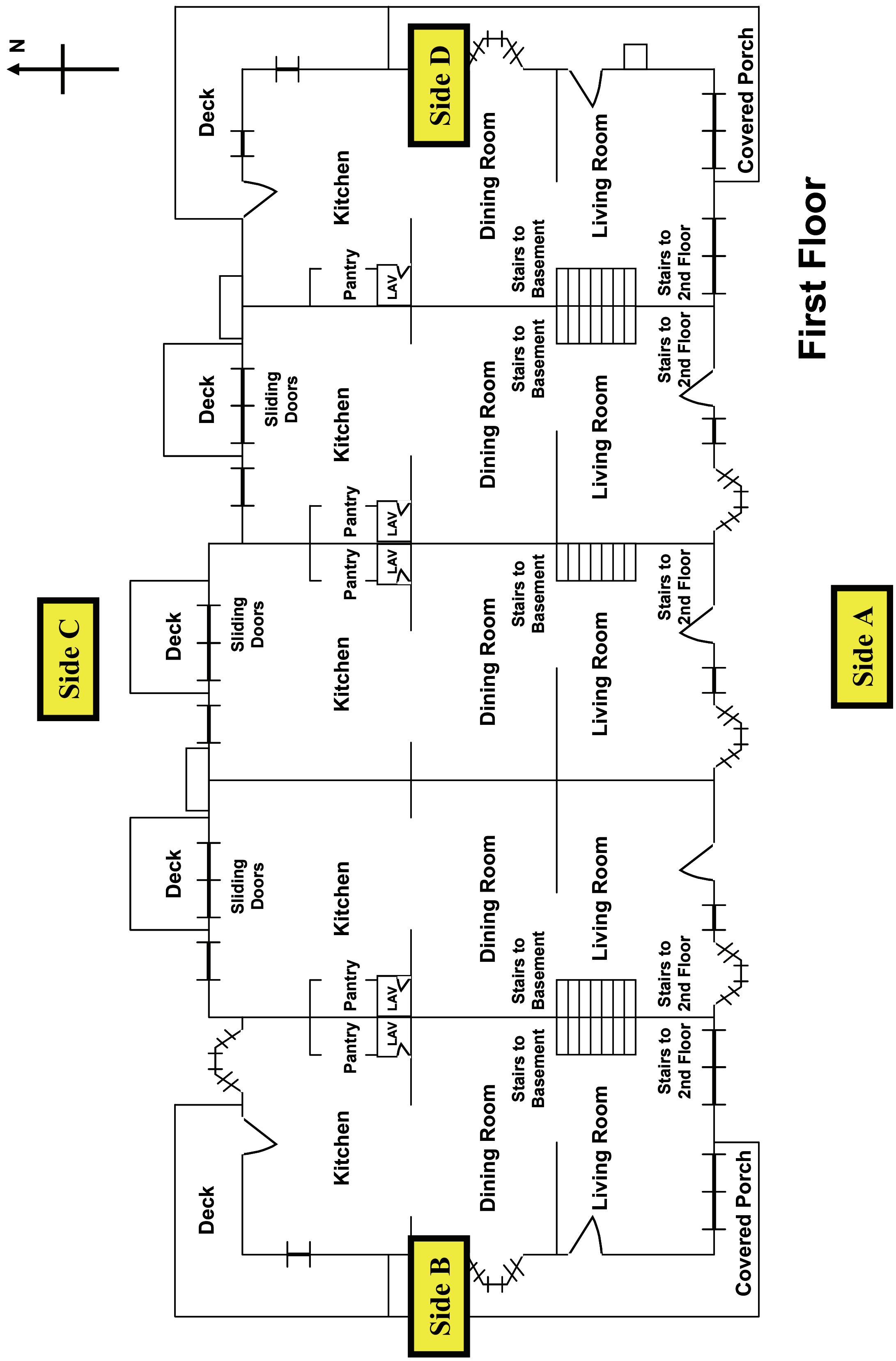


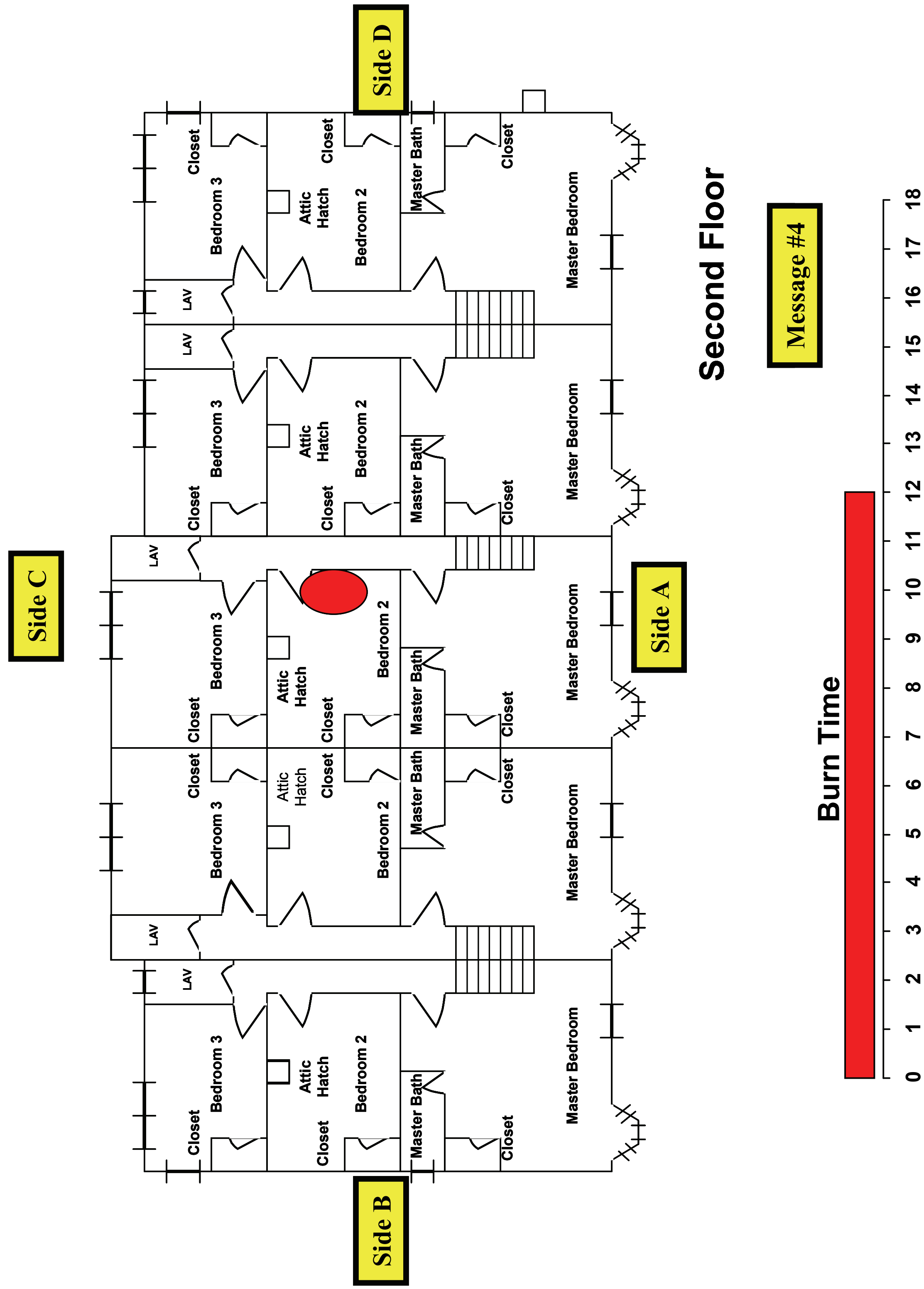

Side C
Side D
Side A
Side B
Second Floor
Message #3
Burn Time
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
Bedroom 3
Bedroom 2
Master Bedroom
Master Bath
Closet
Attic Hatch
LAV

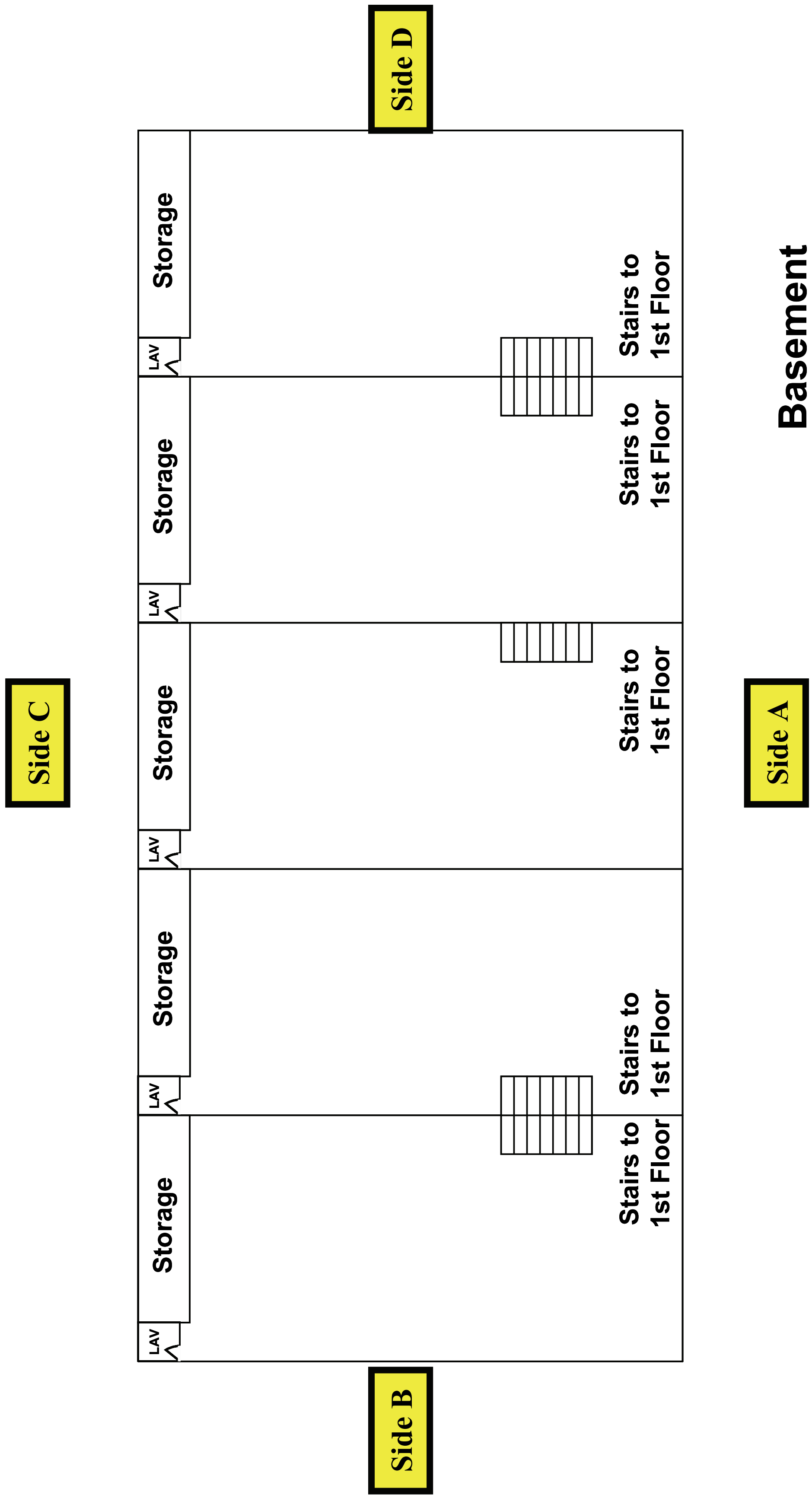

Side D
Side C
Side A
Side B
Storage
LAV
Stairs to 1st Floor
Basement

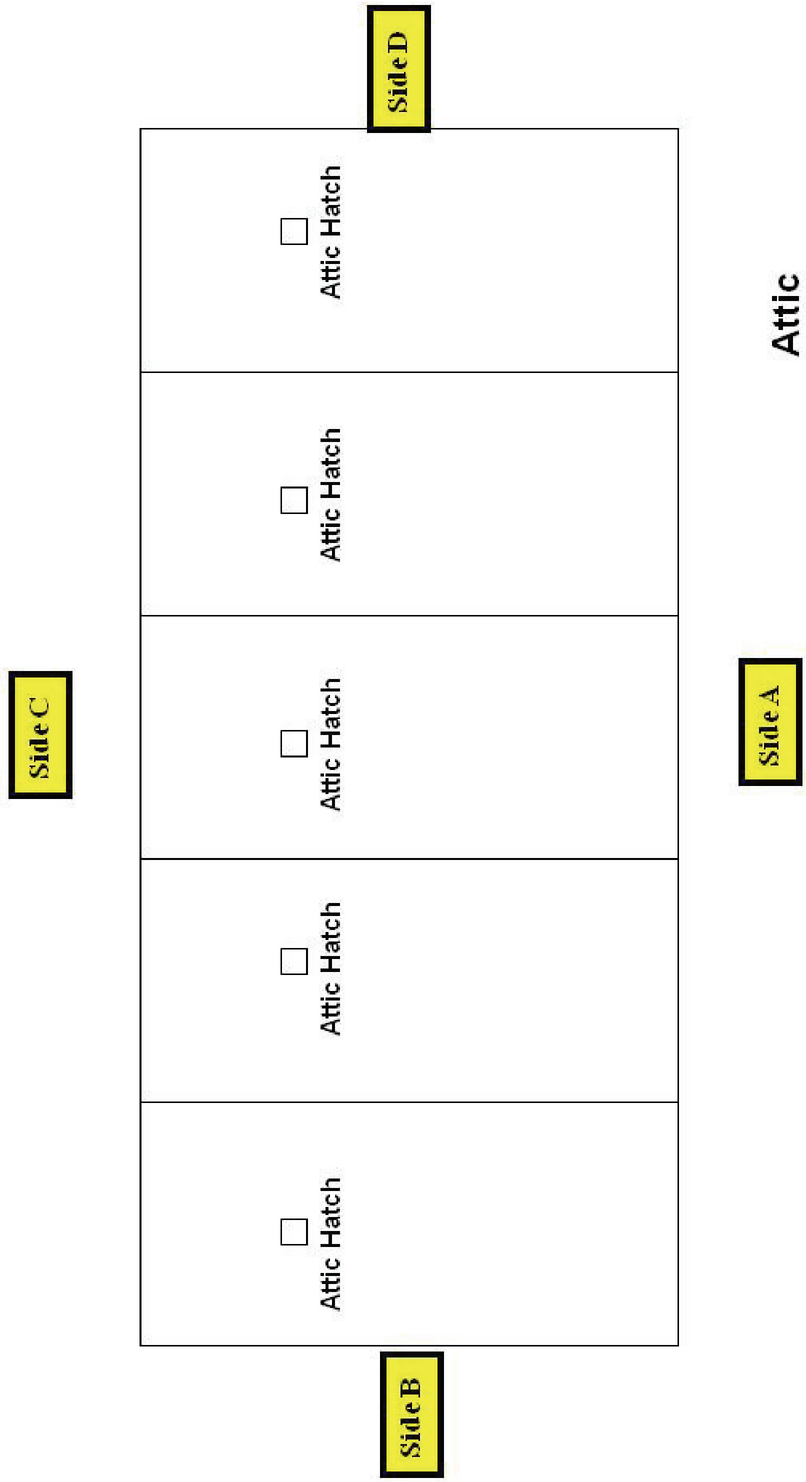

Side D
Attic Hatch
Attic Hatch
Attic Hatch
Attic Hatch
Attic Hatch
Attic
Side C
Side A
Side B

Iteration 3--Message 4

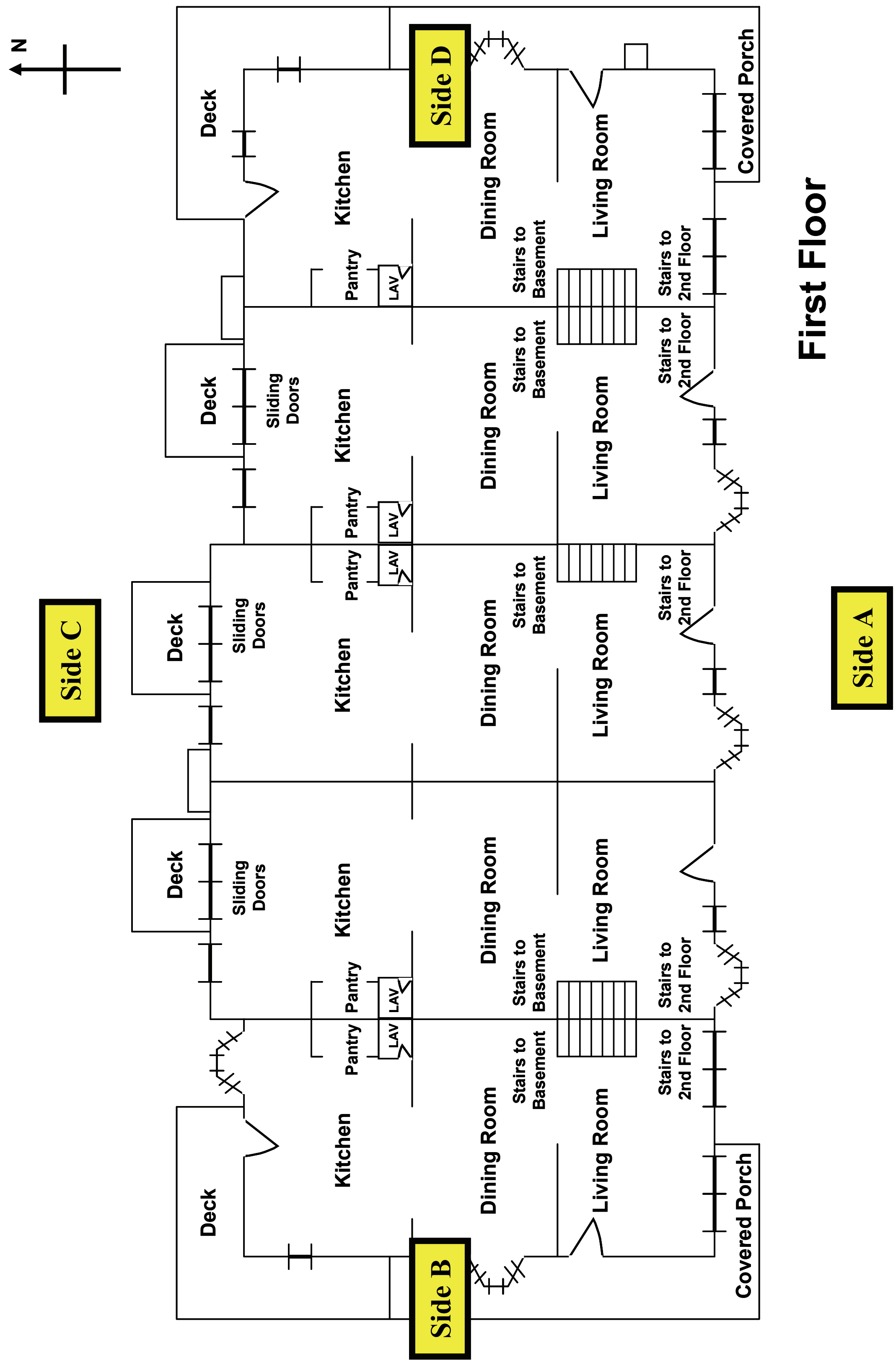


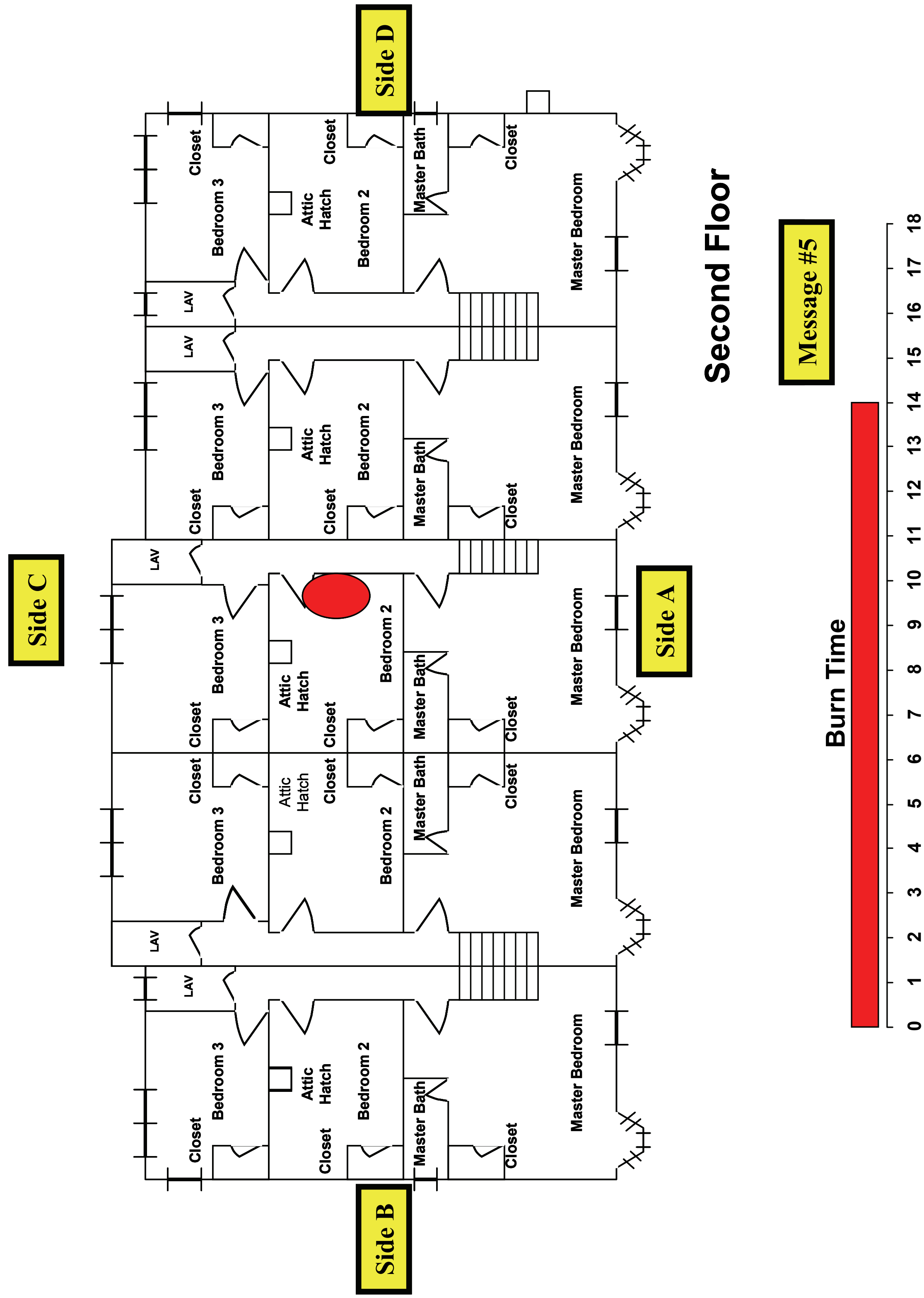

Side C
Side D
Side B
Side A
Second Floor
Message #4
Burn Time
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
Closet
Bedroom 3
Bedroom 2
Attic Hatch
Master Bath
Master Bedroom
LAV

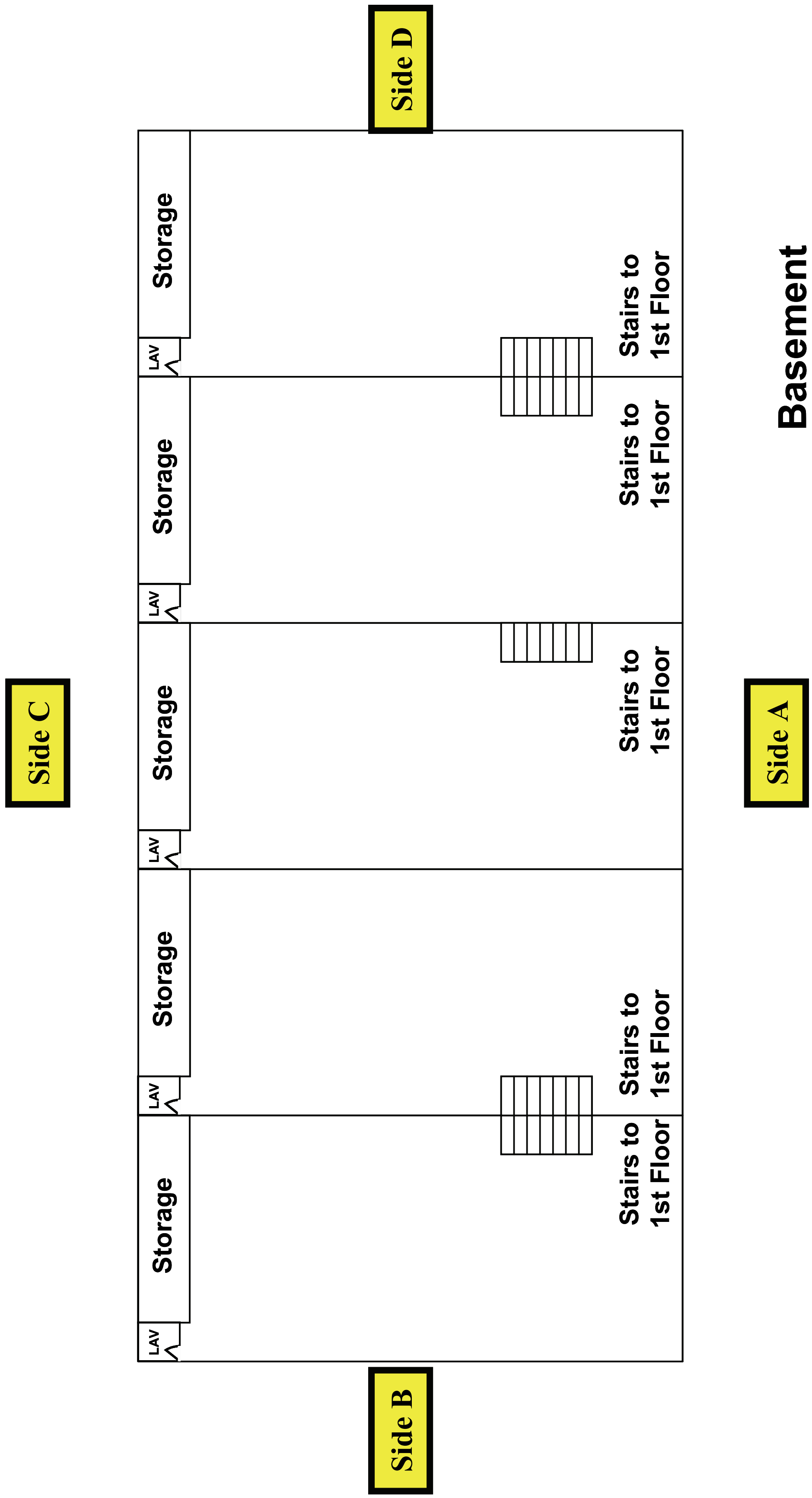

Side D
Side C
Side A
Side B
Storage
LAV
Stairs to 1st Floor
Storage
LAV
Stairs to 1st Floor
Storage
LAV
Stairs to 1st Floor
Storage
LAV
Stairs to 1st Floor
Storage
LAV
Stairs to 1st Floor
Basement

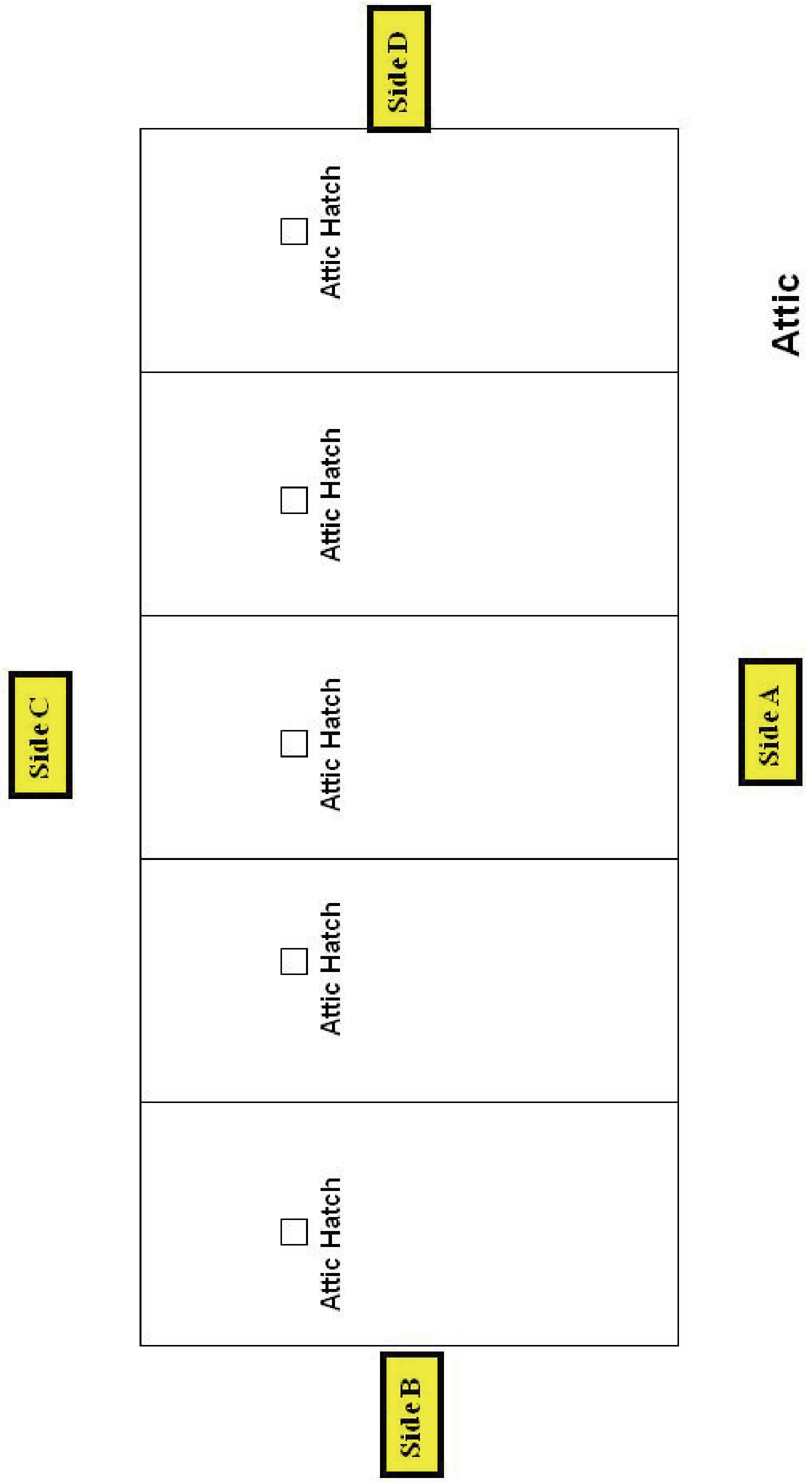

Side D
Attic Hatch
Attic Hatch
Attic Hatch
Attic Hatch
Attic Hatch
Attic
Side C
Side A
Side B

Iteration 3--Message 5

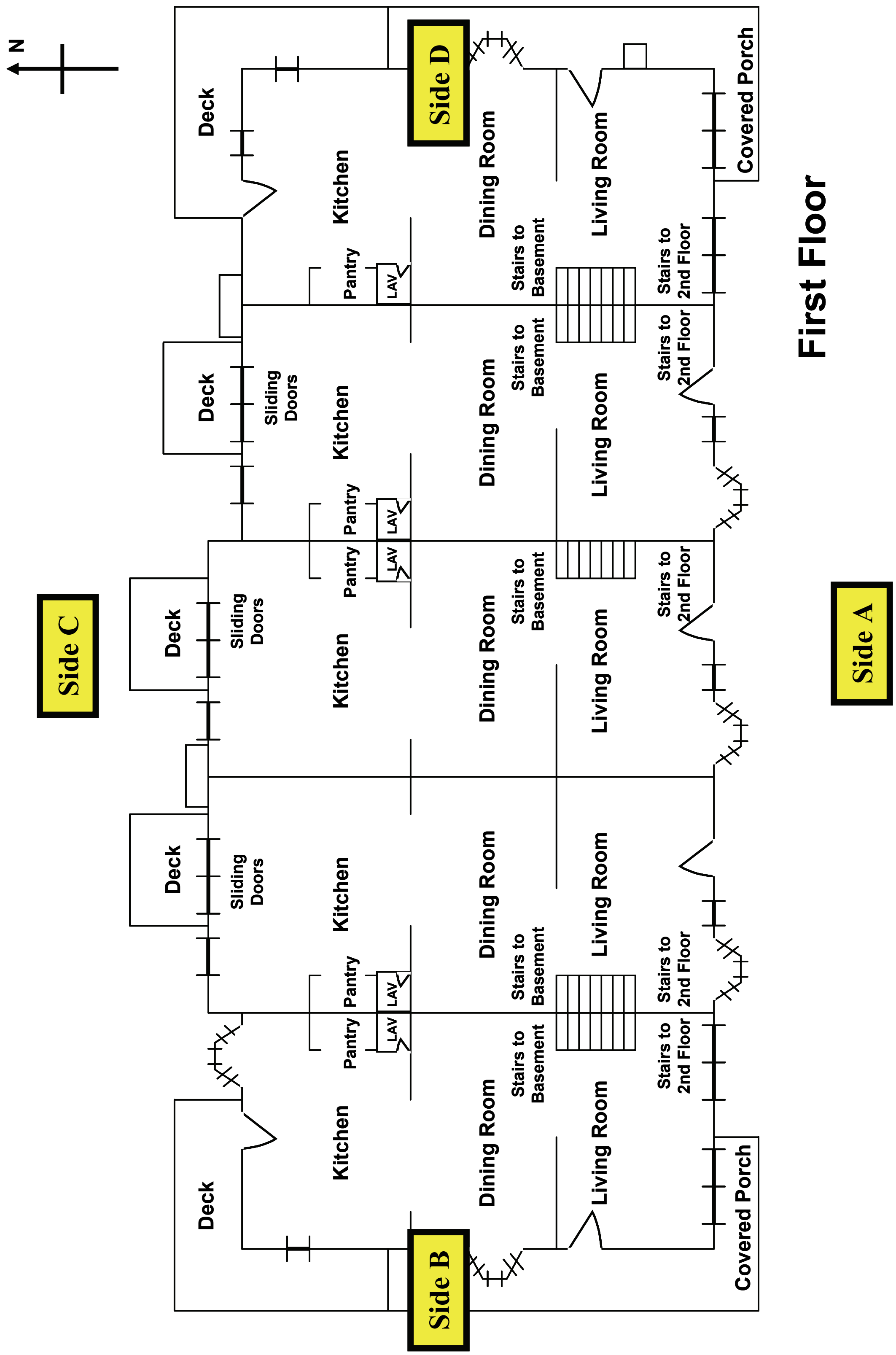


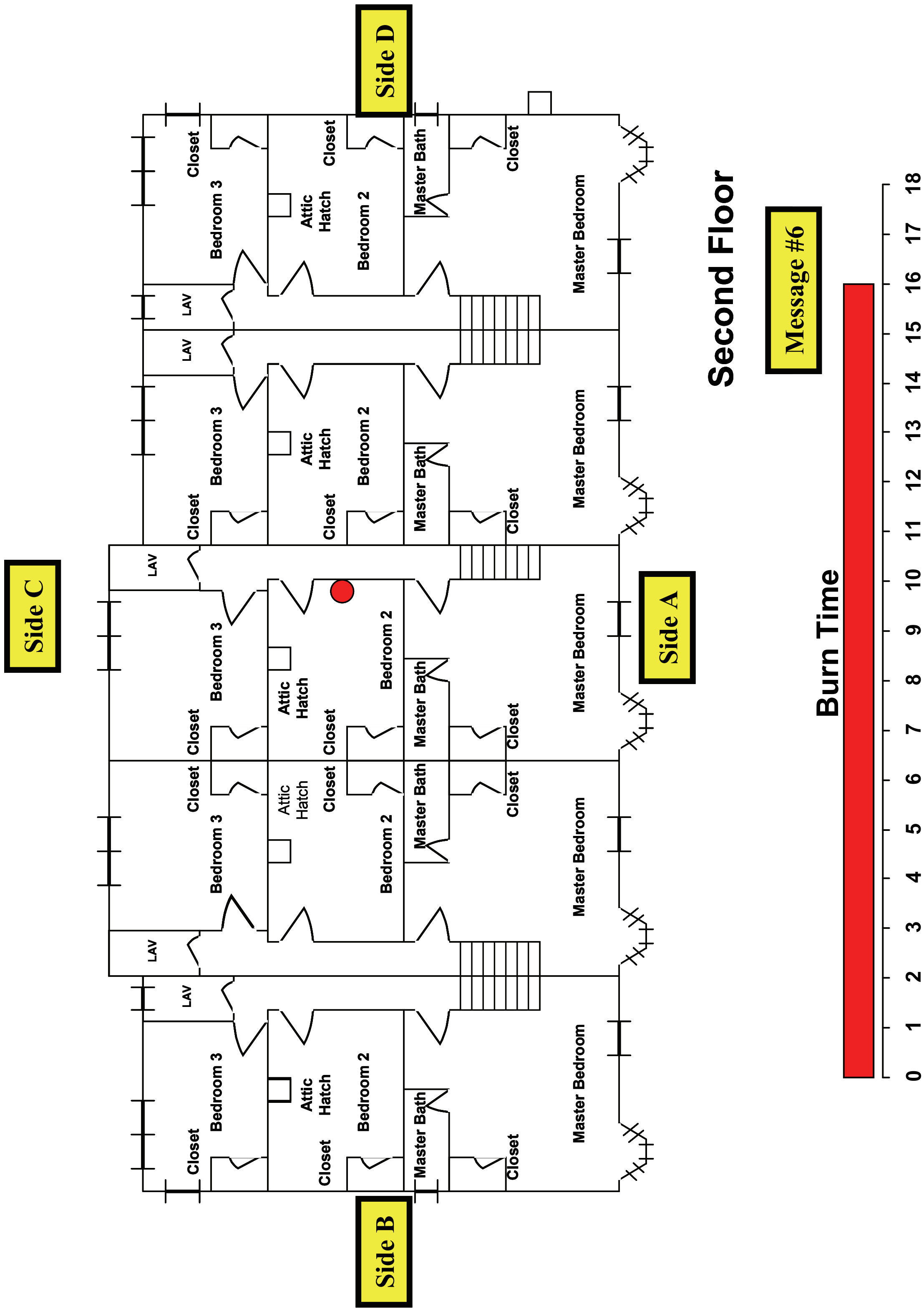

Side D
Side C
Side A
Side B
Second Floor
Message #5
Burn Time
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
Closet
Bedroom 3
Attic Hatch
Bedroom 2
Master Bath
Master Bedroom
LAV

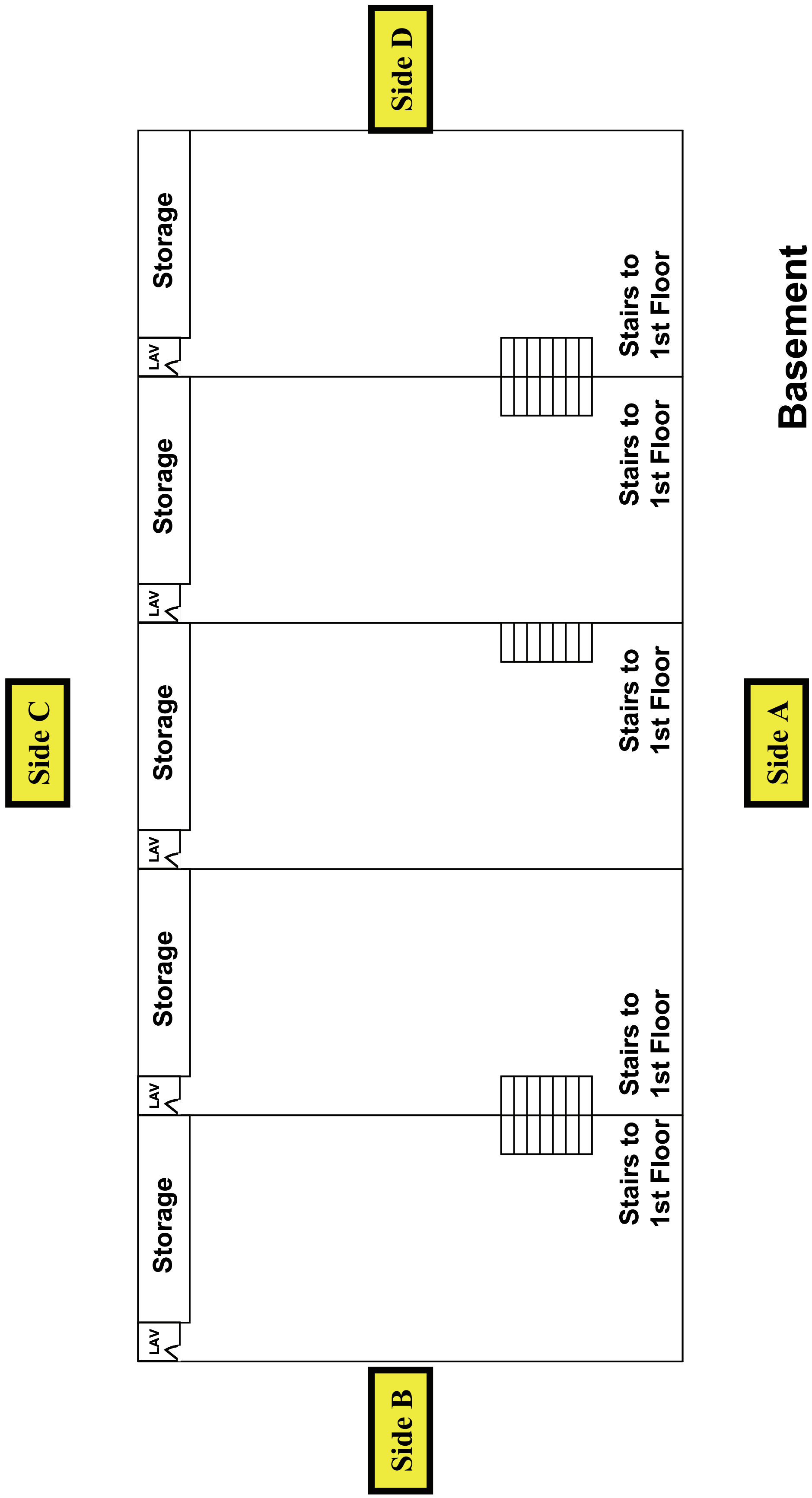

Side D
Storage
LAV
Stairs to 1st Floor
Storage
LAV
Stairs to 1st Floor
Basement
Side C
Storage
LAV
Stairs to 1st Floor
Side A
Storage
LAV
Stairs to 1st Floor
Storage
LAV
Stairs to 1st Floor
Side B

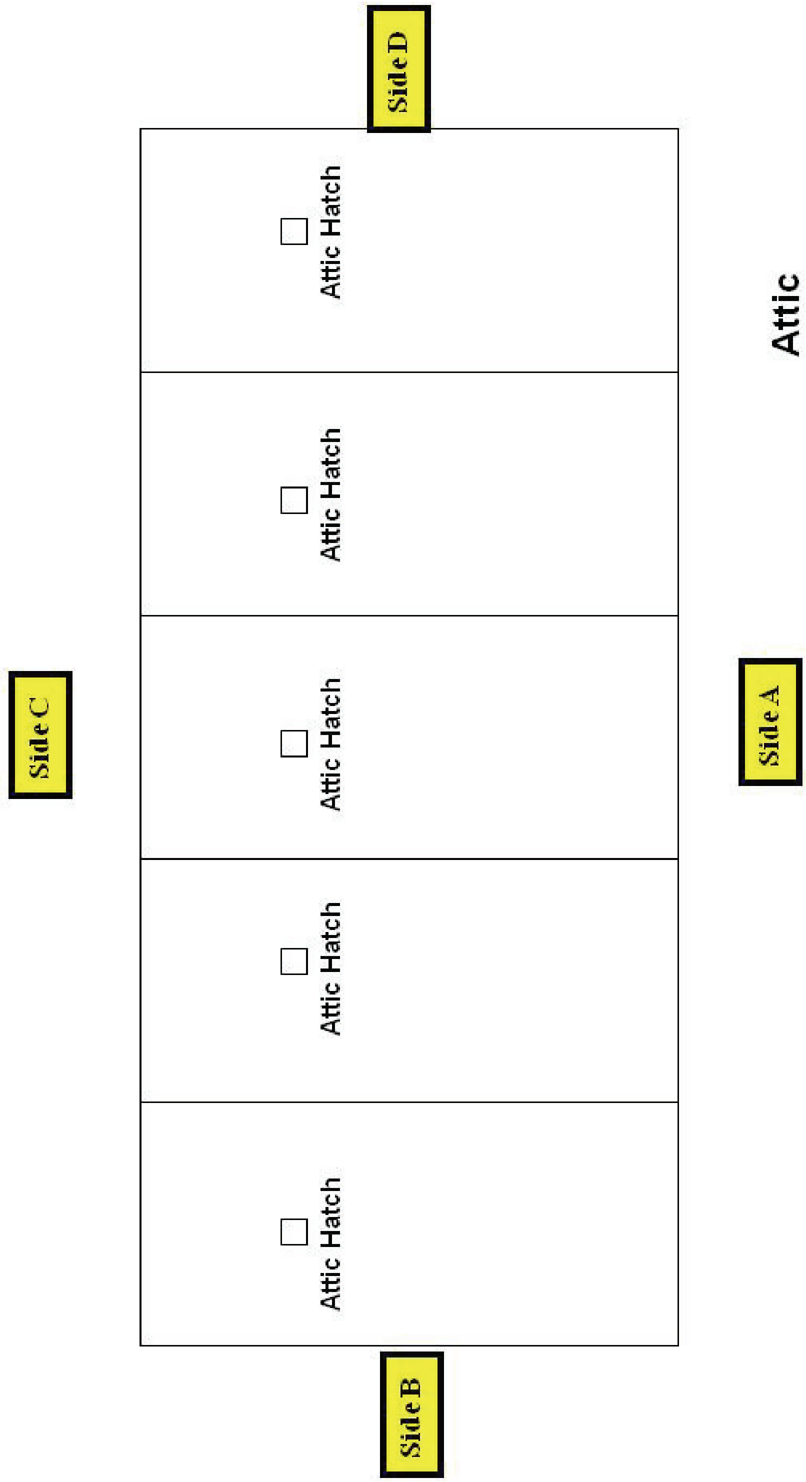

Side D
Attic Hatch
Attic Hatch
Attic Hatch
Attic Hatch
Attic Hatch
Attic
Side C
Side A
Side B

Iteration 4--Message 6

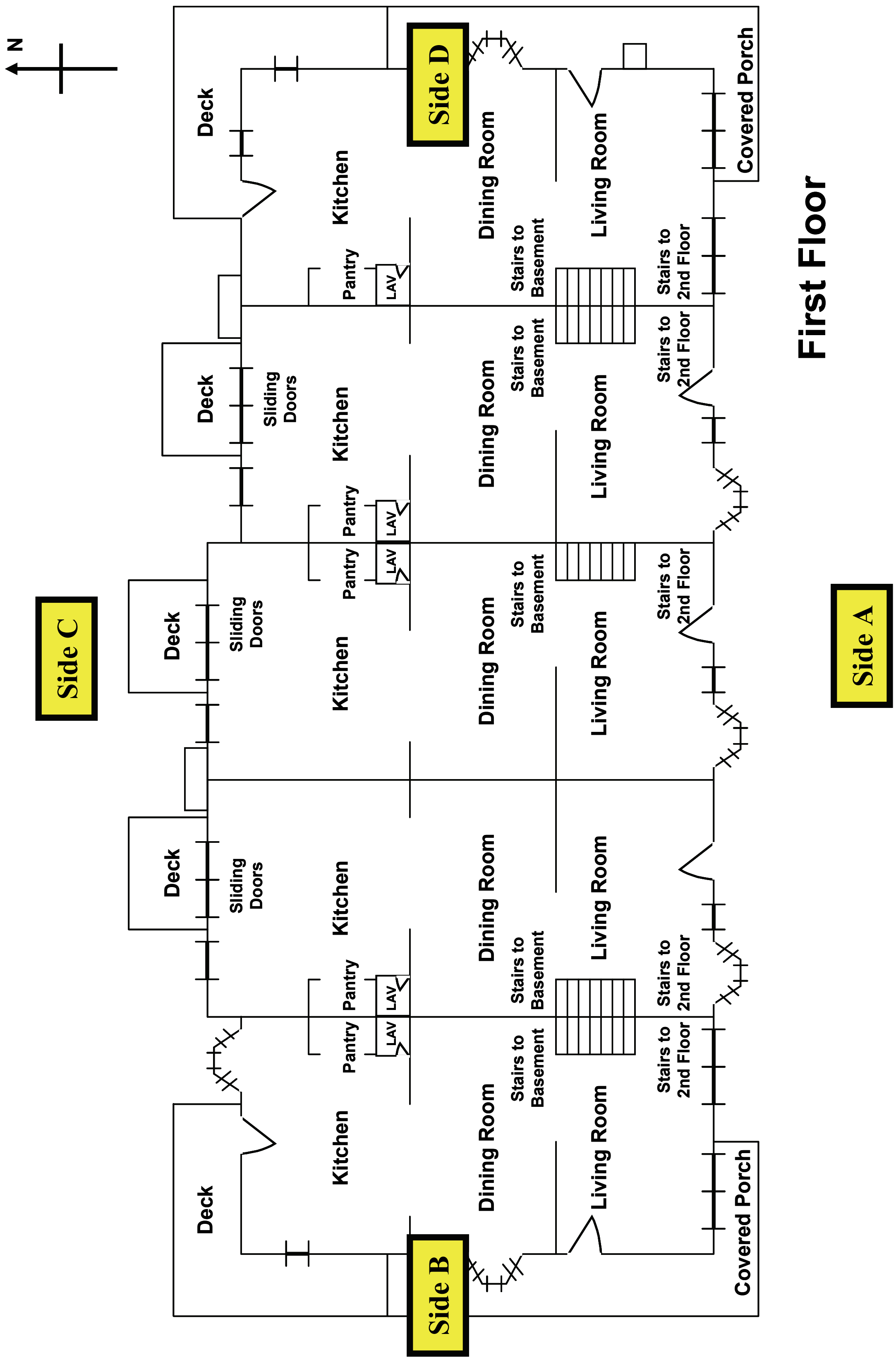


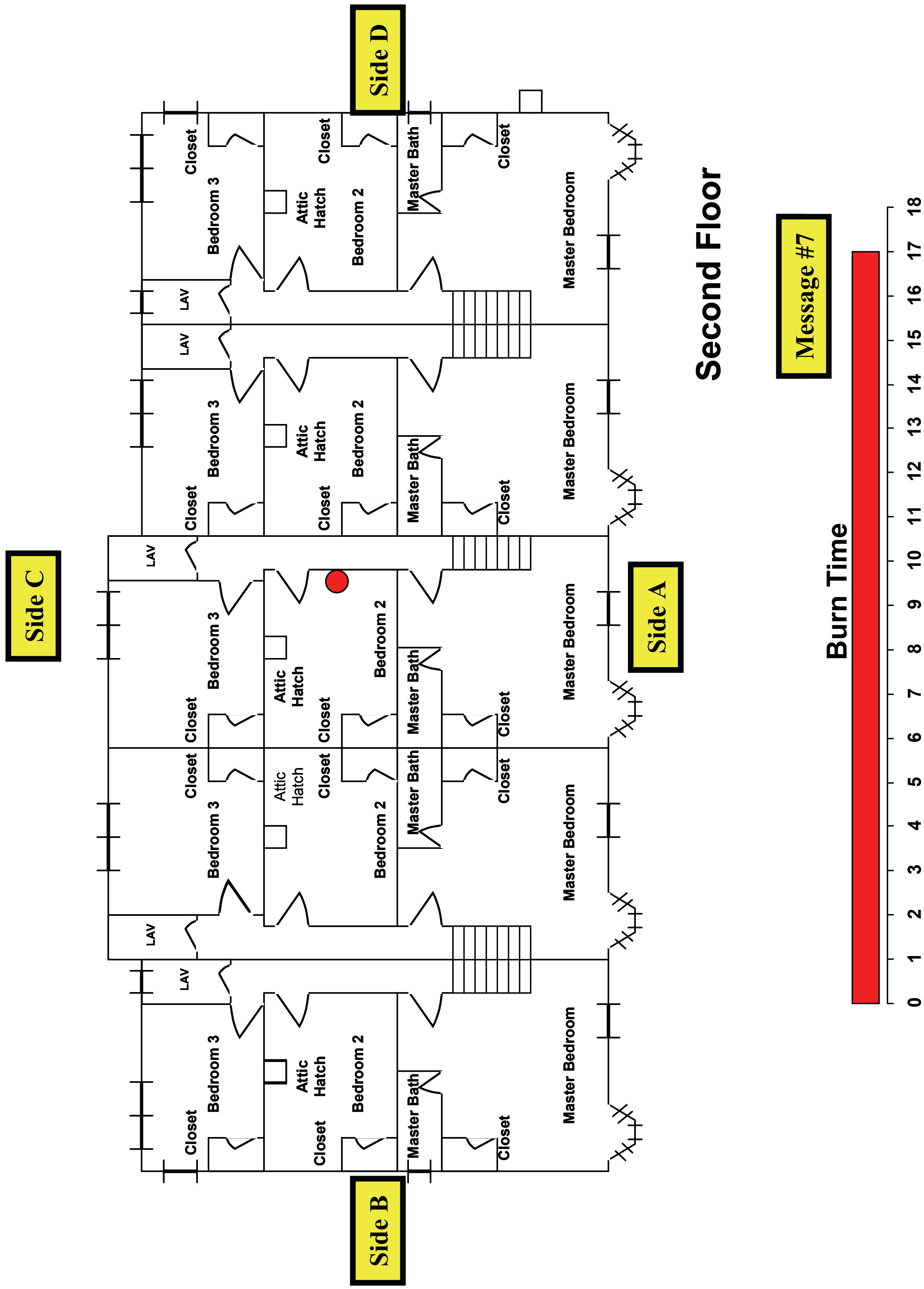

Side C
Side D
Side B
Side A
Second Floor
Message #6
Burn Time
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
Closet
Bedroom 3
Attic
Hatch
Bedroom 2
Master Bath
Master Bedroom
LAV

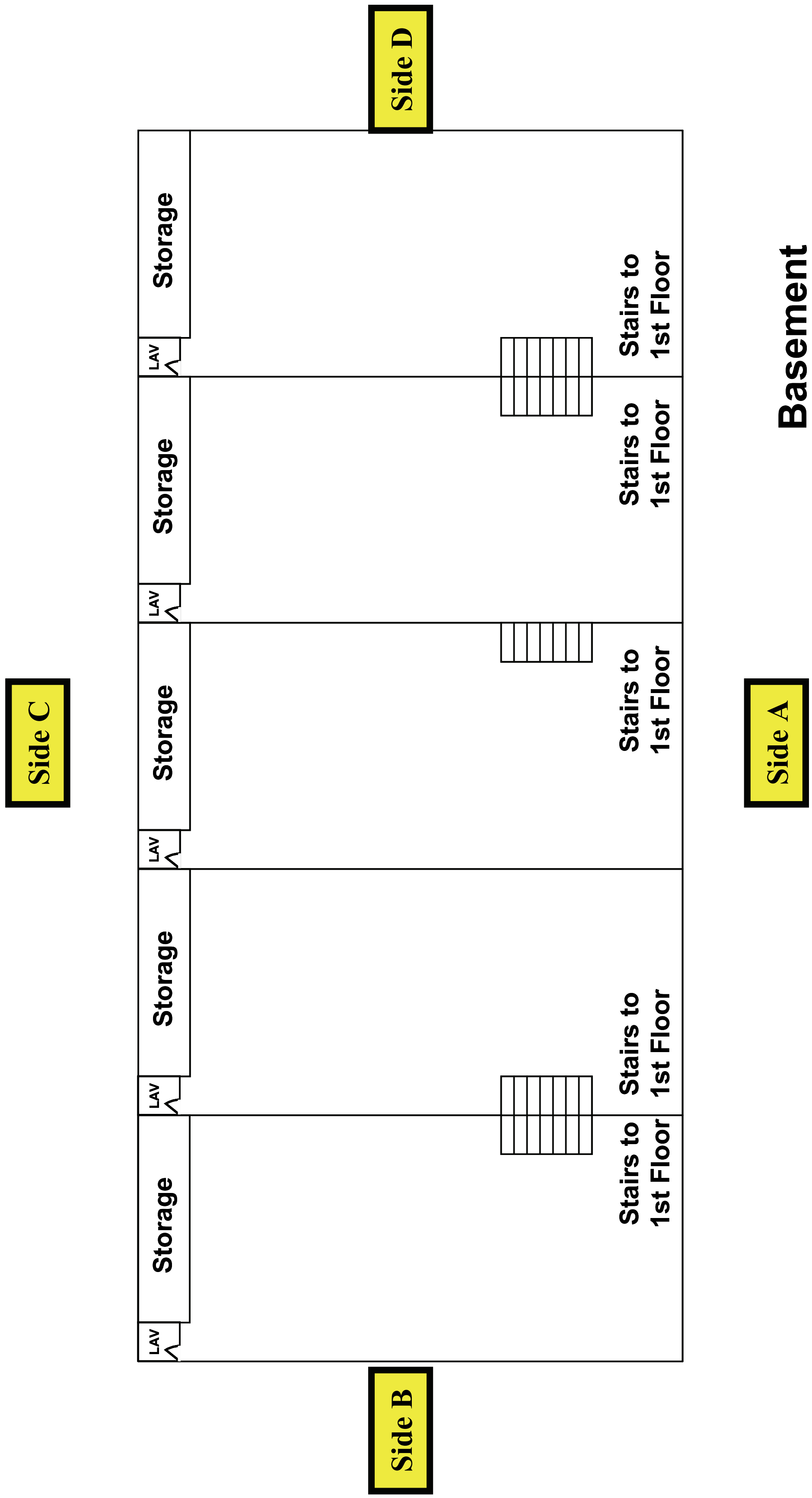

Side D
Side C
Side A
Side B
Storage
LAV
Storage
LAV
Storage
LAV
Storage
LAV
Storage
LAV
Stairs to 1st Floor
Stairs to 1st Floor
Stairs to 1st Floor
Stairs to 1st Floor
Stairs to 1st Floor
Basement

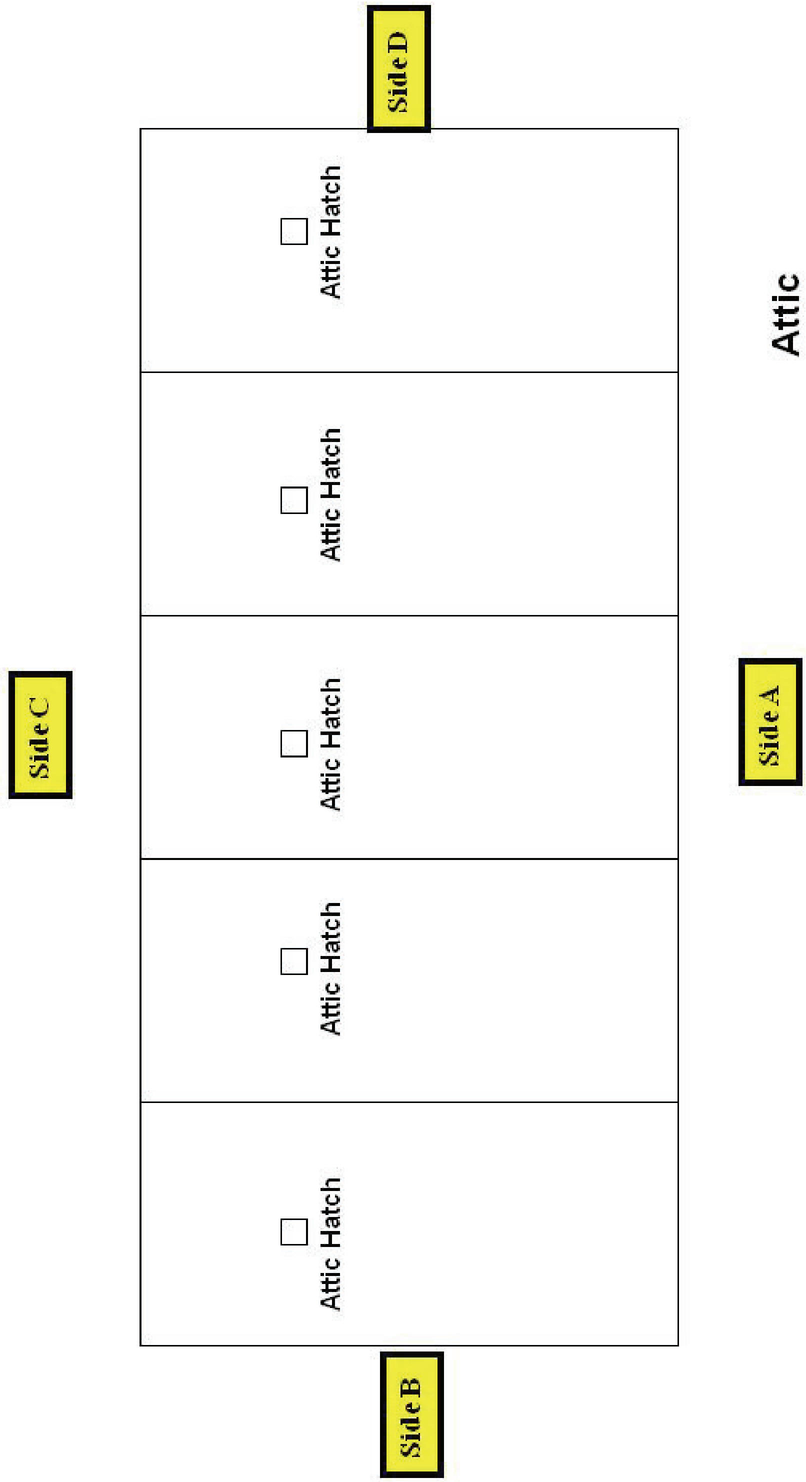

Side D
Attic Hatch
Attic Hatch
Attic Hatch
Attic Hatch
Attic Hatch
Attic
Side C
Side A
Side B

Iteration 4--Message 7

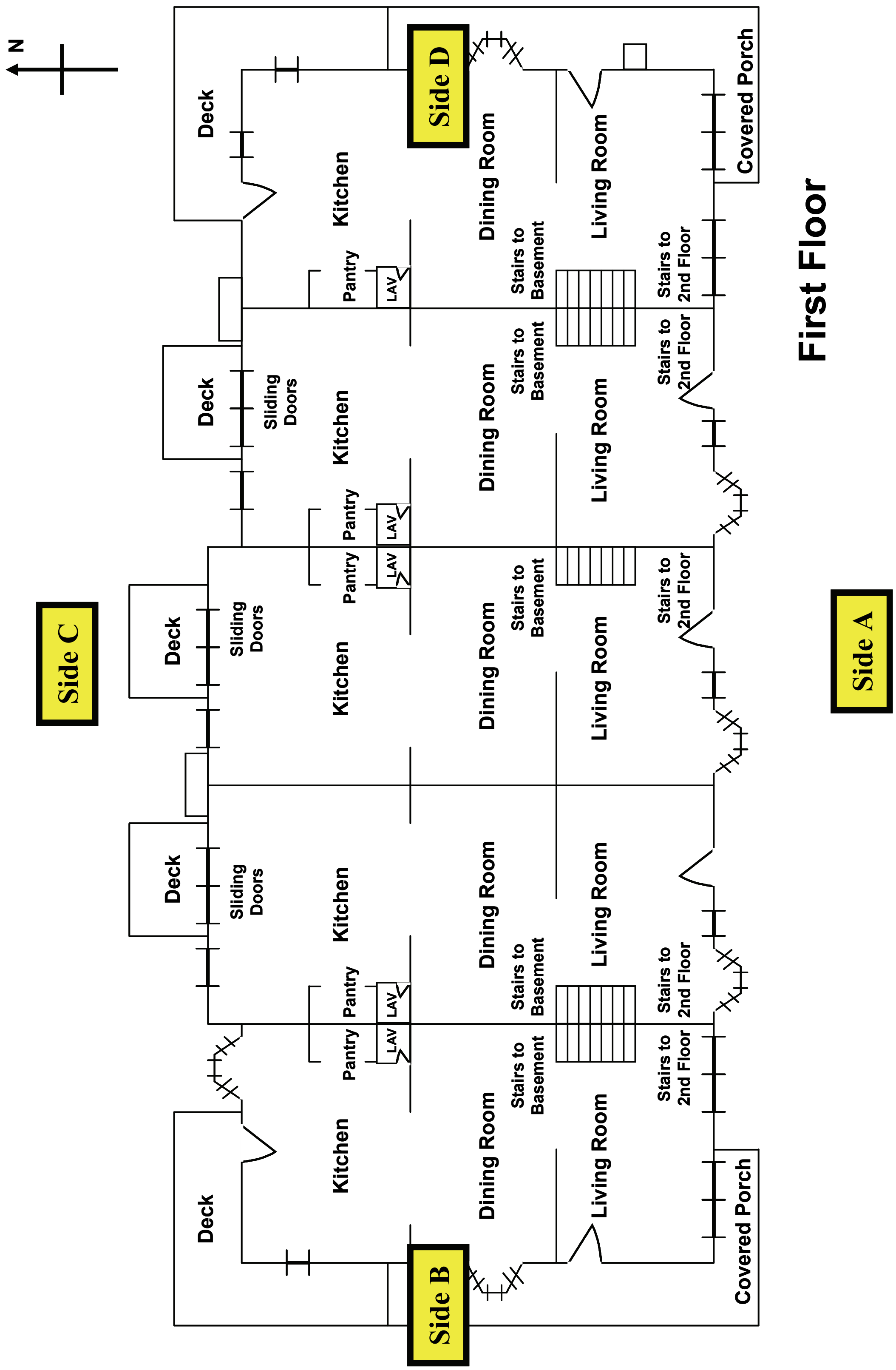


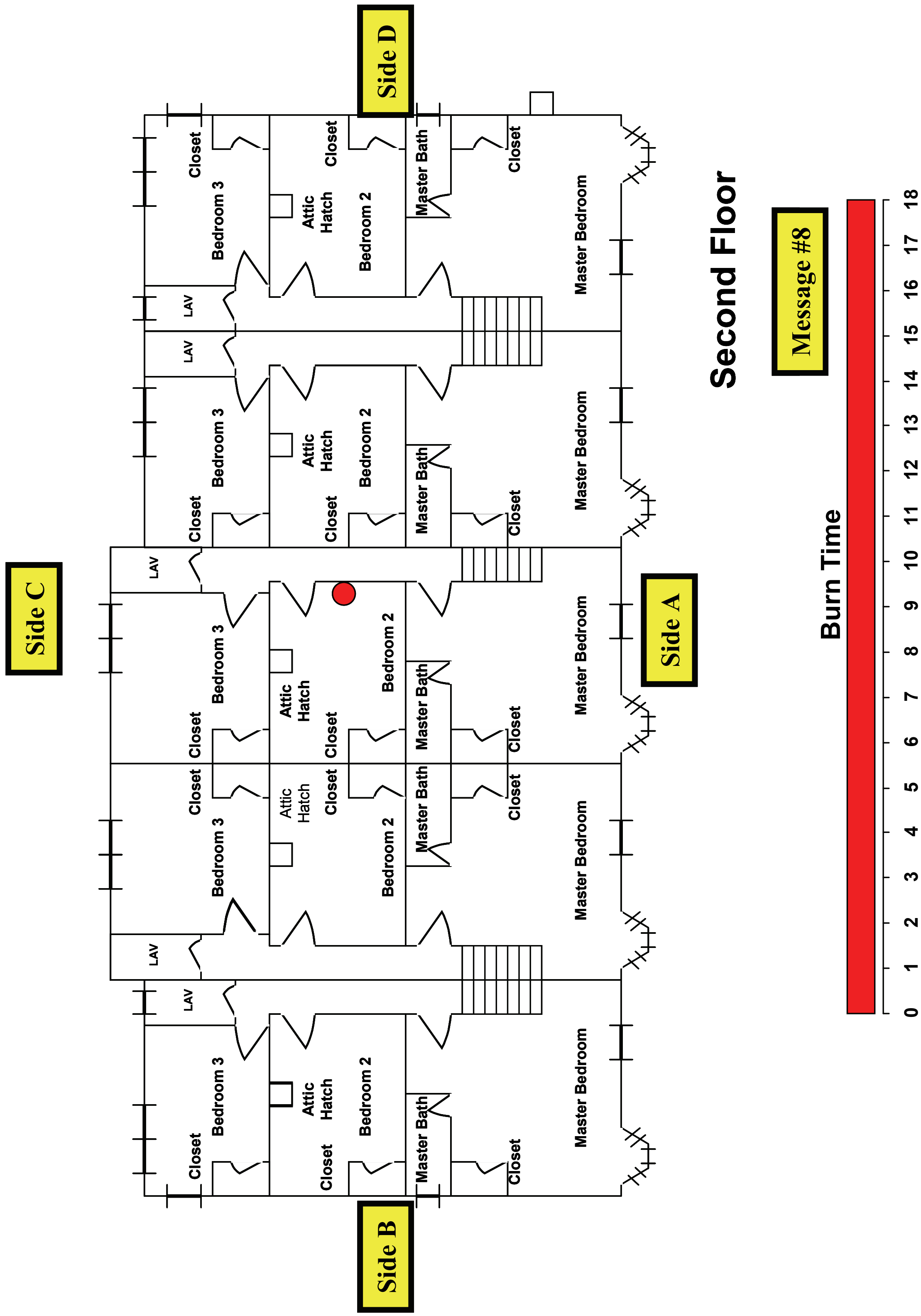

Side D
Side C
Side A
Side B
Second Floor
Message #7
Burn Time
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
Closet
Bedroom 3
Attic Hatch
Bedroom 2
Master Bath
Master Bedroom
LAV

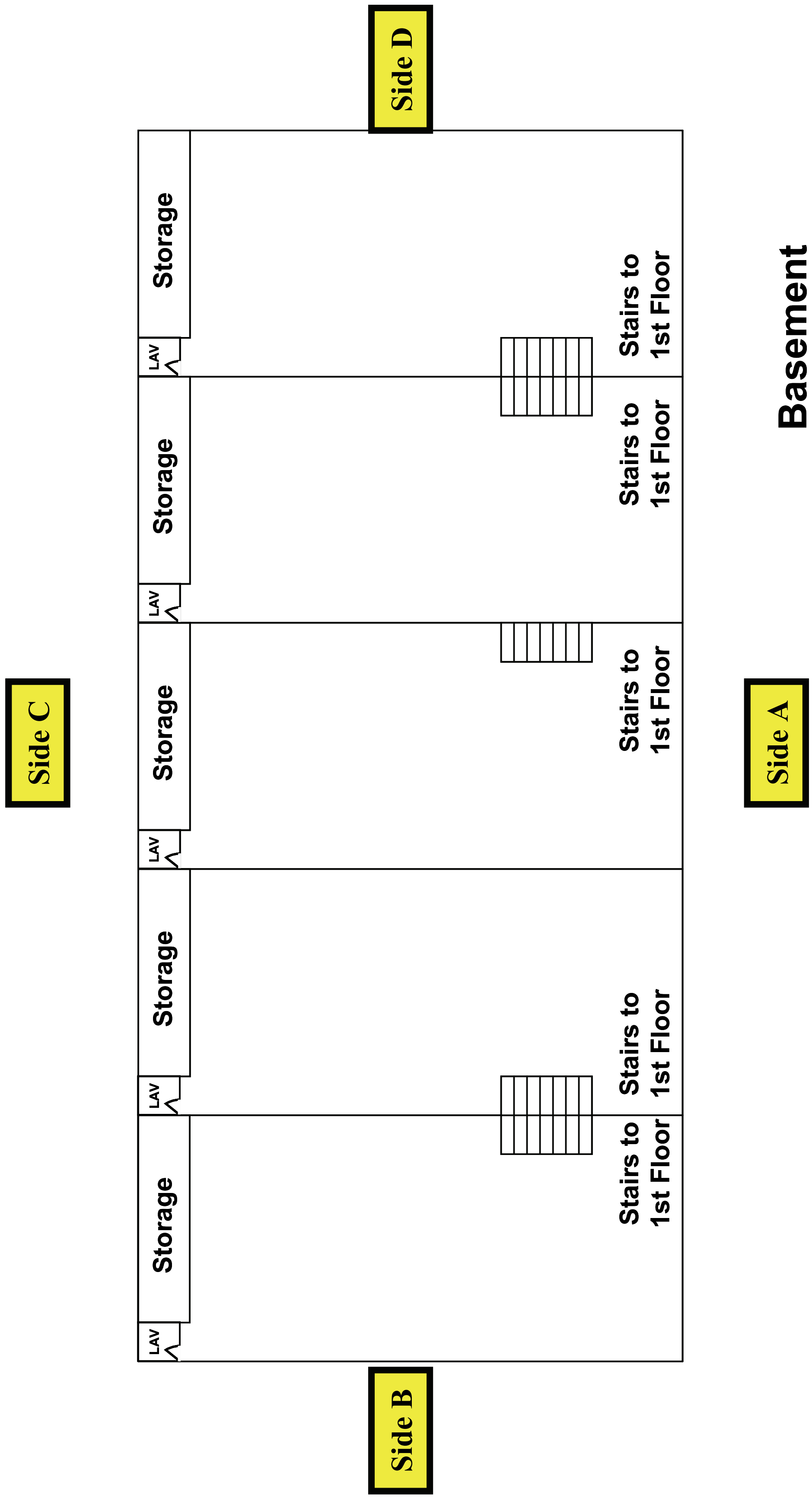

Side D
Storage
LAV
Stairs to 1st Floor
Storage
LAV
Stairs to 1st Floor
Basement
Side C
Storage
LAV
Stairs to 1st Floor
Side A
Storage
LAV
Stairs to 1st Floor
Storage
LAV
Stairs to 1st Floor
Side B

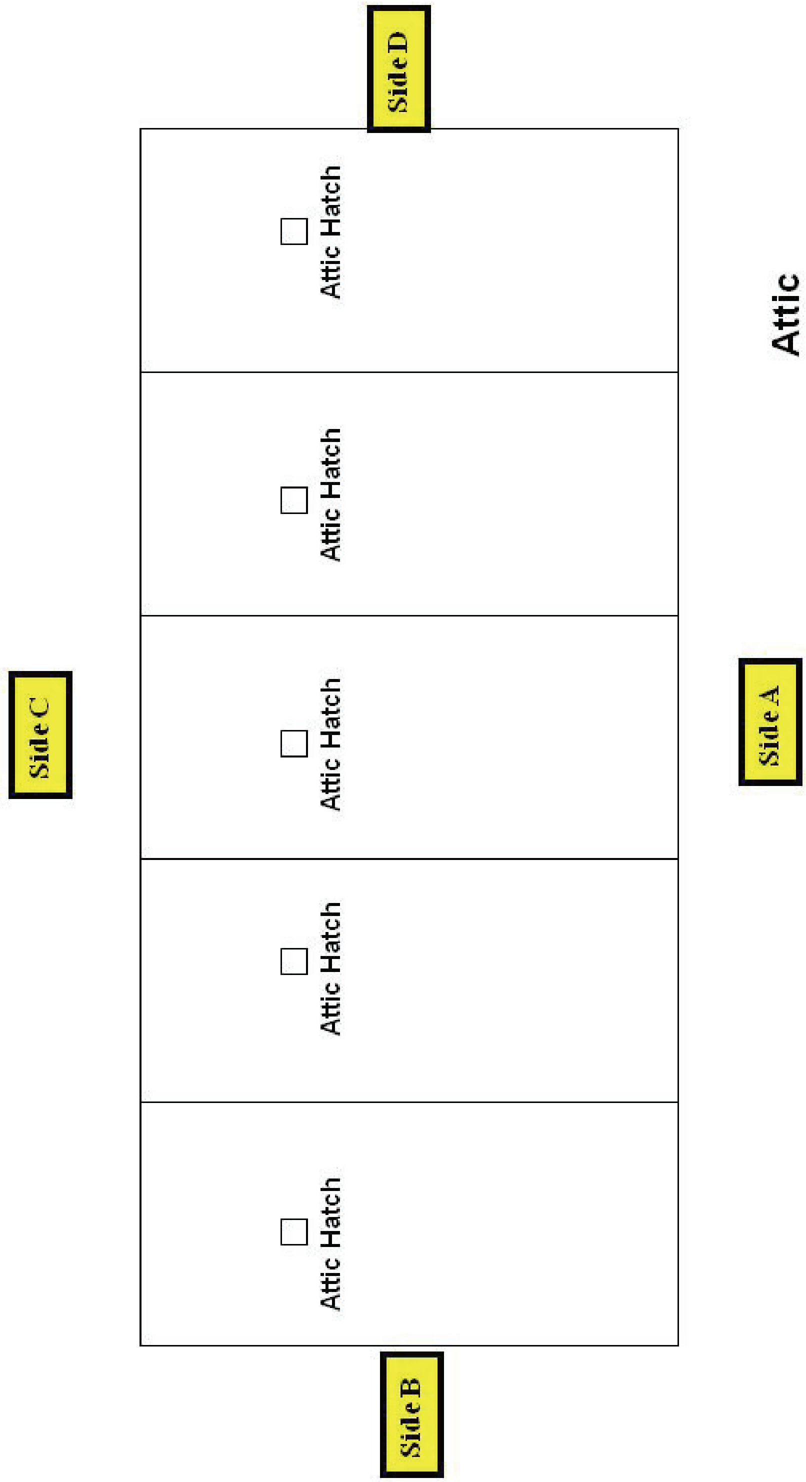

Attic
Side D
Attic Hatch
Attic Hatch
Attic Hatch
Attic Hatch
Attic Hatch
Side C
Side A
Side B

Iteration 4--Message 8




Side D
Side C
Side A
Side B
Closet
Bedroom 3
Attic Hatch
Bedroom 2
Master Bath
Master Bedroom
LAV
Second Floor
Message #8
Burn Time
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18


Side D
Side C
Side A
Side B
Storage
Storage
Storage
Storage
Storage
LAV
LAV
LAV
LAV
LAV
Stairs to 1st Floor
Stairs to 1st Floor
Stairs to 1st Floor
Stairs to 1st Floor
Stairs to 1st Floor
Basement


Attic
Side D
Side C
Side A
Side B
Attic Hatch
Attic Hatch
Attic Hatch
Attic Hatch
Attic Hatch

Activity 7.1 (cont'd)

Large Group Exercise #2: Office Complex

Purpose

To allow you to demonstrate your knowledge, skills, and abilities (KSAs) you have gained as a result ot attending this course. Conduct a walk-around of exposures A-B-C-D of the structures that will be seen in the exercise.

There can be up to seven structures used in the activity.

Directions

1. You will be working in small groups.

2. Each group will do each construction type. Exercise is designed to place the **ICO** as the Incident Commander (IC) until relieved by the next level of authority arriving at the incident. (This will be your instructor.)

3. For this simulation the **ICO** will have additional students assigned to Command and General Staff positions, which under normal field conditions would be the sole responsibility of the ICO.

4. Student group assignments for each group:

    a. ICO.

    b. ICOA--scribe.

    c. IISO.

    d. Initial Planning Section--Situation Unit.

    e. Initial Logistics Section--service and support.

5. Your group will record your predictions on an easel pad or paper.

6. Your group will select a spokesperson to explain to the class how fire would travel in this building.

7. Throughout the activity you will receive messages from the instructor.

8. In this portion of exercise your group is to concentrate on Column 1 Primary Factors Chart. You will have 10 minutes to complete this portion of the activity.

9. The ICOA-scribe shall develop a Primary Factors Exercise Chart on an easel pad for his/her assigned exercise scenario.

   a. Identify the most pertinent primary factors for each exercise scenario.

   b. Place findings on Column 1 of the Primary Factors Exercise Chart.

   c. Identify the most pertinent subfactors for each identified primary factor for exercise scenario. Place findings on Column 2 of the Primary Factors Exercise Chart.

   d. Identify pertinent precautions that will be taken to address each identified sub-factor for exercise scenario. Place findings on Column 3 of the Primary Factors Exercise Chart.

Activity 7.1 (cont'd)

Primary Factors Chart

Column #1 — Primary Factor - Situation Awareness- Chart

Primary Factors	(Check appropriate boxes) Pertinent Sub-Factors (P)	P
Life Hazard	Occupants	
	Firefighters	
Location/Fire	Fire Building on Arrival– Burn Time	
	Exposures On Arrival - Burn Time	
	Fire Spread Considerations Radiation/Conduction/Convection	
Construction	Fire Building – Type 1-2-3-4-5 (Lightweight Awareness)	
	Exposures – Type 1-2-3-4-5 (Lightweight Awareness)	
Occupancy (Contents)	Fire Building – (Fuel Load)	
	Exposures (Fuel Load)	
Height	Fire Building (Front-Rear)	
	Exposures (Front-Rear)	
Area	Fire Building/Configuration	
	Proximity of Exposures /Configuration	
Structural Collapse	Fire Building – Burn Clock After Arrival	
	Exposures – Burn Clock After Arrival	
	Collapse Zone – Safe Corridors	
	Apparatus Placement	
Weather	Visibility	
	Temperature/Humidity	
	Wind – Direction/Velocity	
Resource Requirement	Apparatus/Personnel/Equipment - RIT	
	Water Supply/Suppression Agent	
Auxiliary Appliances	Fire Building Supplied	
	Exposures Supplied	
Topography	Front-Rear	
Explosions/ Back Draft	Proper Ventilation Flash-Over Time Awareness	
Time	Time of Day Time of Year Duration of Incident	

Column #2 — Incident Objectives Attainable/ Measurable/ Flexible

Examples of Incident Objectives:

- Safe Removal of All Occupants within 10 minutes.
- Contain and Control Fire to Room/Building of Origin within 10 minutes
- Contain, Control and Limit Fire in Exposures within 10 minutes
- Other.

List Incident Objectives:

1. ______________________________
____
2. ______________________________
____
3. ______________________________
____
4. ______________________________
____
5. ______________________________
____

Column #3 — Activities (Strategies)

Activities (Strategies)	Column #4: Effective	Ineffective
[R] Rescue • Interior/Exterior/Both		
[E] Exposure Protection • Exposure Examination		
[C/E] Confinement/Extinguishment • Hose Line Placement		
[O] Overhaul • Expose Hidden Fire		
[V] Ventilation • Removal of Occupants • Fire Control		
[S] Salvage • Water – Run-Off • Apply Covers		
Forcible Entry • Location • Method		
Special Equipment • Imaging Cameras		

Column #4 — Evaluate Effect of Activities (Strategies) Every 10 Minutes (Effective / Ineffective)

List Incident Strategies	Assign Tactics:
For Objective # 1:	
For Objective # 2:	:
For Objective # 3:	
For Objective # 4:	
For Objective # 5:	
____________________	

Identify alternative strategies for firefighter safety when occupant safety has been determined not to be a Primary Factor.

- ______________________
- ______________________
- ______________________
- ______________________
- ______________________
- ______________________
- ______________________

Activity 7.1 (cont'd)

Primary Factors Exercise Chart

Pertinent Primary Factor	Pertinent Subfactor	Pertinent Precautions To Be Taken
1.	1. 2.	1. 2.
2.	1. 2. 3.	1. 2. 3.
3.	1. 2.	1. 2.
4.	1. 2.	1. 2.
5.	1. 2.	1. 2.
6.	1. 2.	1. 2.
7.	1. 2. 3. 4.	1. 2. 3. 4.
8.	1. 2. 3.	1. 2. 3.
9.	1. 2.	1. 2.
10.	1. 2.	1. 2.
11.	1.	1.
12.	1. 2.	1. 2.
13.	1. 2.	1. 2.

LARGE EXERCISE #2
Vital Building Information
Situation Report

COMMERCIAL--TYPE V--BALLOON FRAME

Structure:	Office complex, 50 by 120 feet 12 one-story offices 20 by 25 feet various office tenants Special care occupancies
Building Construction:	Type V--frame
Roof Construction:	2- by 6-inch truss roof support system Common attic storage
Floors:	Concrete slab
Alarm System:	Smoke detectors installed
Occupants:	Tenant occupancy varies 4 to 8 employees per occupancy
Special Concerns:	Units 3 and 4--methadone clinic Units 11 and 12--daycare center

Situation Report:

Fire Building:

It is March 5, 1030 hours, temperature is 27 °F (-3 °C), wind from east at 8 miles per hour (mph).

Upon arrival, several people are outside the office complex on Sides A and C. Occupants from Offices 3 and 4 report that they are not sure everyone is accounted for. The daycare center is evacuating children from Offices 11 and 12. All offices are reported occupied.

Exposures:

Each occupancy has attic storage. Attic access is located in near the rear of office.

Activity 7.1 (cont'd)

Objectives-Strategy-Tactics Chart

1. Use the enlarged Objectives-Strategy-Tactics Chart or easel pad.

2. Refer back the Primary Factors Exercise materials in Unit 4: The Analytical Sizeup Process if necessary.

3. Place Slide Iteration #2 for Sides A-B-C-D for each scenario chosen.

4. Receive and act on Exercise Message #2 and Plot Plan #2.

5. Concentrate on Columns 2 and 3 and develop the Objectives-Strategy-Tactics for the scenario.

6. ICOA scribe shall develop an easel pad for Objectives-Strategy-Tactics for assigned exercise scenario. (You have 20 minutes to complete.)

    a. Column 1: Identify the first operational period objectives for the scenario.

    b. Column 2: Identify the first operational period strategies for each objective.

    c. Column 3: Identify the first operational period tactics for each strategy.

    d. Column 4: Assign companies to perform tactics.

Each scenario has first alarm structural resources available at start of exercise:

- Engine 1
- Engine 2
- Engine 3
- Ladder 1
- Basic Life Support (BLS) 1

Each scenario will have working incident structural resources arrive 10 minutes into incident.

- **Engine 5**
- Engine 6
- **Squad 1**
- Engine 6 (Rapid Intervention Crew (RIC))
- Air Cascade-1 FF
- Safety Officer

Central City Fire EMS Dispatch Criteria

Assignment	Alarm Type	Engine	Ladder	Squad	Battalion Chief	EMS Unit	RIC	Safety Officer	Air Cascade
First Alarm	Structural	3	1			1 BLS			
Working Incident	Structural	2		1	1		1	1	1
First Alarm	Target Hazard	3	2	1	1	1 BLS			
Working Incident	Target Hazard	2				1 ALS	1	1	1
Second Alarm	Structural/ Target Hazard	2	1		1	1EMS		1	1
Third Alarm	Structural/ Target Hazard	2	1			1 MS			
Fourth Alarm	Structural/ Target Hazard	2	1		1				

Central City Fire/EMS Staffing:

- **Engine-Ladder-Squad Company--1 Officer--3 Firefighters**
- **Rapid Intervention Crew (RIC)--One Engine Company**
- **EMS BLS Unit--2 EMT Basic**
- **EMS ALS Unit--2 EMT Paramedic**
- **Air Cascade - 1 Firefighter**

A second alarm may be requested but will not arrive on scene before end of exercise.

Activity 7.1 (cont'd)

Objectives-Strategy-Tactics Chart

Objectives	Strategy (s)	Tactics	Assigned to:
Objective #1	**1.**	**1.** **2.** **3.**	**1.** **2.** **3.**
	2.	**1.** **2.** **3.**	**1.** **2.** **3.**
	3.	**1.** **2.** **3.**	**1.** **2.** **3.**
Objective #2	**1.**	**1.** **2.** **3.**	**1.** **2.** **3.**
	2.	**1.** **2.** **3.**	**1.** **2.** **3.**
	3.	**1.** **2.** **3.**	**1.** **2.** **3.**
Objective #3	**1.**	**1.** **2.** **3.**	**1.** **2.** **3.**
	2.	**1.** **2.** **3.**	**1.** **2.** **3.**
	3.	**1.** **2.** **3.**	**1.** **2.** **3.**

Activity 7.1 (cont'd)

ICS Form 201, *Incident Debriefing* and ICS Form 214, *Unit Log*

1. Use the enlarged ICS Form 214, *Unit Log* or easel pad.

2. The ICOA will maintain ICS Form 214 for all tactical decisions made by the ICO along with other pertinent messages and decisions made by the ICO during the exercise. Entries should be recorded under Time and Major Events columns.

3. Distribute ICS Form 214.

    a. IISO.

    b. Initial Planning Section (Situation Unit).

    c. Initial Logistics Section (Service and Support).

4. Distribute ICS Form 201, *Incident Debriefing* (enlarged to 11 by 17).

    a. Initial Planning Section (Situation Unit).

    b. Initial Logistics Section (Service and Support).

5. Begin exercise scenario message distribution.

6. Follow message distribution time frames until all messages have been distributed. (You have 30 minutes.)

Activity 7.1 (cont'd)

Preparing for Exercise Debriefing

You have 15 minutes for each group to prepare their debriefing materials for presentation.

1. ICO.
   a. Primary Factors Chart.
   b. Objectives-Strategy-Tactics Chart.
2. Initial Company Officer Assistant--ICS Form 214.
3. Initial Safety Officer--ICS Form 214.
4. Initial Planning Section.
5. Initial Logistics Section--ICS Form 201.

Activity 7.1 (cont'd)

ICS Form 214, *Unit Log*

UNIT LOG	1. Incident Name	2. Date Prepared	3. Time Prepared
4. Unit Name/Designators	5. Unit Leader (Name and Position)		6. Operational Period

7. Personnel Roster Assigned

Name	ICS Position	Home Base

8. Activity Log

Time	Major Events

9. Prepared by (Name and Position)

Instructions for completing the Unit Log (ICS Form 214)

ITEM NUMBER	ITEM TITLE	INSTRUCTIONS
1.	Incident Name	Print the name assigned to the incident.
2.	Date Prepared	Enter date prepared (month, day, year).
3.	Time Prepared	Enter time prepared (24-hour clock).
4.	Unit Name	Enter the title of the organizational unit or resource designator (Engine 1 - Safety Officer, Situation Unit – Logistics Section).
5.	Unit Leader	Enter the name of the individual in charge of the Unit.
6.	Operational Period	Enter the time span covered by the log (e.g., 1800 Oct. 12 to 0600 Oct. 13).
7.	Personnel Roster	List the name, position, and home base of each member assigned to the unit during the operational period.
8.	Activity Log	Enter the time and briefly describe each significant occurrence or event (e.g., task assignments, task completions, injuries, difficulties encountered, etc.).
9.	Prepared By	Enter the name and title of the person approving the log. Provide log to immediate supervisor at the end of each operational period.

Activity 7.1 (cont'd)

ICS Form 201, *Incident Debriefing*

INCIDENT DEBRIEFING	1. INCIDENT NAME	2. DATE PREPARED	3. TIME PREPARED
4. MAP SKETCH			
ICS 201 (12/93) **NFES1325**	PAGE 1	5. PREPARED BY (NAME AND POSITION)	

6. SUMMARY OF CURRENT ACTIONS		
ICS 201	PAGE 2	

7. CURRENT ORGANIZATION		
ICS 201 (12/93) **NFES1325**	PAGE 3	

8. RESOURCES SUMMARY				
RESOURCES ORDERED	**RESOURCE IDENTIFICATION**	**ETA**	**ON SCENE √**	**LOCATION/ASSIGNMENT**

ICS 201 (12/93) **NFES 1325**	PAGE 4	

Instructions for completing the Incident Briefing (ICS Form 201)

ITEM NUMBER	ITEM TITLE	INSTRUCTIONS
1.	Incident Name	Print the name assigned to the incident.
2.	Date Prepared	Enter date prepared (month, day, year).
3.	Time Prepared	Enter time prepared (24-hour clock).
4.	Map Sketch	Show perimeter and control lines, resources assignments, incident facilities, and other special information on a sketch map or attached to the topographic or orthophoto map.
5.	Resources Summary	Enter the following information about the resources allocated to the incident. Enter the number and type of resource ordered.
	Resources Ordered	Enter the number and type of resource ordered.
	Resource Identification	Enter the agency three-letter designator, S/T, Kind/ Type and resource designator.
	ETA/On Scene	Enter the estimated arrival time and place the arrival time or a checkmark in the "on scene" column upon arrival.
	Location/ Assignment	Enter the assigned location of the resource and/or the actual assignment.
6.	Current Organization	Enter on the organization chart the names of the individuals assigned to each position. Modify the chart as necessary.
7.	Summary of Current Actions	Enter the strategy and tactics used on the incident and note any specific problem areas.
8.	Prepared By	Enter the name and position of the person completing the form.
*Note		Additional pages may be added to ICS Form 201 if needed.

Activity 7.1 (cont'd)

Debriefing Procedures

1. The instructor will debrief exercise scenarios with each group.

2. The instructor will display the slides for your group's scenario when debriefing.

3. Assigned ICO for each group shall present the following:

   a. Primary Factors Chart.

   b. Objectives-Strategy-Tactics Chart.

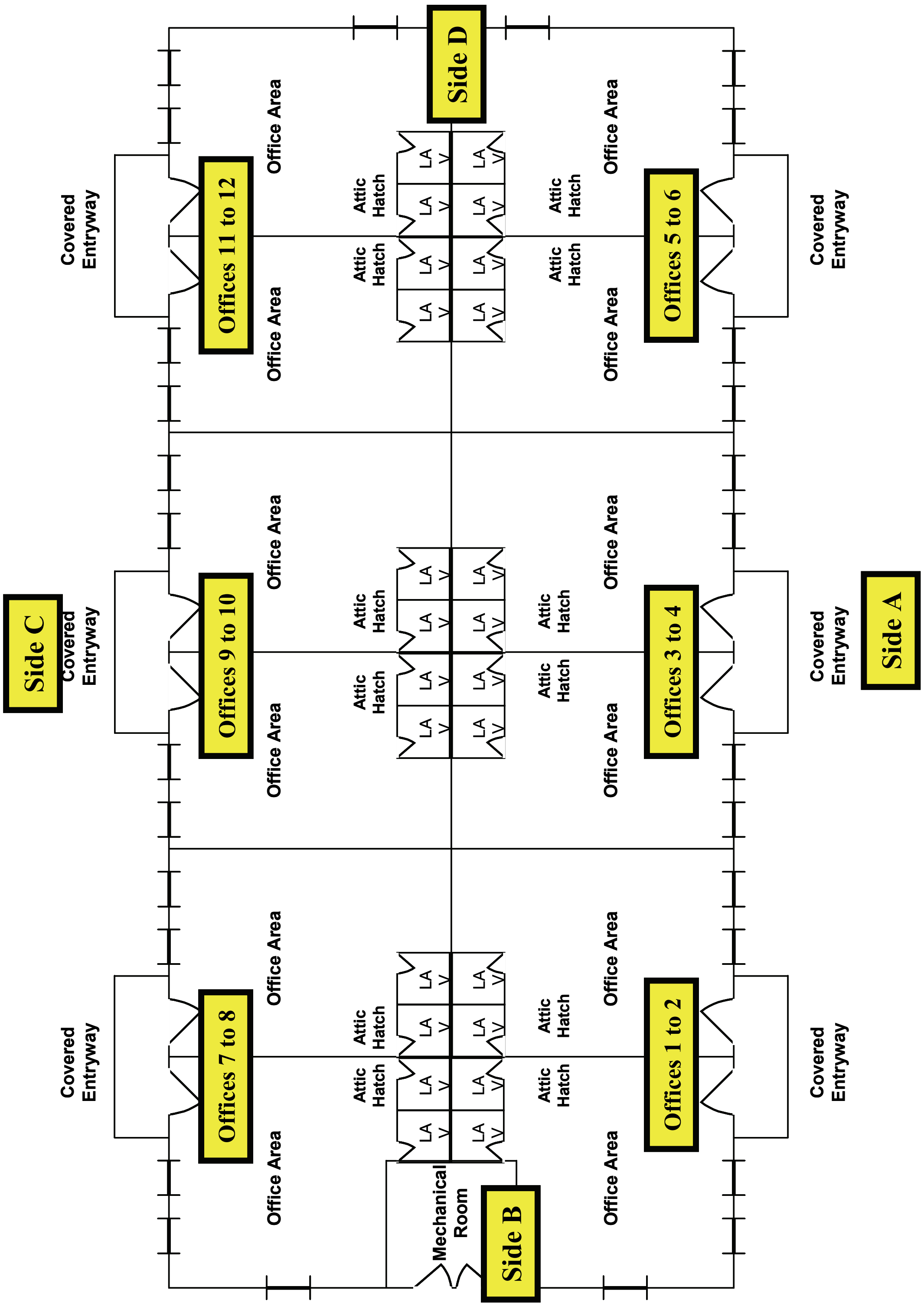
   c. ICS Form 214.

4. Each group will have 15 minutes to debrief.

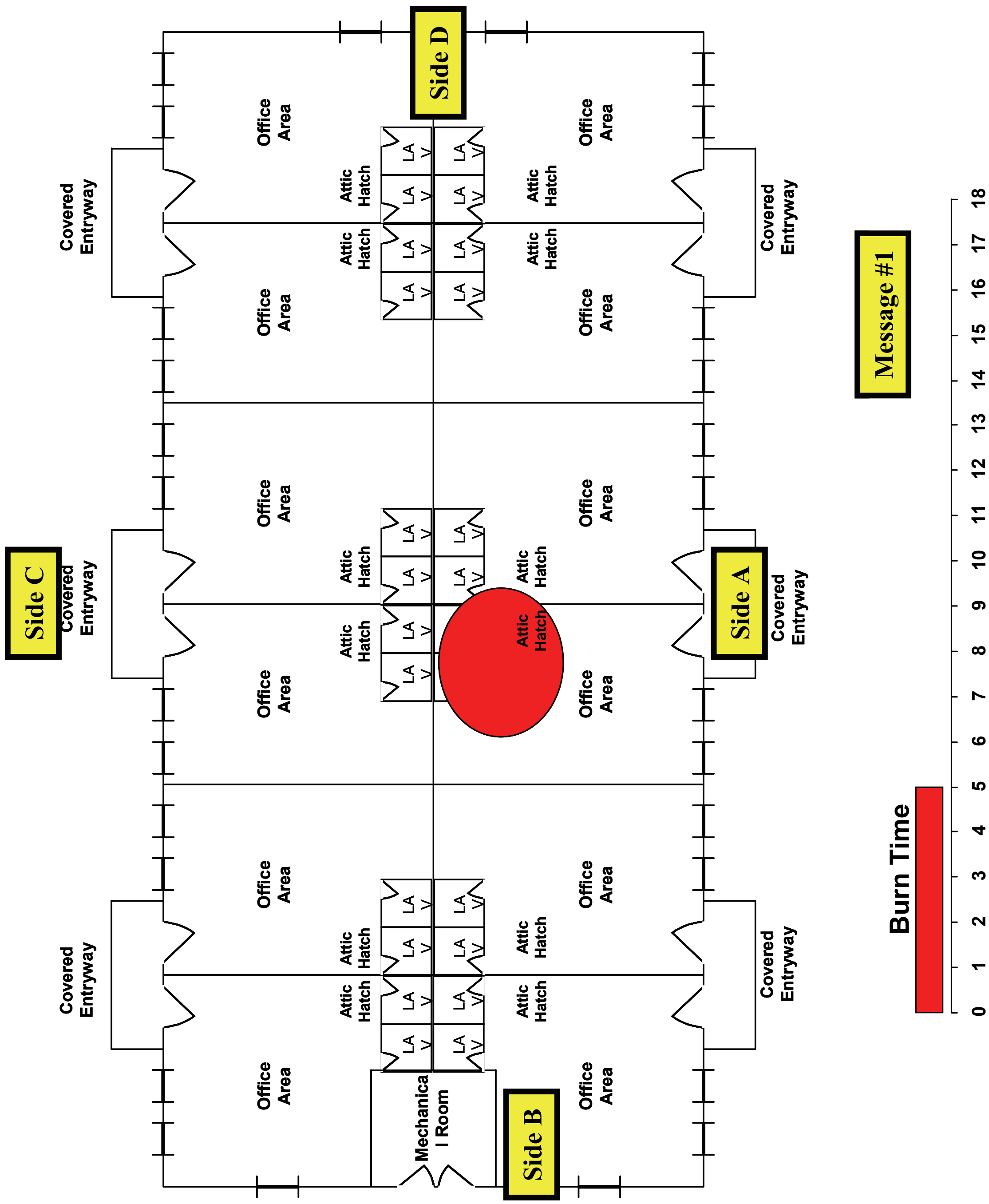
5. The instructor will address any specific issues that were omitted from charts and identify issues where improvement is required.

Activity 7.1 (cont'd)
Plot Plans
Exercise #2

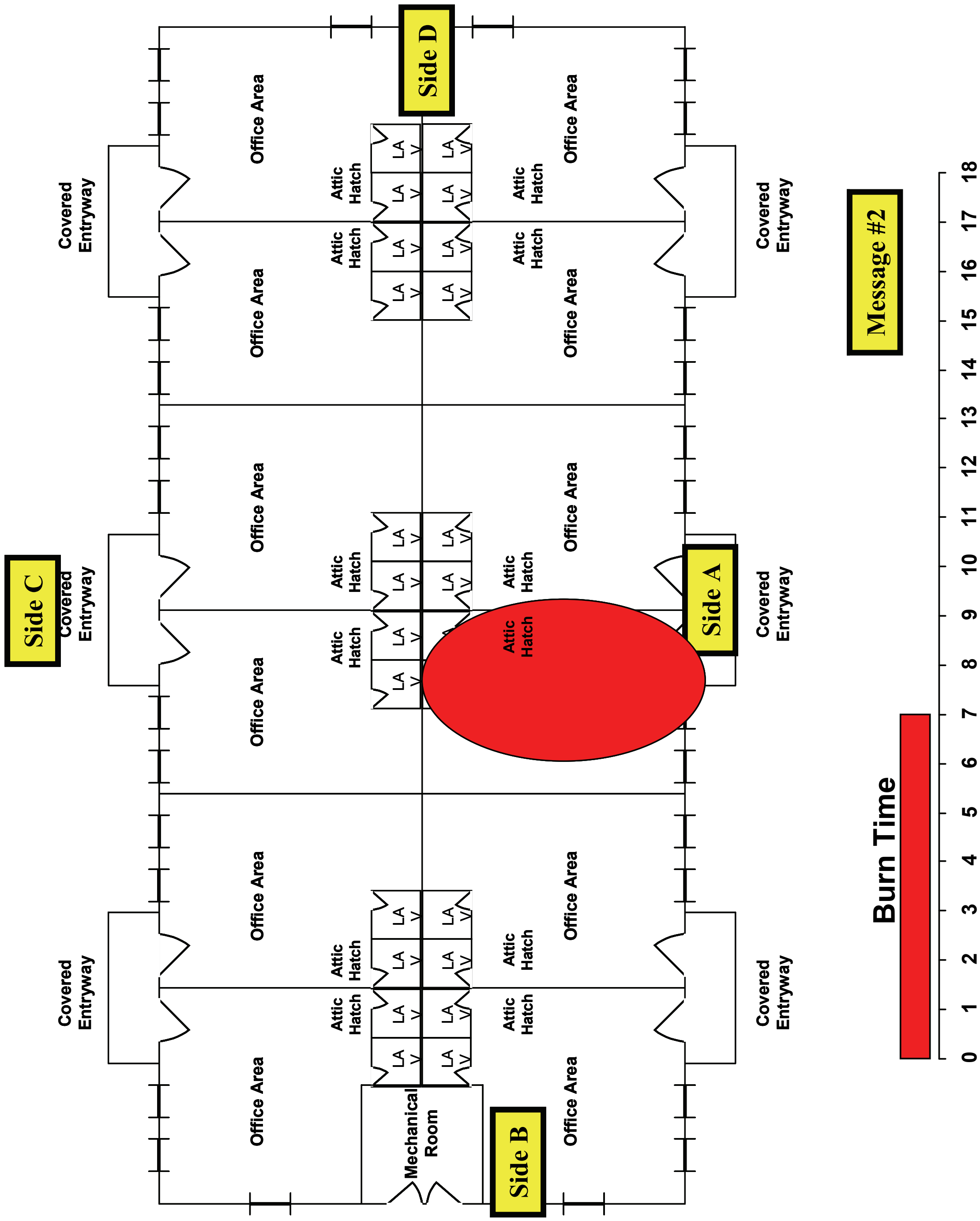
Office Complex--Walkaround



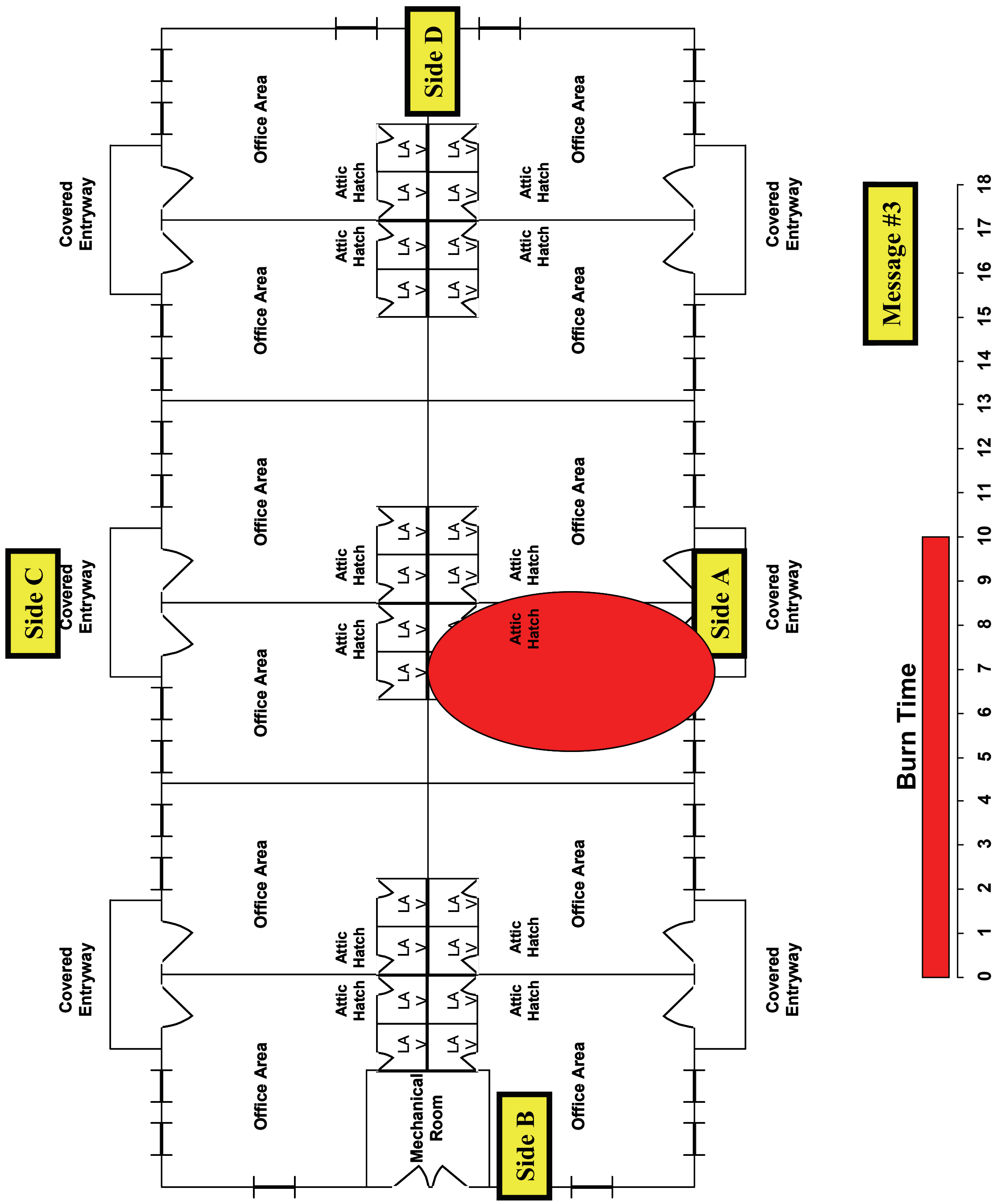
Iteration 1--Message 1



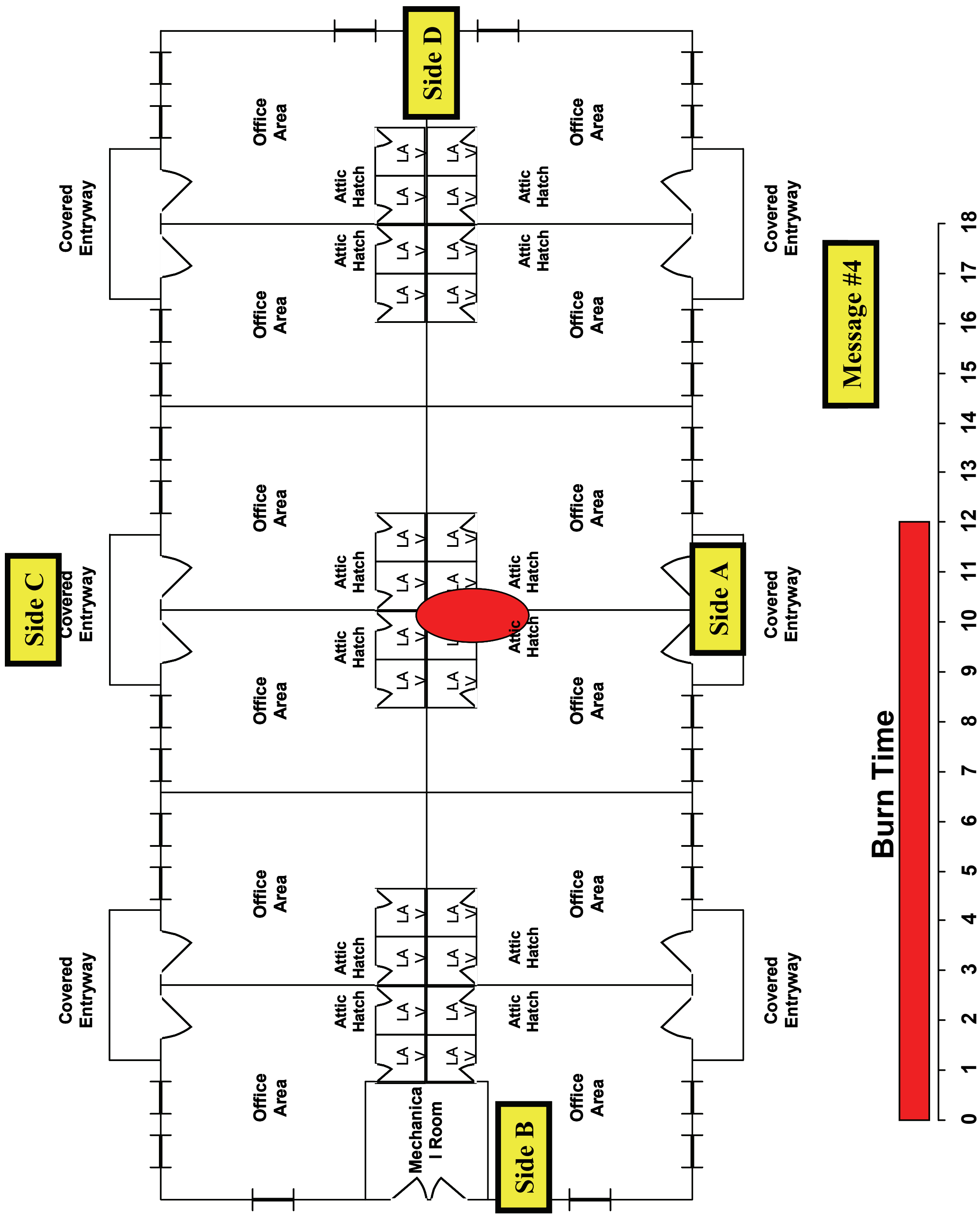
Iteration 2--Message 2



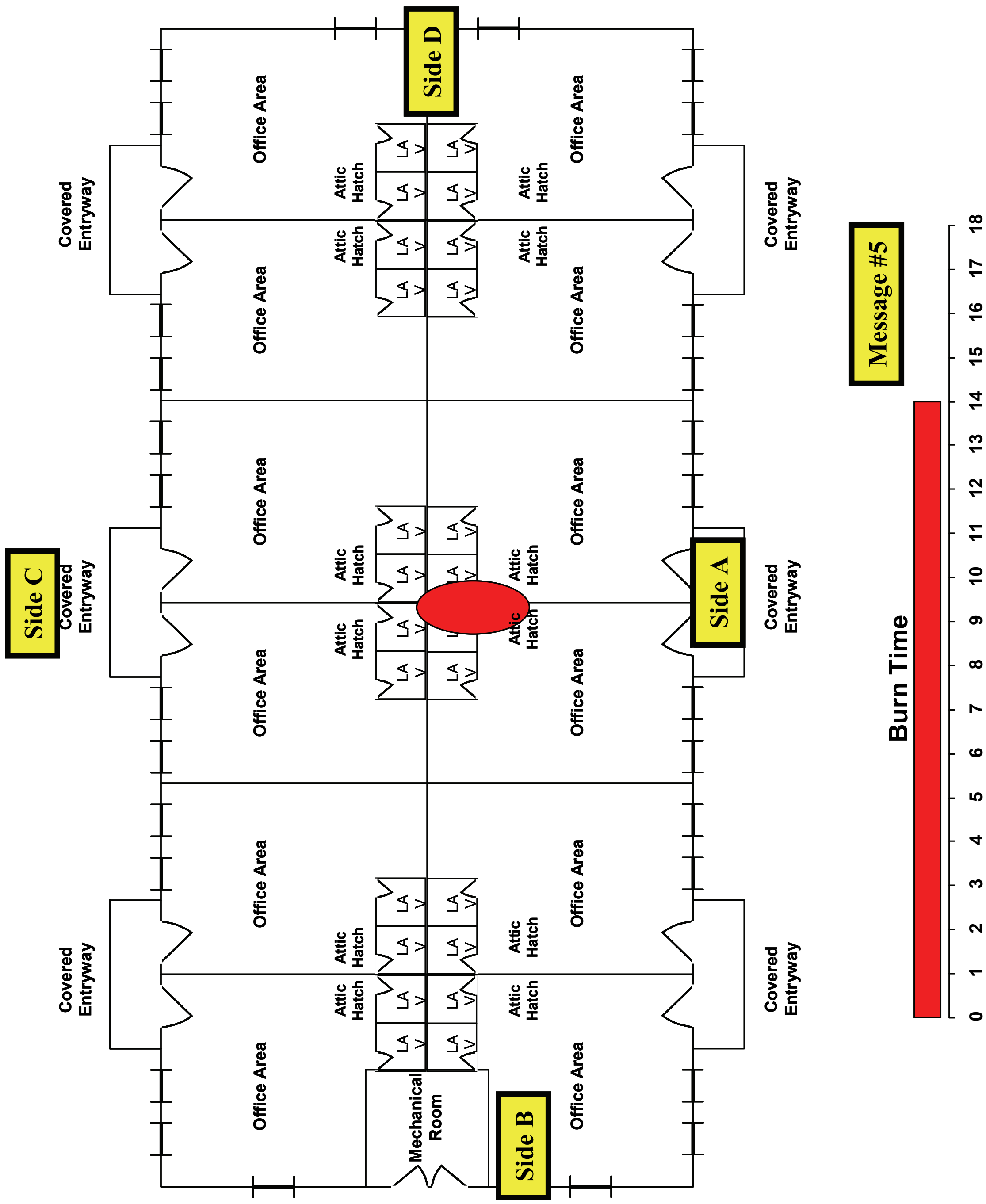
Iteration 2--Message 3



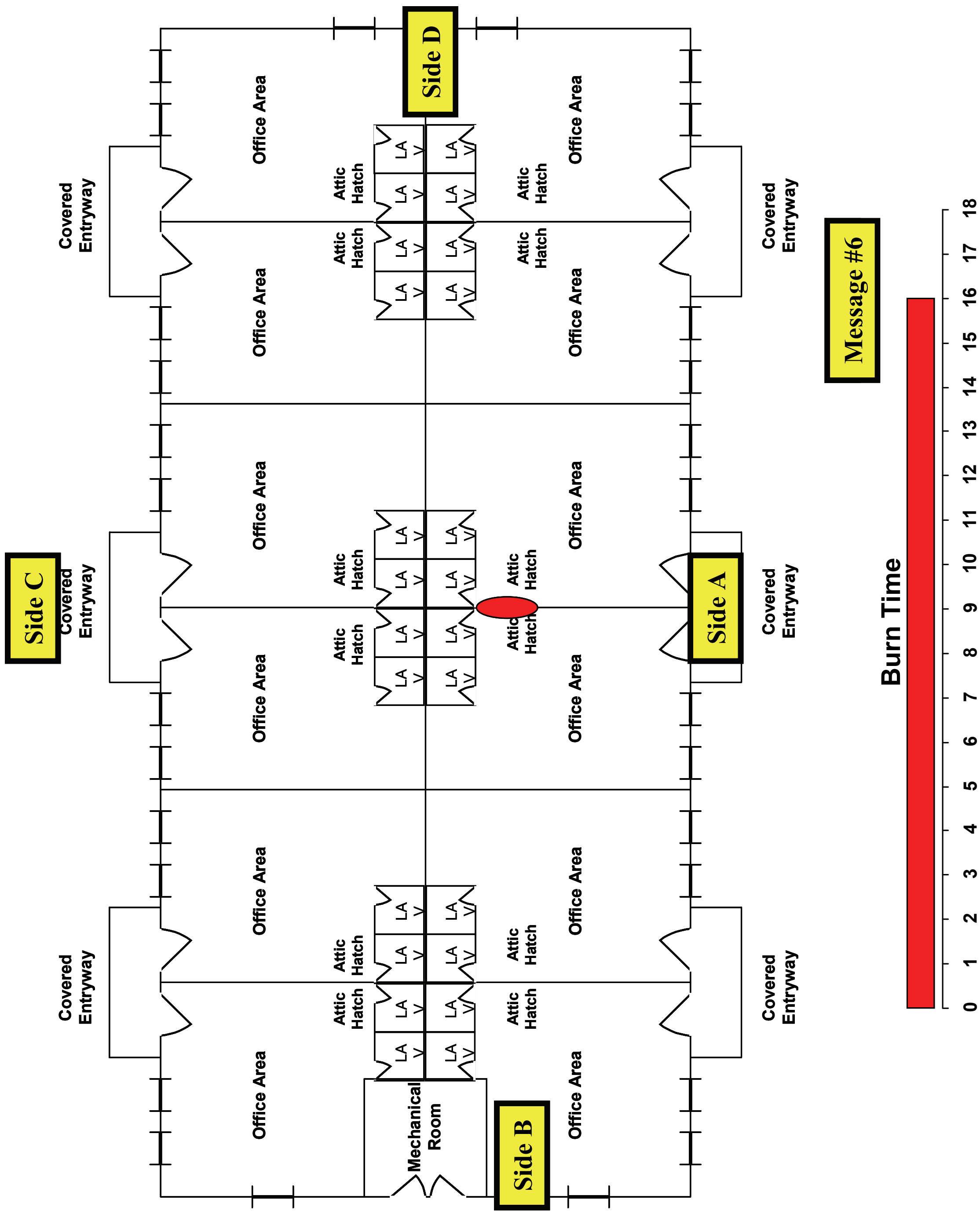
Iteration 3--Message 4



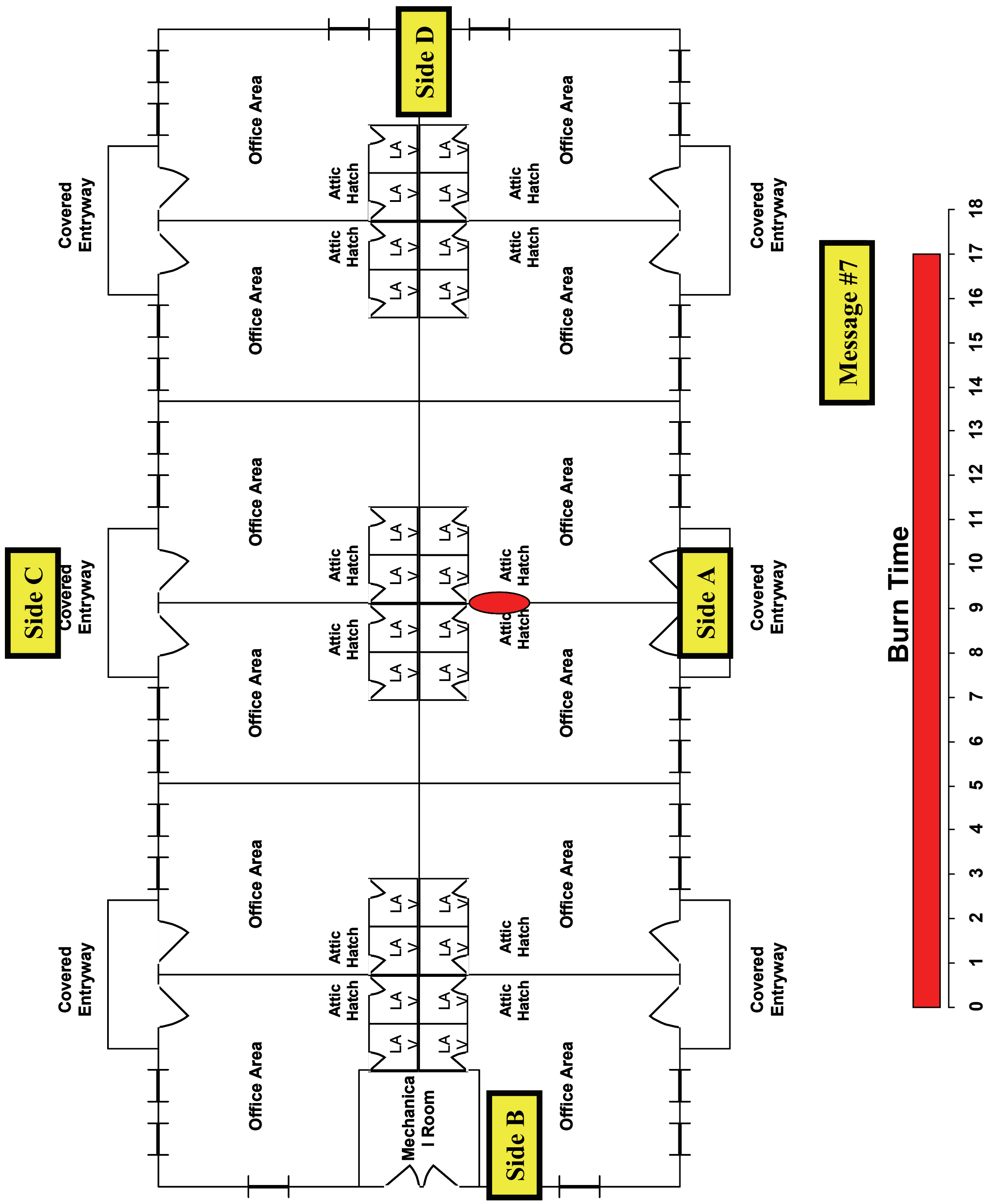
Iteration 3--Message 5



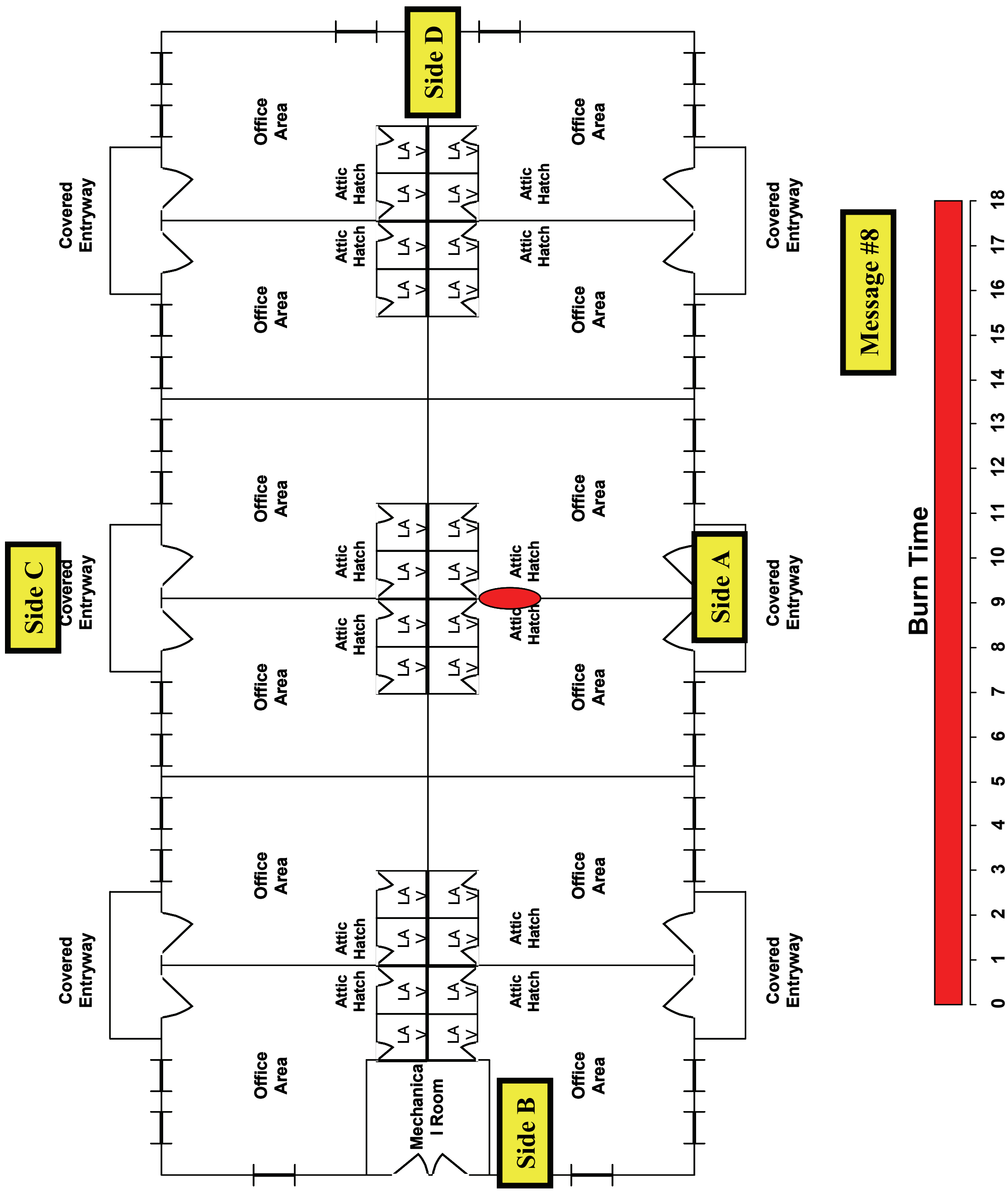
Iteration 4--Message 6



Iteration 4--Message 7



Iteration 4--Message 8



Activity 7.1 (cont'd)

Large Group Exercise #3: Highrise

Purpose

To allow you to demonstrate your knowledge, skills, and abilities (KSAs) you have gained as a result of attending this course. Conduct a walk-around of exposures A-B-C-D of the structures that will be seen in the exercise.

There can be up to seven structures used in the activity.

Directions

1. You will be working in small groups.

2. Each group will do each construction type. Exercise is designed to place the **ICO** as the Incident Commander (IC) until relieved by the next level of authority arriving at the incident. (This will be your instructor.)

3. For this simulation the **ICO** will have additional students assigned to Command and General Staff positions, which under normal field conditions would be the sole responsibility of the ICO.

4. Student group assignments for each group:

    a. ICO.

    b. ICOA--scribe.

    c. IISO.

    d. Initial Planning Section--Situation Unit.

    e. Initial Logistics Section--service and support.

5. Your group will record your predictions on an easel pad or paper.

6. Your group will select a spokesperson to explain to the class how fire would travel in this building.

7. Throughout the activity you will receive messages from the instructor.

8. In this portion of exercise your group is to concentrate on Column 1 Primary Factors Chart. You will have 10 minutes to complete this portion of the activity.

9. The ICOA-scribe shall develop a Primary Factors Exercise Chart on an easel pad for his/her assigned exercise scenario.

   a. Identify the most pertinent primary factors for each exercise scenario.

   b. Place findings on Column 1 of the Primary Factors Exercise Chart.

   c. Identify the most pertinent subfactors for each identified primary factor for exercise scenario. Place findings on Column 2 of the Primary Factors Exercise Chart.

   d. Identify pertinent precautions that will be taken to address each identified sub-factor for exercise scenario. Place findings on Column 3 of the Primary Factors Exercise Chart.

Activity 7.1 (cont'd)

Primary Factors Chart

Column #1 — Primary Factor - Situation Awareness- Chart

Primary Factors	(Check appropriate boxes) Pertinent Sub-Factors (P)	P
Life Hazard	Occupants	
	Firefighters	
Location/Fire	Fire Building on Arrival– Burn Time	
	Exposures On Arrival - Burn Time	
	Fire Spread Considerations Radiation/Conduction/Convection	
Construction	Fire Building – Type 1-2-3-4-5 (Lightweight Awareness)	
	Exposures – Type 1-2-3-4-5 (Lightweight Awareness)	
Occupancy (Contents)	Fire Building – (Fuel Load)	
	Exposures (Fuel Load)	
Height	Fire Building (Front-Rear)	
	Exposures (Front-Rear)	
Area	Fire Building/Configuration	
	Proximity of Exposures /Configuration	
Structural Collapse	Fire Building – Burn Clock After Arrival	
	Exposures – Burn Clock After Arrival	
	Collapse Zone – Safe Corridors	
	Apparatus Placement	
Weather	Visibility	
	Temperature/Humidity	
	Wind – Direction/Velocity	
Resource Requirement	Apparatus/Personnel/Equipment - RIT	
	Water Supply/Suppression Agent	
Auxiliary Appliances	Fire Building Supplied	
	Exposures Supplied	
Topography	Front-Rear	
Explosions/ Back Draft	Proper Ventilation Flash-Over Time Awareness	
Time	Time of Day Time of Year Duration of Incident	

Column #2 — Incident Objectives Attainable/ Measurable/ Flexible

Examples of Incident Objectives:

- Safe Removal of All Occupants within 10 minutes.
- Contain and Control Fire to Room/Building of Origin within 10 minutes
- Contain, Control and Limit Fire in Exposures within 10 minutes
- Other.

List Incident Objectives:

1. ______________________

____

2. ______________________

____

3. ______________________

____

4. ______________________

____

5. ______________________

____

Column #3 — Activities (Strategies) / **Column #4 — Evaluate Effect of Activities (Strategies) Every 10 Minutes**

Column #3 Activities (Strategies)	Effective	Ineffective
[R] **Rescue** • Interior/Exterior/Both		
[E] **Exposure Protection** • Exposure Examination		
[C/E] **Confinement/Extinguishment** • Hose Line Placement		
[O] **Overhaul** • Expose Hidden Fire		
[V] **Ventilation** • Removal of Occupants • Fire Control		
[S] **Salvage** • Water – Run-Off • Apply Covers		
Forcible Entry • Location • Method		
Special Equipment • Imaging Cameras		

List Incident Strategies	Assign Tactics:
For Objective # 1:	
For Objective # 2:	:
For Objective # 3:	
For Objective # 4:	
For Objective # 5:	
______________	

Identify alternative strategies for firefighter safety when occupant safety has been determined not to be a Primary Factor.

- ______________
- ______________
- ______________
- ______________
- ______________
- ______________
- ______________

Activity 7.1 (cont'd)

Primary Factors Exercise Chart

Pertinent Primary Factor	Pertinent Subfactor	Pertinent Precautions To Be Taken
1.	1. 2.	1. 2.
2.	1. 2. 3.	1. 2. 3.
3.	1. 2.	1. 2.
4.	1. 2.	1. 2.
5.	1. 2.	1. 2.
6.	1. 2.	1. 2.
7.	1. 2. 3. 4.	1. 2. 3. 4.
8.	1. 2. 3.	1. 2. 3.
9.	1. 2.	1. 2.
10.	1. 2.	1. 2.
11.	1.	1.
12.	1. 2.	1. 2.
13.	1. 2.	1. 2.

LARGE EXERCISE #3
Vital Building Information
Situation Report

RESIDENTIAL--TYPE I--FIRE RESISTIVE

Structure:	Residential highrise, 50 by 100 feet 22-Story Senior Citizen Occupancy
Building Construction:	Type I--fire resistive--steel frame
Roof Construction:	Concrete slab
Floors:	2-inch concrete over Q decking
Alarm System:	Smoke detectors installed
Stairwell:	Rear of building--Side C
Standpipe:	6-inch dry system--stairwell connection in rear of building
Elevators:	Double bank Rear of building
Occupants:	6 apartments per floor 2 occupants per apartment
Special Concerns:	Wheelchair occupant--Apt. 1002 Nonambulatory occupant--Apt. 1105 Blind occupant--Apt. 1306

Situation Report:

Fire Building:

It is July 4, 1430 hours, temperature is 94 °F (34 °C), wind from east at 3 mph.

Upon arrival, several people are outside the highrise, Side C and more are evacuating down the rear stairwell. The alarm system is sounding. Status of occupants in Apartment 801 is unknown.

Exposures:

No immediate exposures. Internal exposures only.

Activity 7.1 (cont'd)

Objectives-Strategy-Tactics Chart

1. Use the enlarged Objectives-Strategy-Tactics Chart or easel pad.
2. Refer back the Primary Factors Exercise materials in Unit 4: The Analytical Sizeup Process if necessary.
3. Place Slide Iteration #2 for Sides A-B-C-D for each scenario chosen.
4. Receive and act on Exercise Message #2 and Plot Plan #2.
5. Concentrate on Columns 2 and 3 and develop the Objectives-Strategy-Tactics for the scenario.
6. ICOA scribe shall develop an easel pad for Objectives-Strategy-Tactics for assigned exercise scenario. (You have 20 minutes to complete.)
    a. Column 1: Identify the first operational period objectives for the scenario.
    b. Column 2: Identify the first operational period strategies for each objective.
    c. Column 3: Identify the first operational period tactics for each strategy.
    d. Column 4: Assign companies to perform tactics.

Each scenario has first alarm structural resources available at start of exercise:

- Engine 1
- Engine 2
- Engine 3
- Ladder 1
- Basic Life Support (BLS) 1

Each scenario will have working incident structural resources arrive 10 minutes into incident.

- **Engine 5**
- Engine 6
- **Squad 1**
- Engine 6 (Rapid Intervention Crew (RIC))
- Air Cascade-1 FF
- Safety Officer

Central City Fire EMS Dispatch Criteria

Assignment	Alarm Type	Engine	Ladder	Squad	Battalion Chief	EMS Unit	RIC	Safety Officer	Air Cascade
First Alarm	Structural	3	1			1 BLS			
Working Incident	Structural	2		1	1		1	1	1
First Alarm	Target Hazard	3	2	1	1	1 BLS			
Working Incident	Target Hazard	2				1 ALS	1	1	1
Second Alarm	Structural/ Target Hazard	2	1		1	1EMS		1	1
Third Alarm	Structural/ Target Hazard	2	1			1 MS			
Fourth Alarm	Structural/ Target Hazard	2	1		1				

Central City Fire/EMS Staffing:

- **Engine-Ladder-Squad Company--1 Officer--3 Firefighters**
- **Rapid Intervention Crew (RIC)--One Engine Company**
- **EMS BLS Unit--2 EMT Basic**
- **EMS ALS Unit--2 EMT Paramedic**
- **Air Cascade - 1 Firefighter**

A second alarm may be requested but will not arrive on scene before end of exercise.

Activity 7.1 (cont'd)

Objectives-Strategy-Tactics Chart

Objectives	Strategy (s)	Tactics	Assigned to:
Objective #1	**1.**	**1.** **2.** **3.**	**1.** **2.** **3.**
	2.	**1.** **2.** **3.**	**1.** **2.** **3.**
	3.	**1.** **2.** **3.**	**1.** **2.** **3.**
Objective #2	**1.**	**1.** **2.** **3.**	**1.** **2.** **3.**
	2.	**1.** **2.** **3.**	**1.** **2.** **3.**
	3.	**1.** **2.** **3.**	**1.** **2.** **3.**
Objective #3	**1.**	**1.** **2.** **3.**	**1.** **2.** **3.**
	2.	**1.** **2.** **3.**	**1.** **2.** **3.**
	3.	**1.** **2.** **3.**	**1.** **2.** **3.**

Activity 7.1 (cont'd)

ICS Form 201, *Incident Debriefing* and ICS Form 214, *Unit Log*

1. Use the enlarged ICS Form 214, *Unit Log* or easel pad.

2. The ICOA will maintain ICS Form 214 for all tactical decisions made by the ICO along with other pertinent messages and decisions made by the ICO during the exercise. Entries should be recorded under Time and Major Events columns.

3. Distribute ICS Form 214.

    a. IISO.

    b. Initial Planning Section (Situation Unit).

    c. Initial Logistics Section (Service and Support).

4. Distribute ICS Form 201, *Incident Debriefing* (enlarged to 11 by 17).

    a. Initial Planning Section (Situation Unit).

    b. Initial Logistics Section (Service and Support).

5. Begin exercise scenario message distribution.

6. Follow message distribution time frames until all messages have been distributed. (You have 30 minutes.)

Activity 7.1 (cont'd)

Preparing for Exercise Debriefing

You have 15 minutes for each group to prepare their debriefing materials for presentation.

1. ICO.
    a. Primary Factors Chart.
    b. Objectives-Strategy-Tactics Chart.
2. Initial Company Officer Assistant--ICS Form 214.
3. Initial Safety Officer--ICS Form 214.
4. Initial Planning Section.
5. Initial Logistics Section--ICS Form 201.

Activity 7.1 (cont'd)

ICS Form 214, *Unit Log*

UNIT LOG	1. Incident Name	2. Date Prepared	3. Time Prepared
4. Unit Name/Designators	5. Unit Leader (Name and Position)		6. Operational Period

7. Personnel Roster Assigned

Name	ICS Position	Home Base

8. Activity Log

Time	Major Events

9. Prepared by (Name and Position)

Instructions for completing the Unit Log (ICS Form 214)

ITEM NUMBER	ITEM TITLE	INSTRUCTIONS
1.	Incident Name	Print the name assigned to the incident.
2.	Date Prepared	Enter date prepared (month, day, year).
3.	Time Prepared	Enter time prepared (24-hour clock).
4.	Unit Name	Enter the title of the organizational unit or resource designator (Engine 1 - Safety Officer, Situation Unit – Logistics Section).
5.	Unit Leader	Enter the name of the individual in charge of the Unit.
6.	Operational Period	Enter the time span covered by the log (e.g., 1800 Oct. 12 to 0600 Oct. 13).
7.	Personnel Roster	List the name, position, and home base of each member assigned to the unit during the operational period.
8.	Activity Log	Enter the time and briefly describe each significant occurrence or event (e.g., task assignments, task completions, injuries, difficulties encountered, etc.).
9.	Prepared By	Enter the name and title of the person approving the log. Provide log to immediate supervisor at the end of each operational period.

Activity 7.1 (cont'd)

ICS Form 201, *Incident Debriefing*

INCIDENT DEBRIEFING	1. INCIDENT NAME	2. DATE PREPARED	3. TIME PREPARED
4. MAP SKETCH			
ICS 201 (12/93) **NFES1325**	PAGE 1	5. PREPARED BY (NAME AND POSITION)	

6. SUMMARY OF CURRENT ACTIONS		
ICS 201	PAGE 2	

7. CURRENT ORGANIZATION		
ICS 201 (12/93) **NFES1325**	PAGE 3	

8. RESOURCES SUMMARY				
RESOURCES ORDERED	**RESOURCE IDENTIFICATION**	**ETA**	**ON SCENE √**	**LOCATION/ASSIGNMENT**
ICS 201 (12/93) **NFES 1325**	PAGE 4			

Instructions for completing the Incident Briefing (ICS Form 201)

ITEM NUMBER	ITEM TITLE	INSTRUCTIONS
1.	Incident Name	Print the name assigned to the incident.
2.	Date Prepared	Enter date prepared (month, day, year).
3.	Time Prepared	Enter time prepared (24-hour clock).
4.	Map Sketch	Show perimeter and control lines, resources assignments, incident facilities, and other special information on a sketch map or attached to the topographic or orthophoto map.
5.	Resources Summary	Enter the following information about the resources allocated to the incident. Enter the number and type of resource ordered.
	Resources Ordered	Enter the number and type of resource ordered.
	Resource Identification	Enter the agency three-letter designator, S/T, Kind/ Type and resource designator.
	ETA/On Scene	Enter the estimated arrival time and place the arrival time or a checkmark in the "on scene" column upon arrival.
	Location/ Assignment	Enter the assigned location of the resource and/or the actual assignment.
6.	Current Organization	Enter on the organization chart the names of the individuals assigned to each position. Modify the chart as necessary.
7.	Summary of Current Actions	Enter the strategy and tactics used on the incident and note any specific problem areas.
8.	Prepared By	Enter the name and position of the person completing the form.
*Note		Additional pages may be added to ICS Form 201 if needed.

Activity 7.1 (cont'd)

Debriefing Procedures

1. The instructor will debrief exercise scenarios with each group.

2. The instructor will display the slides for your group's scenario when debriefing.

3. Assigned ICO for each group shall present the following:

    a. Primary Factors Chart.

    b. Objectives-Strategy-Tactics Chart.

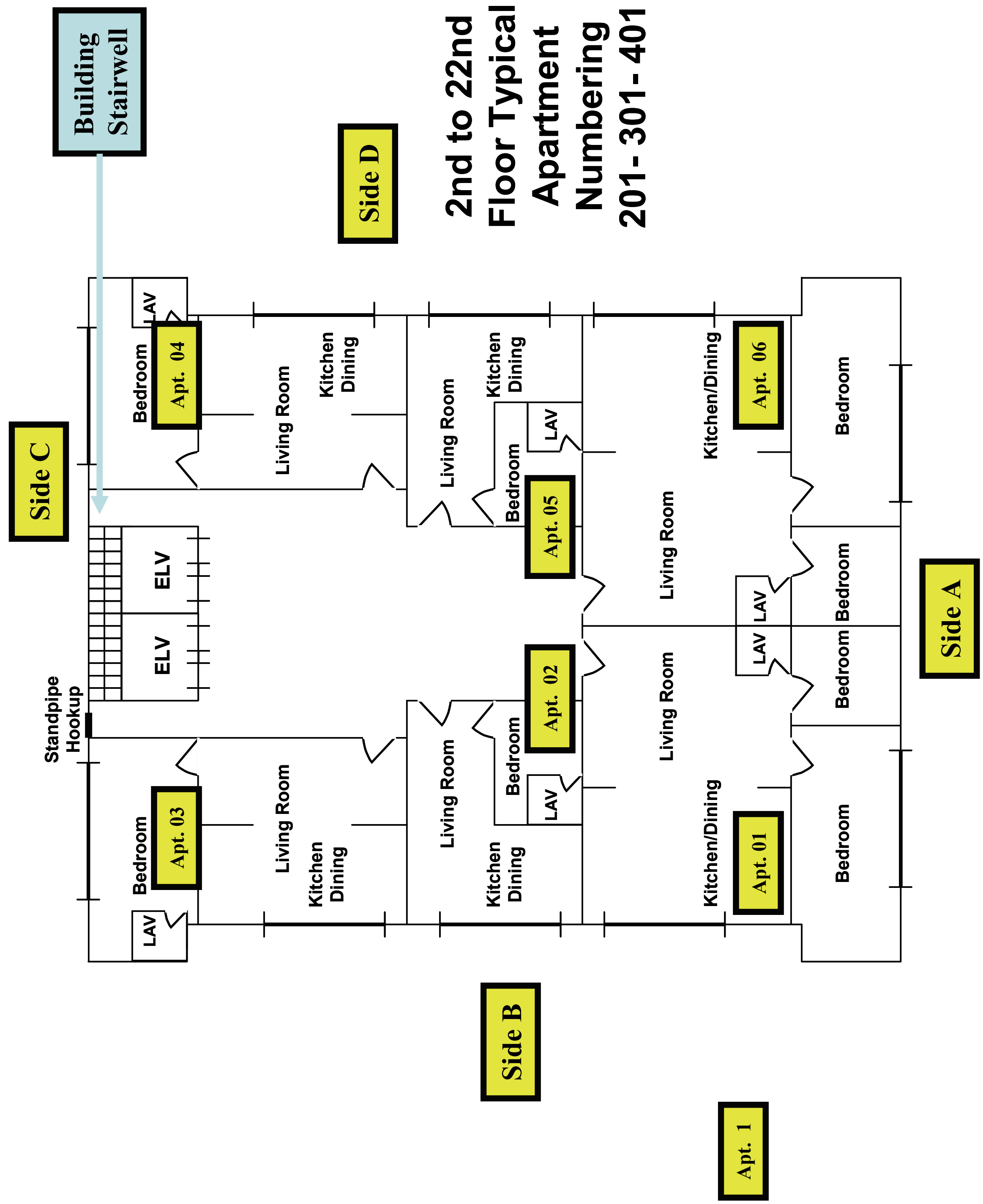
    c. ICS Form 214.

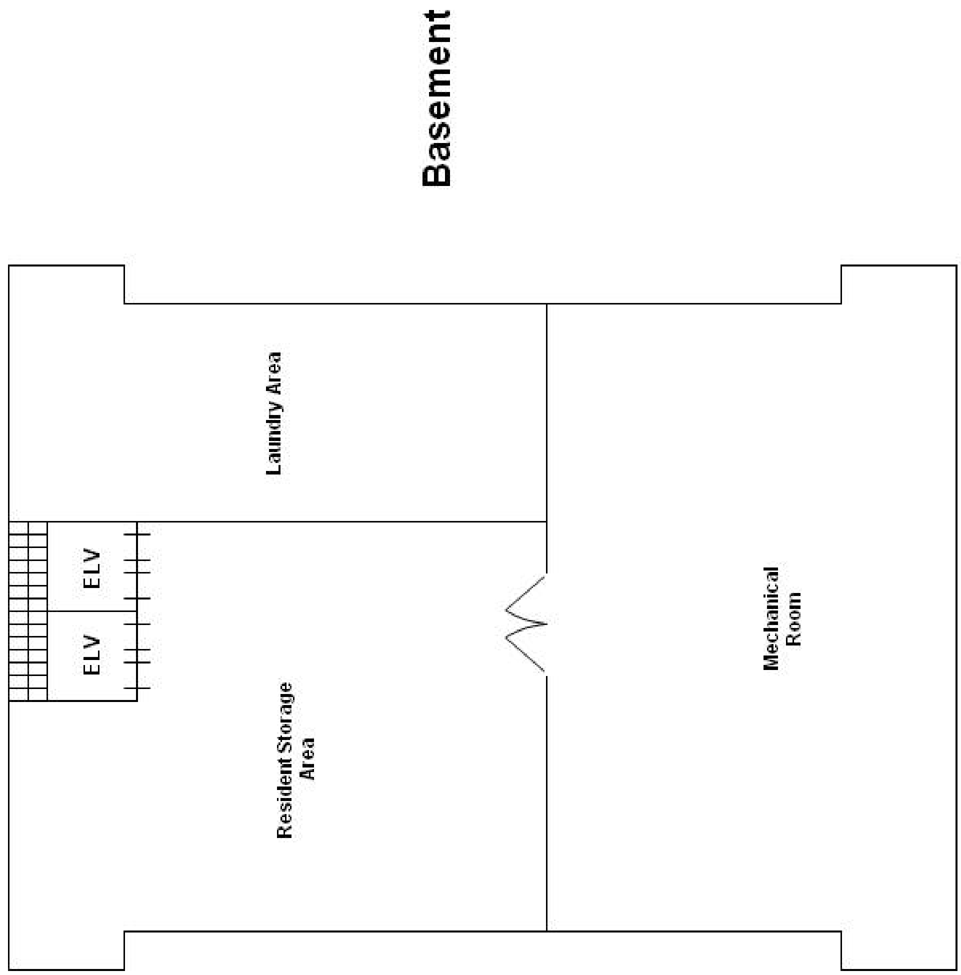
4. Each group will have 15 minutes to debrief.

5. The instructor will address any specific issues that were omitted from charts and identify issues where improvement is required.

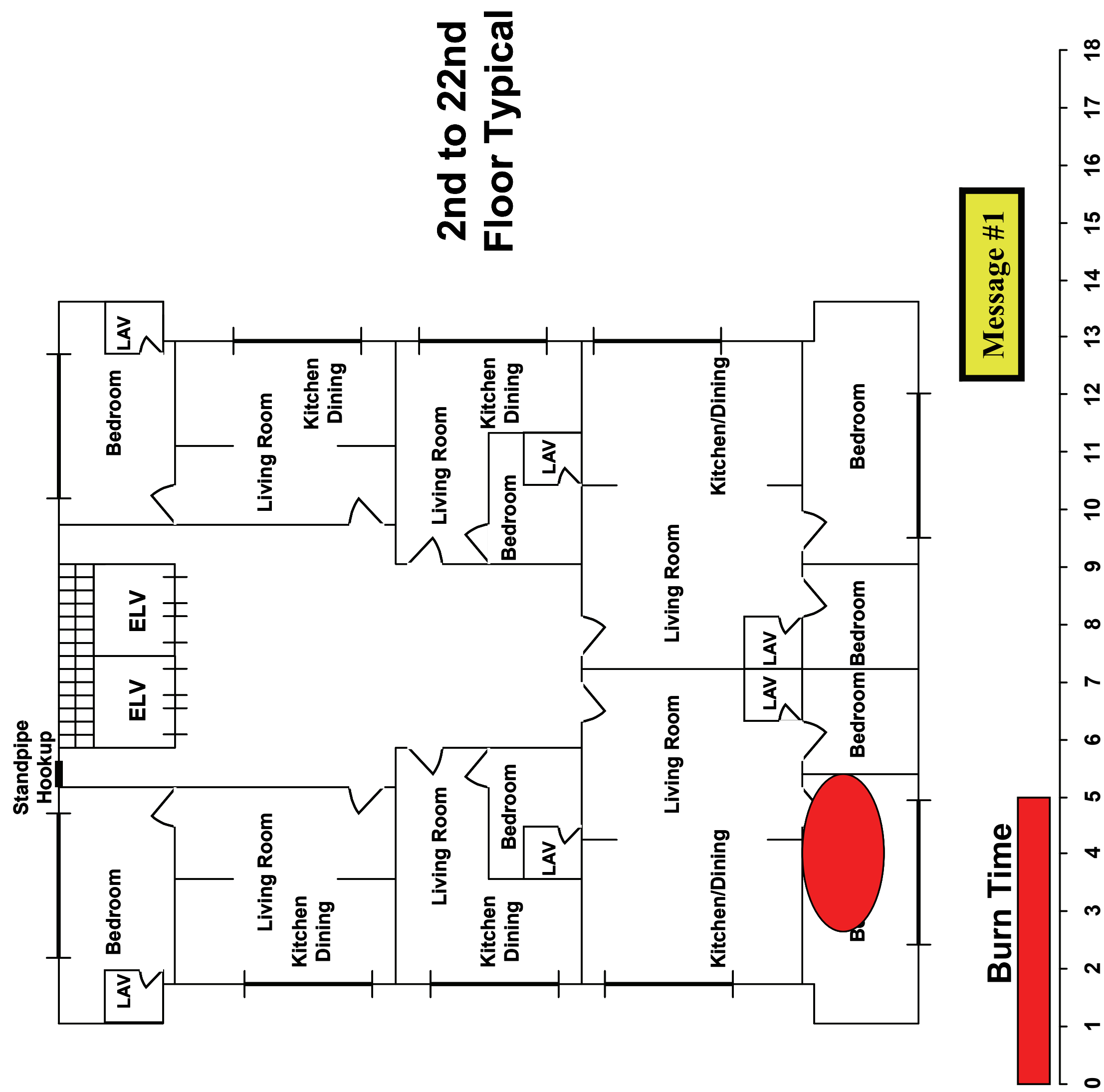
Activity 7.1 (cont'd)
Plot Plans
Exercise #3

Highrise--Walkaround

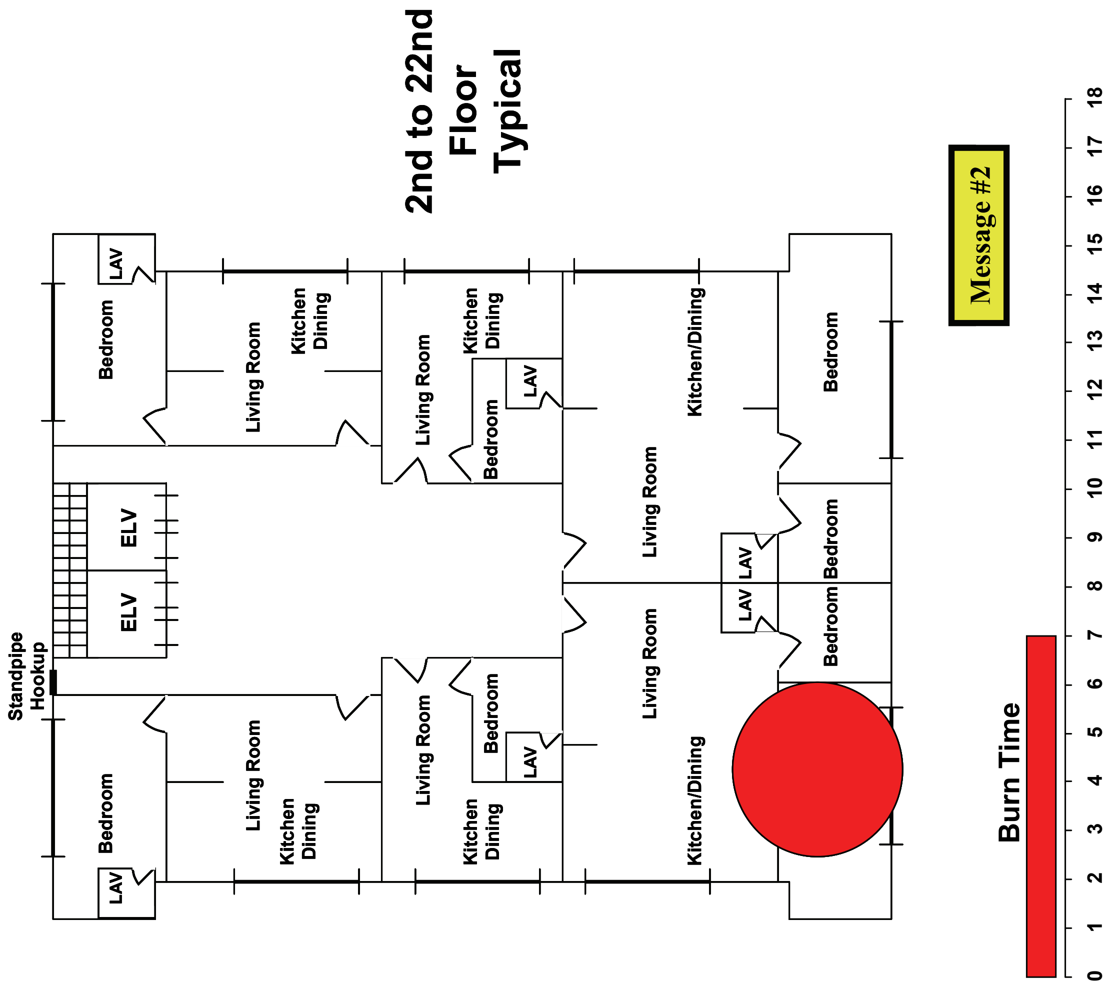



Basement
Laundry Area
ELV
ELV
Resident Storage Area
Mechanical Room

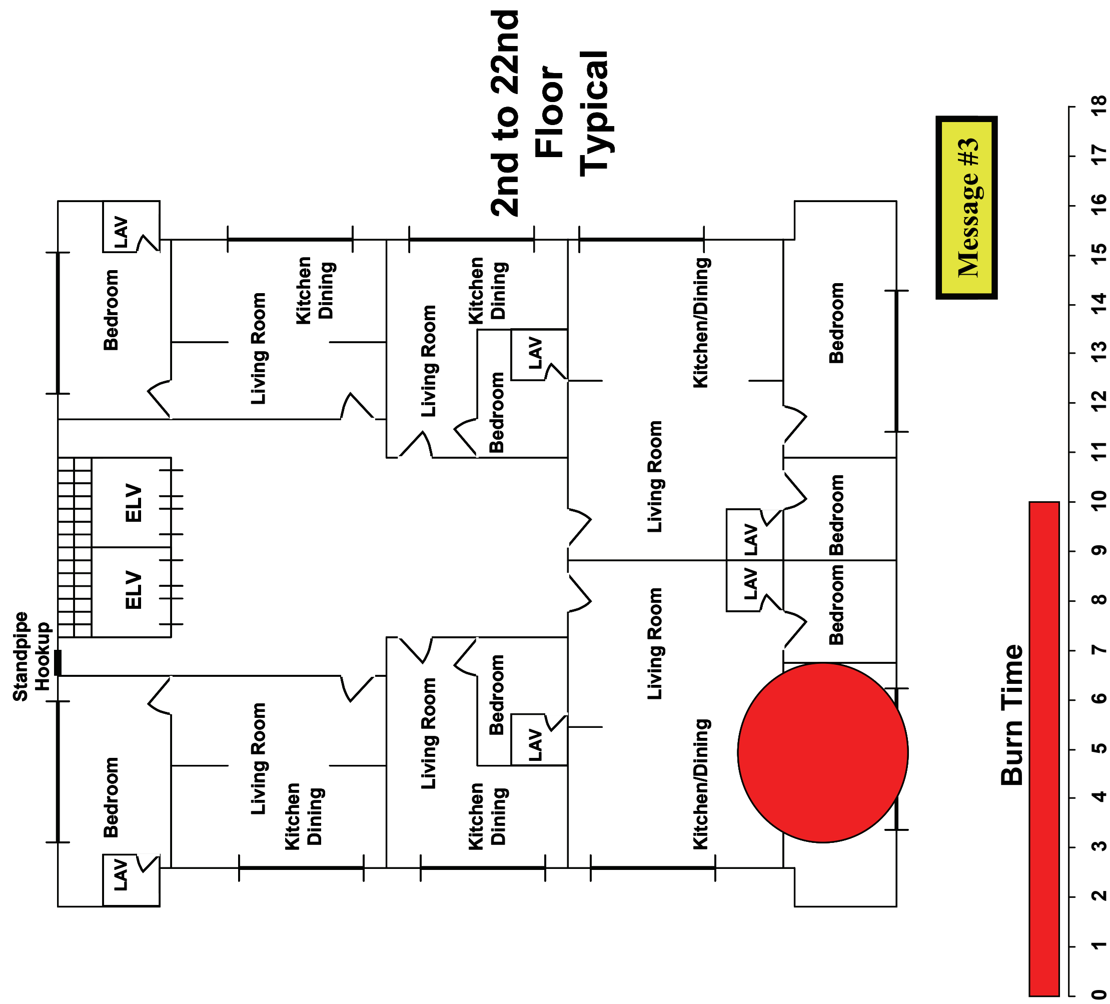
Iteration 1--Message 1



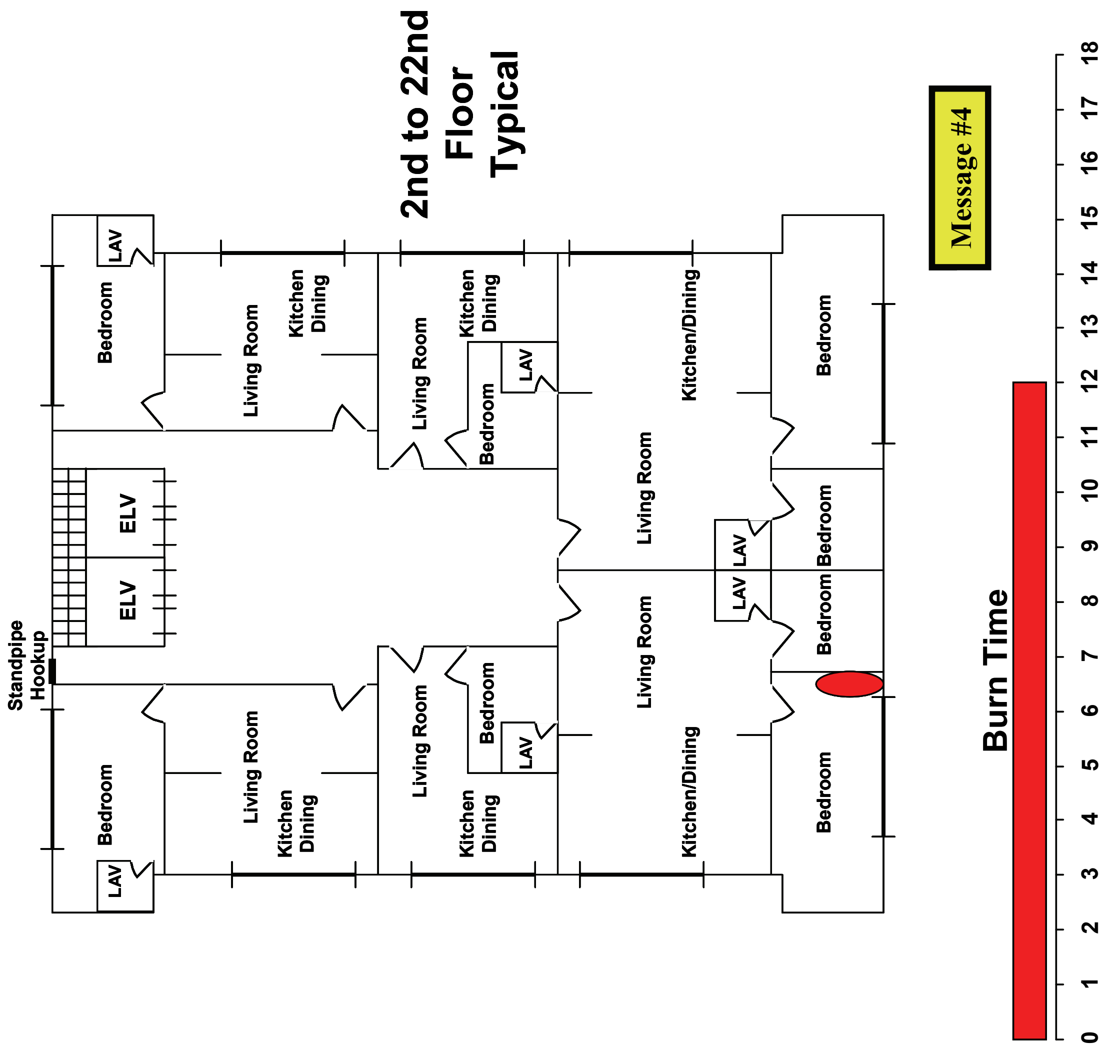
Iteration 2--Message 2



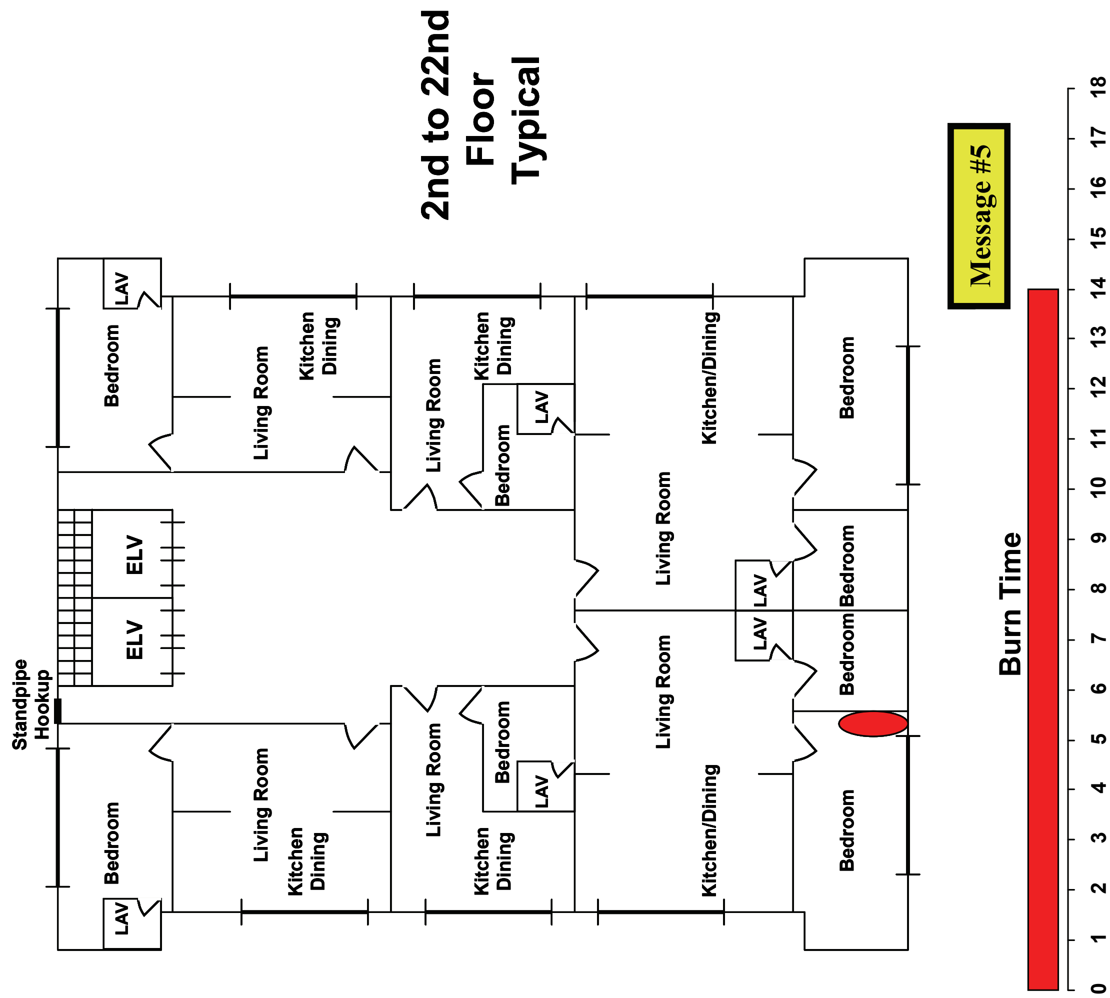
Iteration 2--Message 3



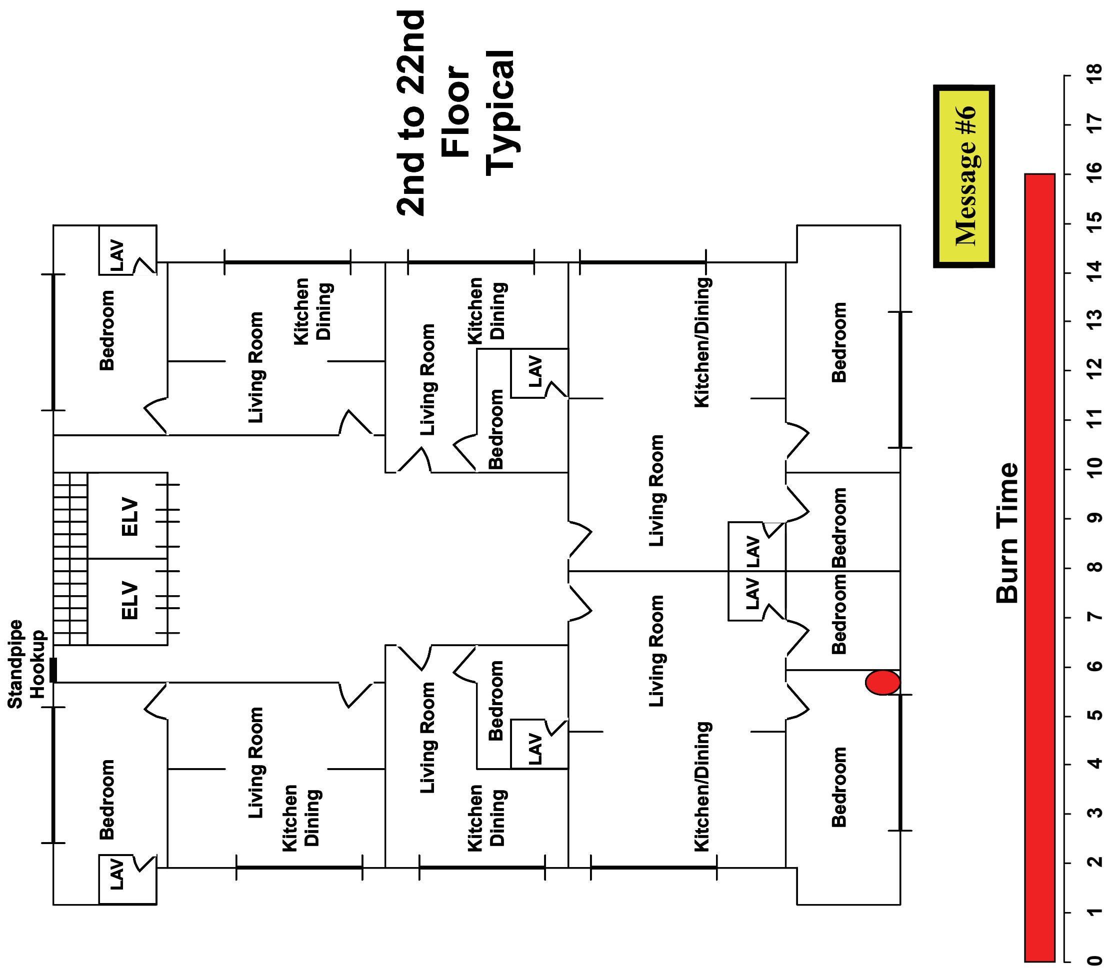
Iteration 3--Message 4



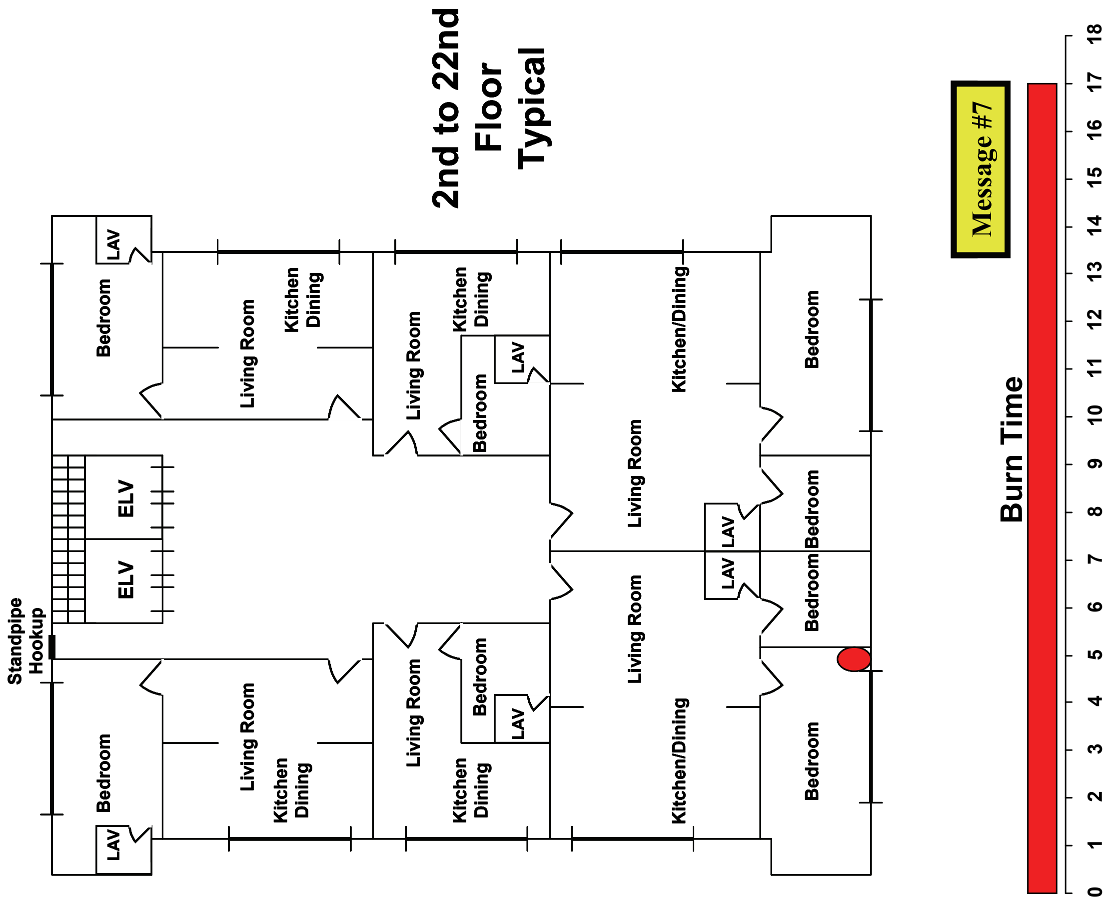
Iteration 3--Message 5



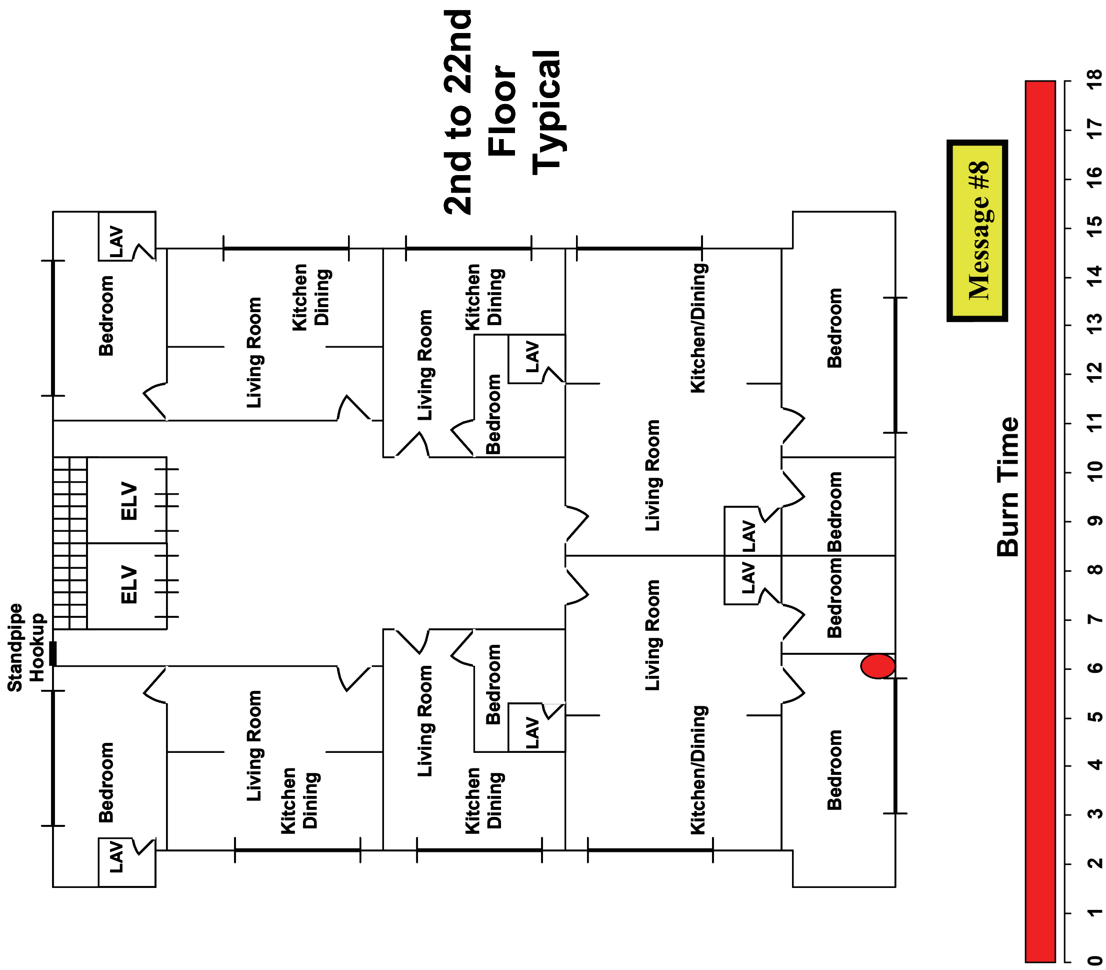
Iteration 4--Message 6



Iteration 4--Message 7



Iteration 4--Message 8



Activity 7.1 (cont'd)

Large Group Exercise #4: Mill Building

Purpose

To allow you to demonstrate your knowledge, skills, and abilities (KSAs) you have gained as a result of attending this course. Conduct a walk-around of exposures A-B-C-D of the structures that will be seen in the exercise.

There can be up to seven structures used in the activity.

Directions

1. You will be working in small groups.

2. Each group will do each construction type. Exercise is designed to place the **ICO** as the Incident Commander (IC) until relieved by the next level of authority arriving at the incident. (This will be your instructor.)

3. For this simulation the **ICO** will have additional students assigned to Command and General Staff positions, which under normal field conditions would be the sole responsibility of the ICO.

4. Student group assignments for each group:

    a. ICO.

    b. ICOA--scribe.

    c. IISO.

    d. Initial Planning Section--Situation Unit.

    e. Initial Logistics Section--service and support.

5. Your group will record your predictions on an easel pad or paper.

6. Your group will select a spokesperson to explain to the class how fire would travel in this building.

7. Throughout the activity you will receive messages from the instructor.

8. In this portion of exercise your group is to concentrate on Column 1 Primary Factors Chart. You will have 10 minutes to complete this portion of the activity.

9. The ICOA-scribe shall develop a Primary Factors Exercise Chart on an easel pad for his/her assigned exercise scenario.

    a. Identify the most pertinent primary factors for each exercise scenario.

    b. Place findings on Column 1 of the Primary Factors Exercise Chart.

    c. Identify the most pertinent subfactors for each identified primary factor for exercise scenario. Place findings on Column 2 of the Primary Factors Exercise Chart.

    d. Identify pertinent precautions that will be taken to address each identified sub-factor for exercise scenario. Place findings on Column 3 of the Primary Factors Exercise Chart.

Activity 7.1 (cont'd)

Primary Factors Chart

Column #1 — Primary Factor - Situation Awareness- Chart

Primary Factors	(Check appropriate boxes) Pertinent Sub-Factors (P)	P
Life Hazard	Occupants	
	Firefighters	
Location/Fire	Fire Building on Arrival– Burn Time	
	Exposures On Arrival - Burn Time	
	Fire Spread Considerations Radiation/Conduction/Convection	
Construction	Fire Building – Type 1-2-3-4-5 (Lightweight Awareness)	
	Exposures – Type 1-2-3-4-5 (Lightweight Awareness)	
Occupancy (Contents)	Fire Building – (Fuel Load)	
	Exposures (Fuel Load)	
Height	Fire Building (Front-Rear)	
	Exposures (Front-Rear)	
Area	Fire Building/Configuration	
	Proximity of Exposures /Configuration	
Structural Collapse	Fire Building – Burn Clock After Arrival	
	Exposures – Burn Clock After Arrival	
	Collapse Zone – Safe Corridors	
	Apparatus Placement	
Weather	Visibility	
	Temperature/Humidity	
	Wind – Direction/Velocity	
Resource Requirement	Apparatus/Personnel/Equipment - RIT	
	Water Supply/Suppression Agent	
Auxiliary Appliances	Fire Building Supplied	
	Exposures Supplied	
Topography	Front-Rear	
Explosions/ Back Draft	Proper Ventilation Flash-Over Time Awareness	
Time	Time of Day Time of Year Duration of Incident	

Column #2 — Incident Objectives Attainable/ Measurable/ Flexible

Examples of Incident Objectives:

- Safe Removal of All Occupants within 10 minutes.
- Contain and Control Fire to Room/Building of Origin within 10 minutes
- Contain, Control and Limit Fire in Exposures within 10 minutes
- Other.

List Incident Objectives:

1. ______________________________
____
2. ______________________________
____
3. ______________________________
____
4. ______________________________
____
5. ______________________________
____

Column #3 — Activities (Strategies)

Column #3 Activities (Strategies)	Column #4 Evaluate Effect of Activities (Strategies) Every 10 Minutes: Effective	Ineffective
[R] **Rescue** • Interior/Exterior/Both		
[E] **Exposure Protection** • Exposure Examination		
[C/E] **Confinement/Extinguishment** • Hose Line Placement		
[O] **Overhaul** • Expose Hidden Fire		
[V] **Ventilation** • Removal of Occupants • Fire Control		
[S] **Salvage** • Water – Run-Off • Apply Covers		
Forcible Entry • Location • Method		
Special Equipment • Imaging Cameras		

List Incident Strategies	Assign Tactics:
For Objective # 1:	
For Objective # 2:	:
For Objective # 3:	
For Objective # 4:	
For Objective # 5:	
______________	

Column #4

Identify alternative strategies for firefighter safety when occupant safety has been determined not to be a Primary Factor.

- ______________
- ______________
- ______________
- ______________
- ______________
- ______________
- ______________

Activity 7.1 (cont'd)

Primary Factors Exercise Chart

Pertinent Primary Factor	Pertinent Subfactor	Pertinent Precautions To Be Taken
1.	1. 2.	1. 2.
2.	1. 2. 3.	1. 2. 3.
3.	1. 2.	1. 2.
4.	1. 2.	1. 2.
5.	1. 2.	1. 2.
6.	1. 2.	1. 2.
7.	1. 2. 3. 4.	1. 2. 3. 4.
8.	1. 2. 3.	1. 2. 3.
9.	1. 2.	1. 2.
10.	1. 2.	1. 2.
11.	1.	1.
12.	1. 2.	1. 2.
13.	1. 2.	1. 2.

LARGE EXERCISE #4
Vital Building Information
Situation Report

HEAVY TIMBER--TYPE IV--MILL CONSTRUCTION

Structure: Two-story--clothing outlet

Building Construction: Type IV--mill construction

Roof Construction: Beam and rafter, 1-1/4-inch wooden roof decking, metal roof covering

Floors: Beam and joist, 2-inch wooden floor decking

Alarm System: Smoke detectors installed

Sprinkler: Basement, first and second floors

Occupants: Office and sales employees

Special Concerns: Heavy fuel load

Situation Report:

Fire Building:

It is May 25, 1330 hours, temperature is 75 °F (24 °C), wind from northeast at 5 mph.

Upon arrival, several employees are outside the building on Sides A. Store manager reports that plumbers were working in the basement repairing a broken water pipe when the fire broke out. The plumbing foreman reported the sprinkler system was shut down for the repairs. One plumber is unaccounted for and was last seen in the basement and one employee working on the second floor is missing.

Exposures:

Side B--two-story retail clothing store--no other immediate exposures.

Activity 7.1 (cont'd)

Objectives-Strategy-Tactics Chart

1. Use the enlarged Objectives-Strategy-Tactics Chart or easel pad.

2. Refer back the Primary Factors Exercise materials in Unit 4: The Analytical Sizeup Process if necessary.

3. Place Slide Iteration #2 for Sides A-B-C-D for each scenario chosen.

4. Receive and act on Exercise Message #2 and Plot Plan #2.

5. Concentrate on Columns 2 and 3 and develop the Objectives-Strategy-Tactics for the scenario.

6. ICOA scribe shall develop an easel pad for Objectives-Strategy-Tactics for assigned exercise scenario. (You have 20 minutes to complete.)

   a. Column 1: Identify the first operational period objectives for the scenario.

   b. Column 2: Identify the first operational period strategies for each objective.

   c. Column 3: Identify the first operational period tactics for each strategy.

   d. Column 4: Assign companies to perform tactics.

Each scenario has first alarm structural resources available at start of exercise:

- Engine 1
- Engine 2
- Engine 3
- Ladder 1
- Basic Life Support (BLS) 1

Each scenario will have working incident structural resources arrive 10 minutes into incident.

- **Engine 5**
- Engine 6
- **Squad 1**
- Engine 6 (Rapid Intervention Crew (RIC))
- Air Cascade-1 FF
- Safety Officer

Central City Fire EMS Dispatch Criteria

Assignment	Alarm Type	Engine	Ladder	Squad	Battalion Chief	EMS Unit	RIC	Safety Officer	Air Cascade
First Alarm	Structural	3	1			1 BLS			
Working Incident	Structural	2		1	1		1	1	1
First Alarm	Target Hazard	3	2	1	1	1 BLS			
Working Incident	Target Hazard	2				1 ALS	1	1	1
Second Alarm	Structural/ Target Hazard	2	1		1	1EMS		1	1
Third Alarm	Structural/ Target Hazard	2	1			1 MS			
Fourth Alarm	Structural/ Target Hazard	2	1		1				

Central City Fire/EMS Staffing:

- **Engine-Ladder-Squad Company--1 Officer--3 Firefighters**
- **Rapid Intervention Crew (RIC)--One Engine Company**
- **EMS BLS Unit--2 EMT Basic**
- **EMS ALS Unit--2 EMT Paramedic**
- **Air Cascade - 1 Firefighter**

A second alarm may be requested but will not arrive on scene before end of exercise.

Activity 7.1 (cont'd)

Objectives-Strategy-Tactics Chart

Objectives	Strategy (s)	Tactics	Assigned to:
Objective #1	**1.**	**1.** **2.** **3.**	**1.** **2.** **3.**
	2.	**1.** **2.** **3.**	**1.** **2.** **3.**
	3.	**1.** **2.** **3.**	**1.** **2.** **3.**
Objective #2	**1.**	**1.** **2.** **3.**	**1.** **2.** **3.**
	2.	**1.** **2.** **3.**	**1.** **2.** **3.**
	3.	**1.** **2.** **3.**	**1.** **2.** **3.**
Objective #3	**1.**	**1.** **2.** **3.**	**1.** **2.** **3.**
	2.	**1.** **2.** **3.**	**1.** **2.** **3.**
	3.	**1.** **2.** **3.**	**1.** **2.** **3.**

Activity 7.1 (cont'd)

ICS Form 201, I*ncident Debriefing* and ICS Form 214, *Unit Log*

1. Use the enlarged ICS Form 214, *Unit Log* or easel pad.

2. The ICOA will maintain ICS Form 214 for all tactical decisions made by the ICO along with other pertinent messages and decisions made by the ICO during the exercise. Entries should be recorded under Time and Major Events columns.

3. Distribute ICS Form 214.

   a. IISO.

   b. Initial Planning Section (Situation Unit).

   c. Initial Logistics Section (Service and Support).

4. Distribute ICS Form 201, *Incident Debriefing* (enlarged to 11 by 17).

   a. Initial Planning Section (Situation Unit).

   b. Initial Logistics Section (Service and Support).

5. Begin exercise scenario message distribution.

6. Follow message distribution time frames until all messages have been distributed. (You have 30 minutes.)

Activity 7.1 (cont'd)

Preparing for Exercise Debriefing

You have 15 minutes for each group to prepare their debriefing materials for presentation.

1. ICO.
    a. Primary Factors Chart.
    b. Objectives-Strategy-Tactics Chart.
2. Initial Company Officer Assistant--ICS Form 214.
3. Initial Safety Officer--ICS Form 214.
4. Initial Planning Section.
5. Initial Logistics Section--ICS Form 201.

Activity 7.1 (cont'd)

ICS Form 214, *Unit Log*

UNIT LOG	1. Incident Name	2. Date Prepared	3. Time Prepared
4. Unit Name/Designators	5. Unit Leader (Name and Position)		6. Operational Period

7. Personnel Roster Assigned

Name	ICS Position	Home Base

8. Activity Log

Time	Major Events

9. Prepared by (Name and Position)

Instructions for completing the Unit Log (ICS Form 214)

ITEM NUMBER	ITEM TITLE	INSTRUCTIONS
1.	Incident Name	Print the name assigned to the incident.
2.	Date Prepared	Enter date prepared (month, day, year).
3.	Time Prepared	Enter time prepared (24-hour clock).
4.	Unit Name	Enter the title of the organizational unit or resource designator (Engine 1 - Safety Officer, Situation Unit – Logistics Section).
5.	Unit Leader	Enter the name of the individual in charge of the Unit.
6.	Operational Period	Enter the time span covered by the log (e.g., 1800 Oct. 12 to 0600 Oct. 13).
7.	Personnel Roster	List the name, position, and home base of each member assigned to the unit during the operational period.
8.	Activity Log	Enter the time and briefly describe each significant occurrence or event (e.g., task assignments, task completions, injuries, difficulties encountered, etc.).
9.	Prepared By	Enter the name and title of the person approving the log. Provide log to immediate supervisor at the end of each operational period.

Activity 7.1 (cont'd)

ICS Form 201, *Incident Debriefing*

INCIDENT DEBRIEFING	1. INCIDENT NAME	2. DATE PREPARED	3. TIME PREPARED
4. MAP SKETCH			
ICS 201 (12/93) **NFES1325**	PAGE 1	5. PREPARED BY (NAME AND POSITION)	

6. SUMMARY OF CURRENT ACTIONS		
ICS 201	PAGE 2	

7. CURRENT ORGANIZATION		
ICS 201 (12/93) **NFES1325**	PAGE 3	

8. RESOURCES SUMMARY				
RESOURCES ORDERED	**RESOURCE IDENTIFICATION**	**ETA**	**ON SCENE √**	**LOCATION/ASSIGNMENT**

ICS 201 (12/93) **NFES 1325**	PAGE 4	

Instructions for completing the Incident Briefing (ICS Form 201)

ITEM NUMBER	ITEM TITLE	INSTRUCTIONS
1.	Incident Name	Print the name assigned to the incident.
2.	Date Prepared	Enter date prepared (month, day, year).
3.	Time Prepared	Enter time prepared (24-hour clock).
4.	Map Sketch	Show perimeter and control lines, resources assignments, incident facilities, and other special information on a sketch map or attached to the topographic or orthophoto map.
5.	Resources Summary	Enter the following information about the resources allocated to the incident. Enter the number and type of resource ordered.
	Resources Ordered	Enter the number and type of resource ordered.
	Resource Identification	Enter the agency three-letter designator, S/T, Kind/ Type and resource designator.
	ETA/On Scene	Enter the estimated arrival time and place the arrival time or a checkmark in the "on scene" column upon arrival.
	Location/ Assignment	Enter the assigned location of the resource and/or the actual assignment.
6.	Current Organization	Enter on the organization chart the names of the individuals assigned to each position. Modify the chart as necessary.
7.	Summary of Current Actions	Enter the strategy and tactics used on the incident and note any specific problem areas.
8.	Prepared By	Enter the name and position of the person completing the form.
*Note		Additional pages may be added to ICS Form 201 if needed.

Activity 7.1 (cont'd)

Debriefing Procedures

1. The instructor will debrief exercise scenarios with each group.

2. The instructor will display the slides for your group's scenario when debriefing.

3. Assigned ICO for each group shall present the following:

    a. Primary Factors Chart.

    b. Objectives-Strategy-Tactics Chart.

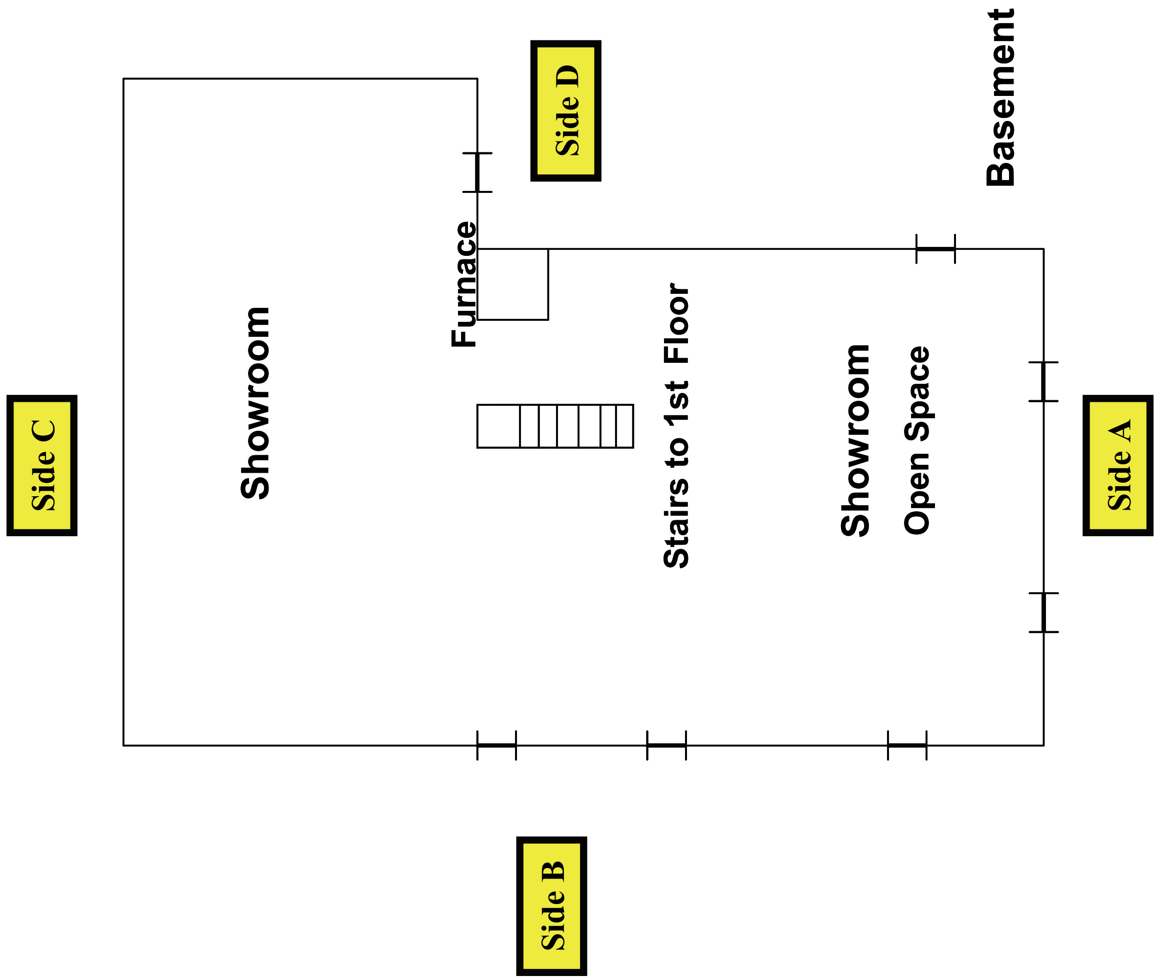
    c. ICS Form 214.

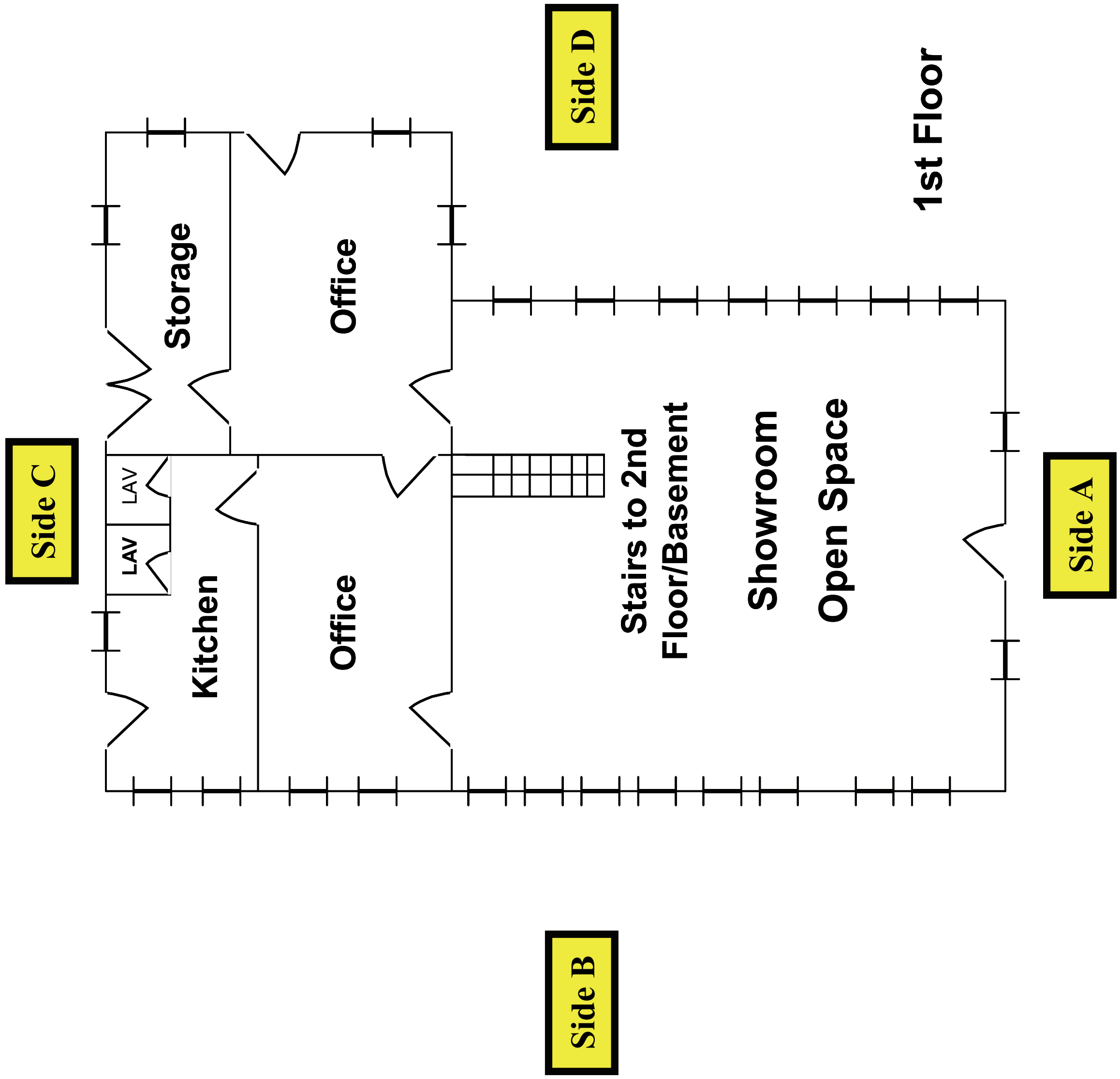
4. Each group will have 15 minutes to debrief.

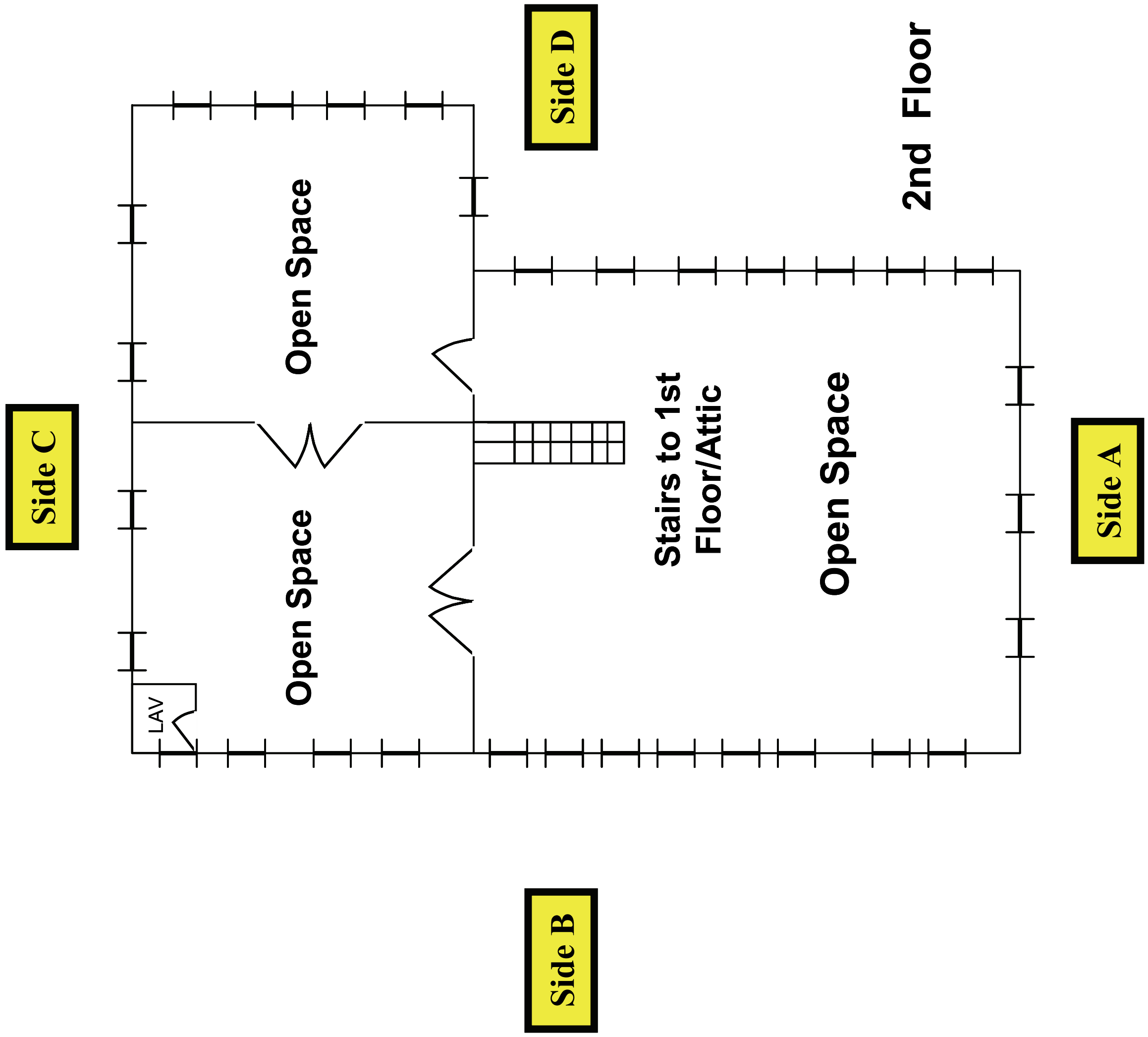
5. The instructor will address any specific issues that were omitted from charts and identify issues where improvement is required.

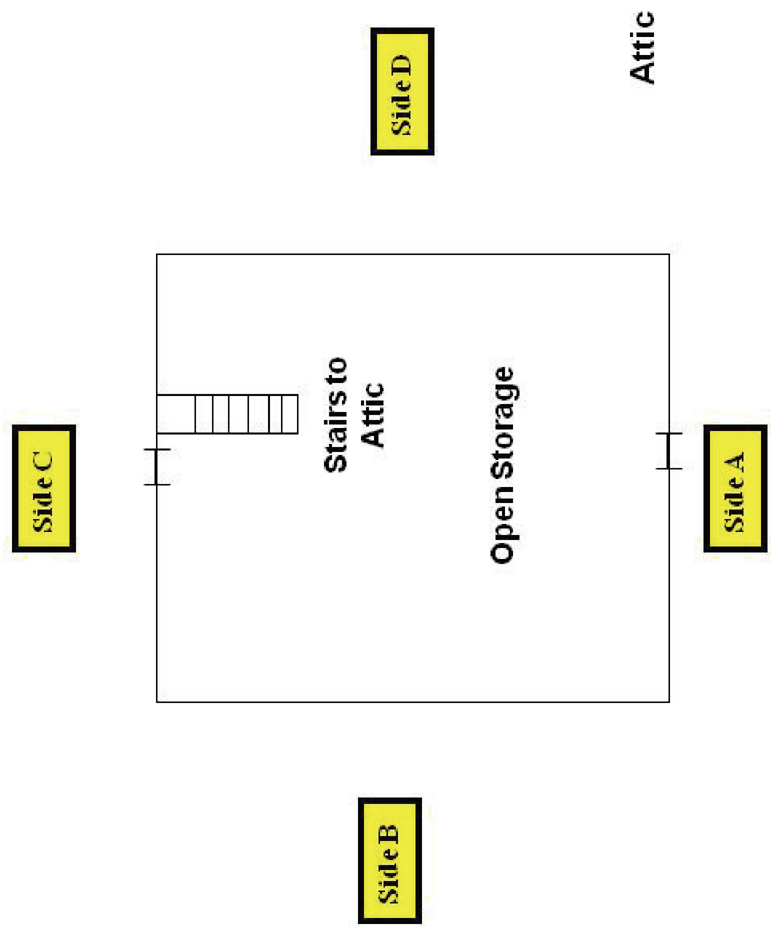
Activity 7.1 (cont'd)
Plot Plans
Exercise #4

Mill Building--Walkaround

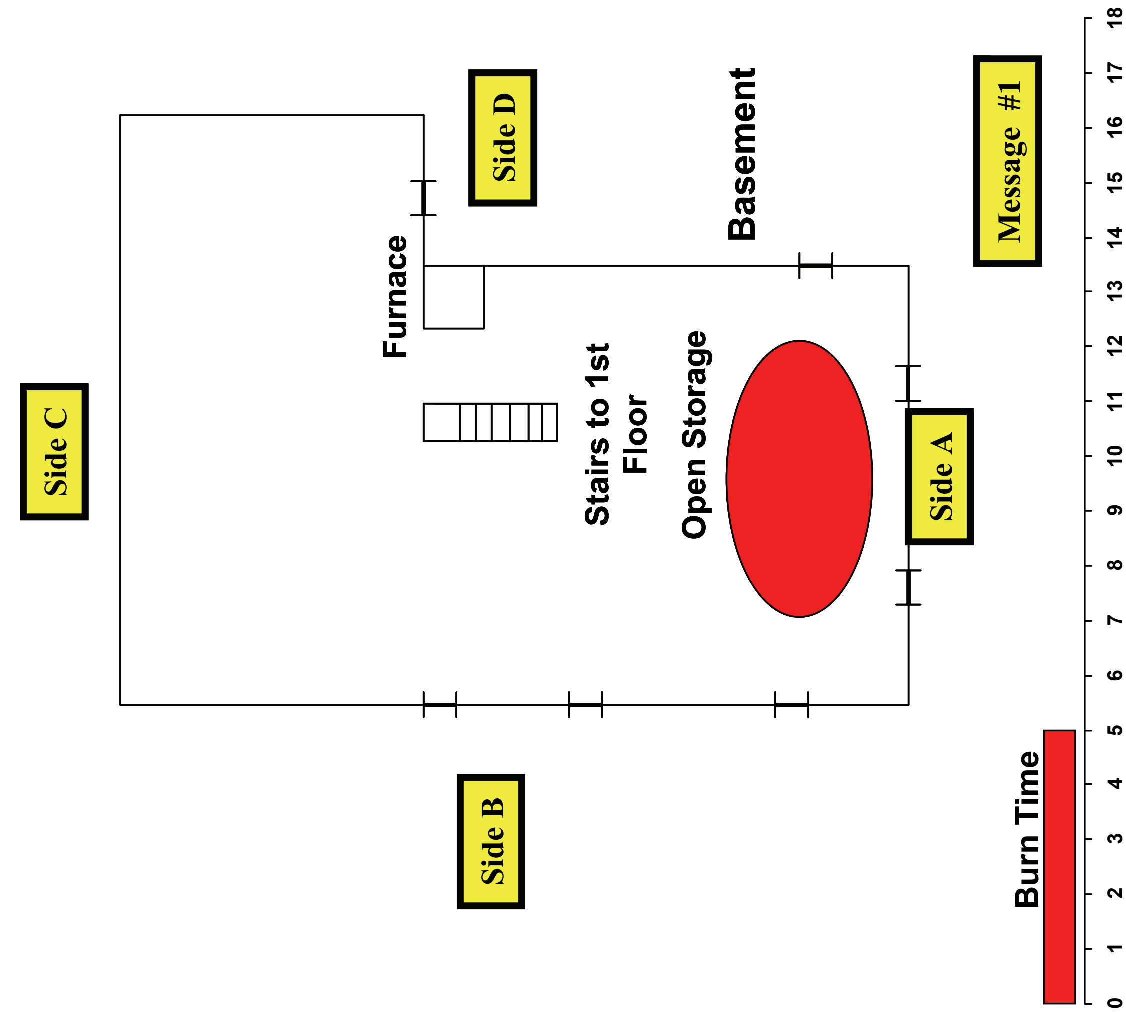


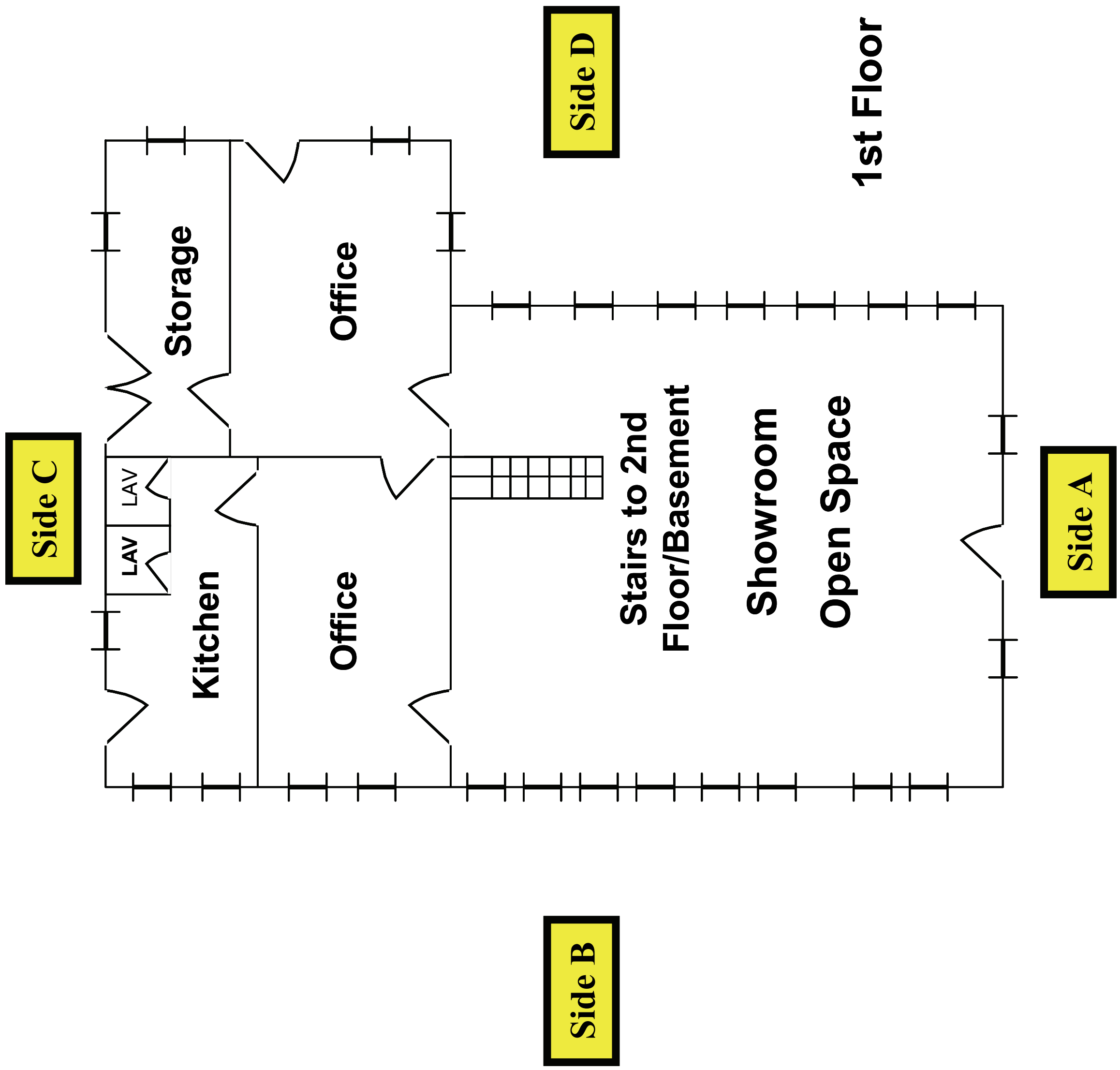

Side D
1st Floor
Storage
Office
Side C
LAV
LAV
Kitchen
Office
Stairs to 2nd Floor/Basement
Showroom
Open Space
Side A
Side B

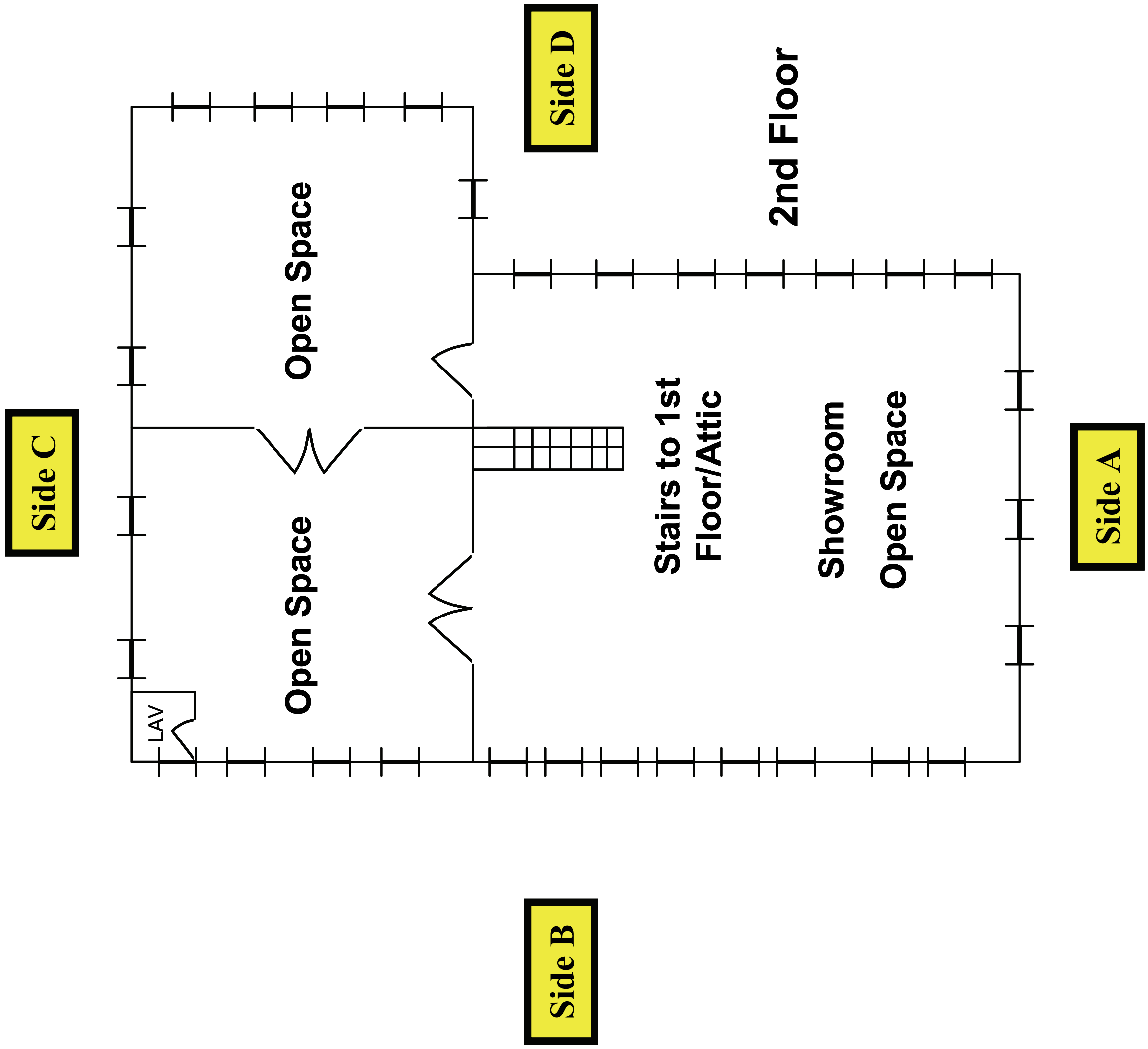

2nd Floor
Side D
Side C
Side A
Side B
Open Space
Open Space
Stairs to 1st Floor/Attic
Open Space
LAV

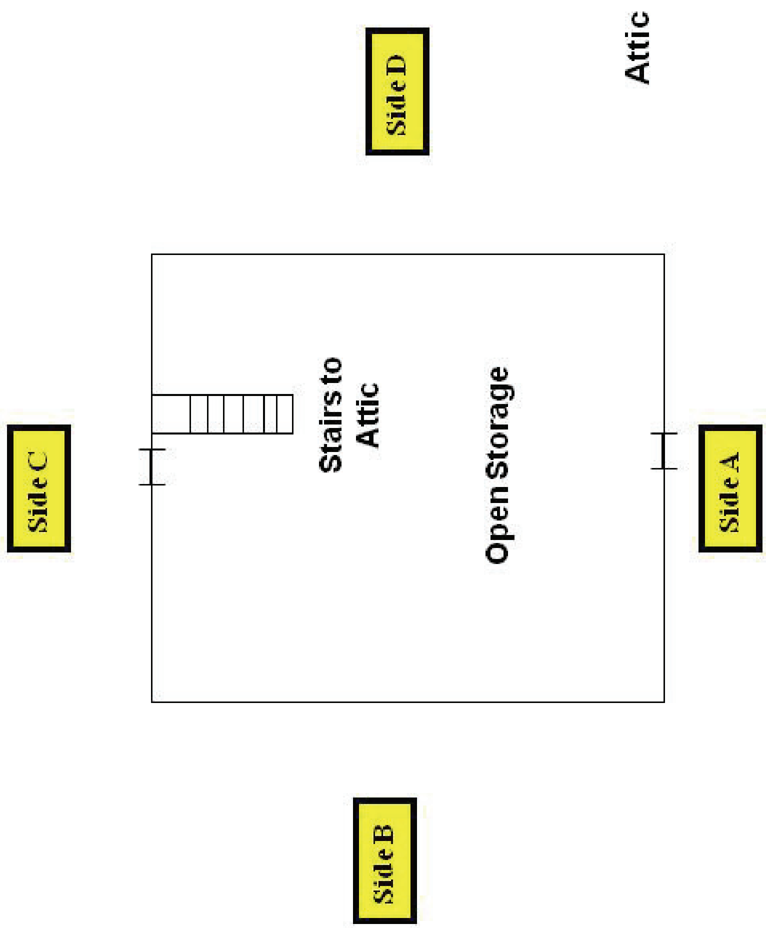

Attic
Side D
Stairs to Attic
Open Storage
Side C
Side A
Side B

Iteration 1--Message 1

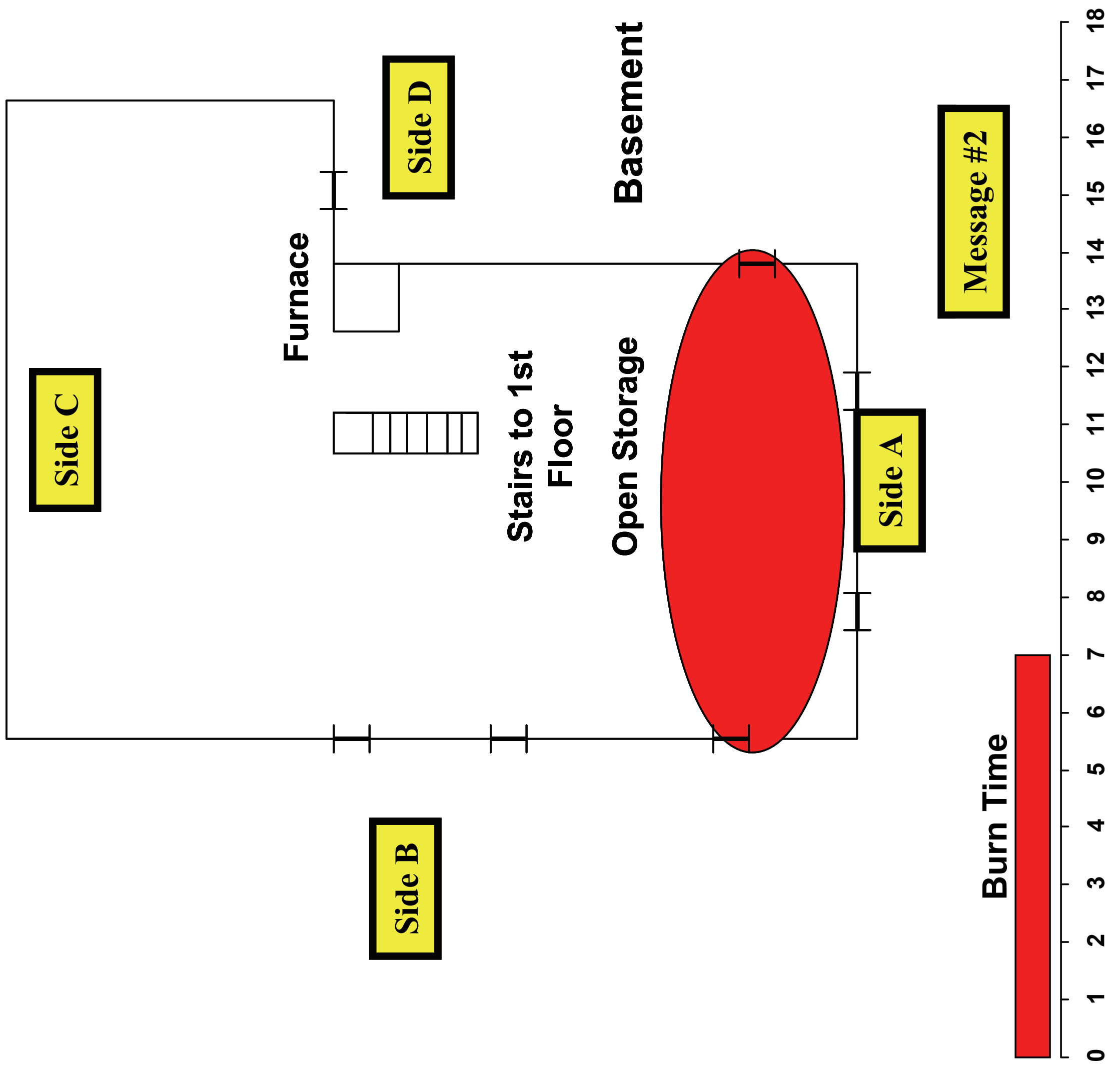



Side D
1st Floor
Storage
Office
Side C
LAV
LAV
Kitchen
Office
Stairs to 2nd
Floor/Basement
Showroom
Open Space
Side A
Side B

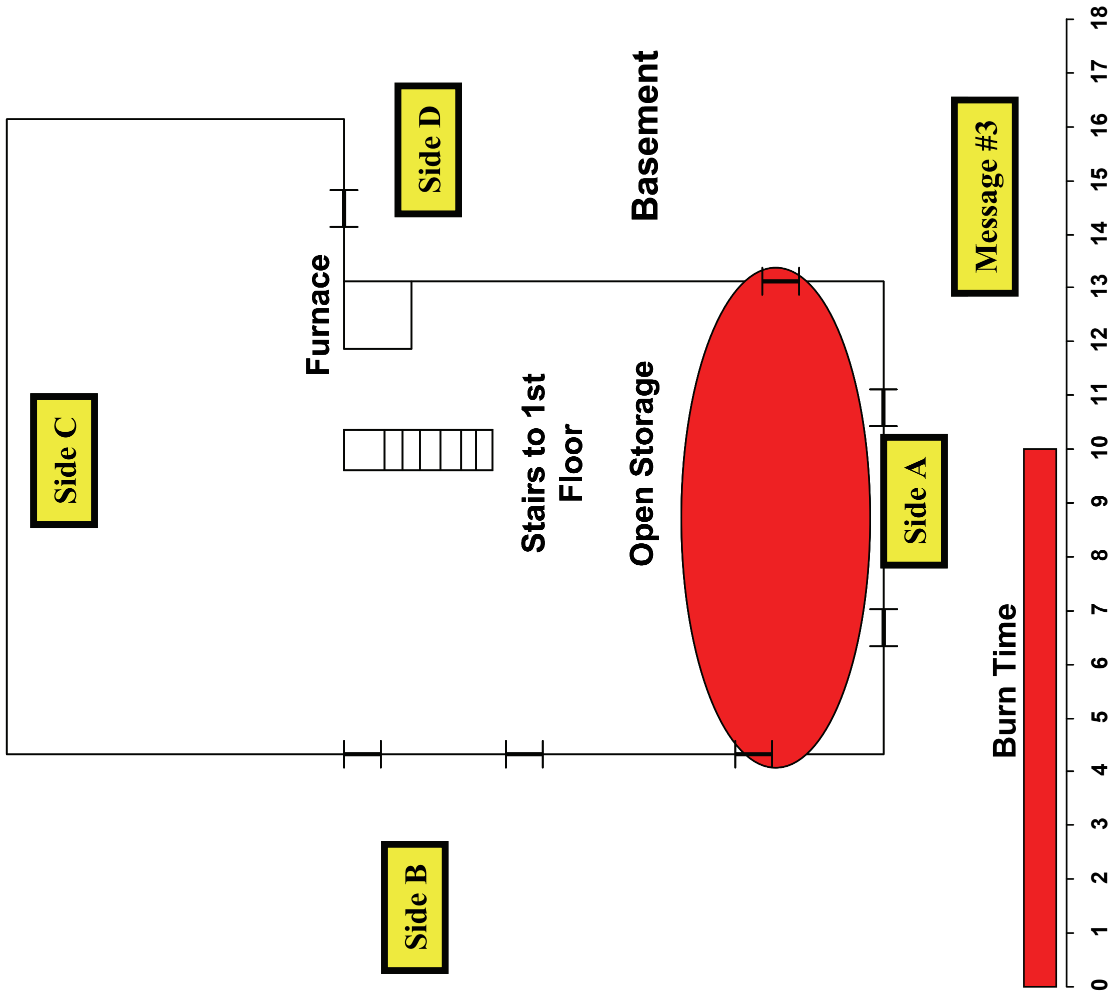

2nd Floor
Side A
Side B
Side C
Side D
Showroom
Open Space
Stairs to 1st
Floor/Attic
Open Space
Open Space
LAV


Attic
Side D
Stairs to Attic
Open Storage
Side C
Side A
Side B

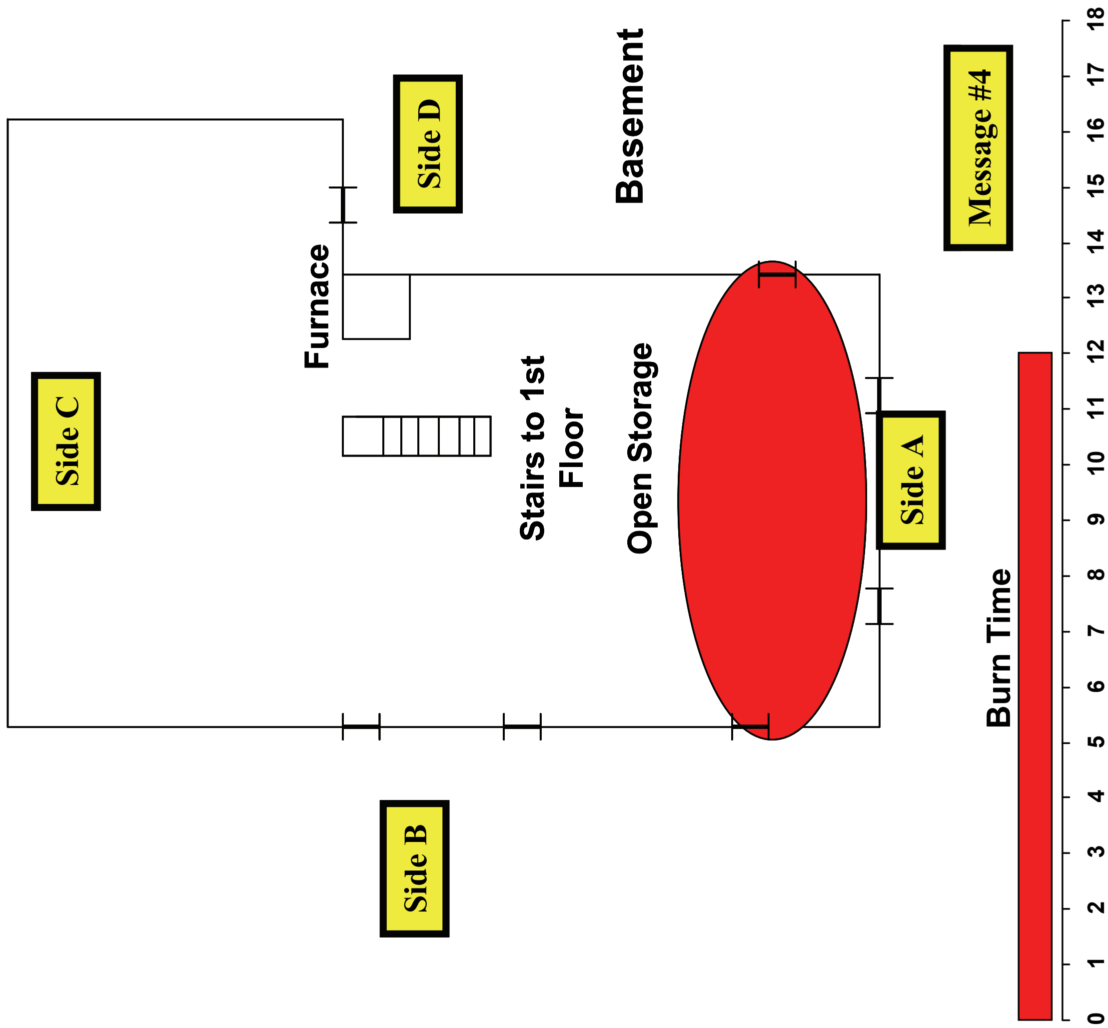
Iteration 2--Message 2

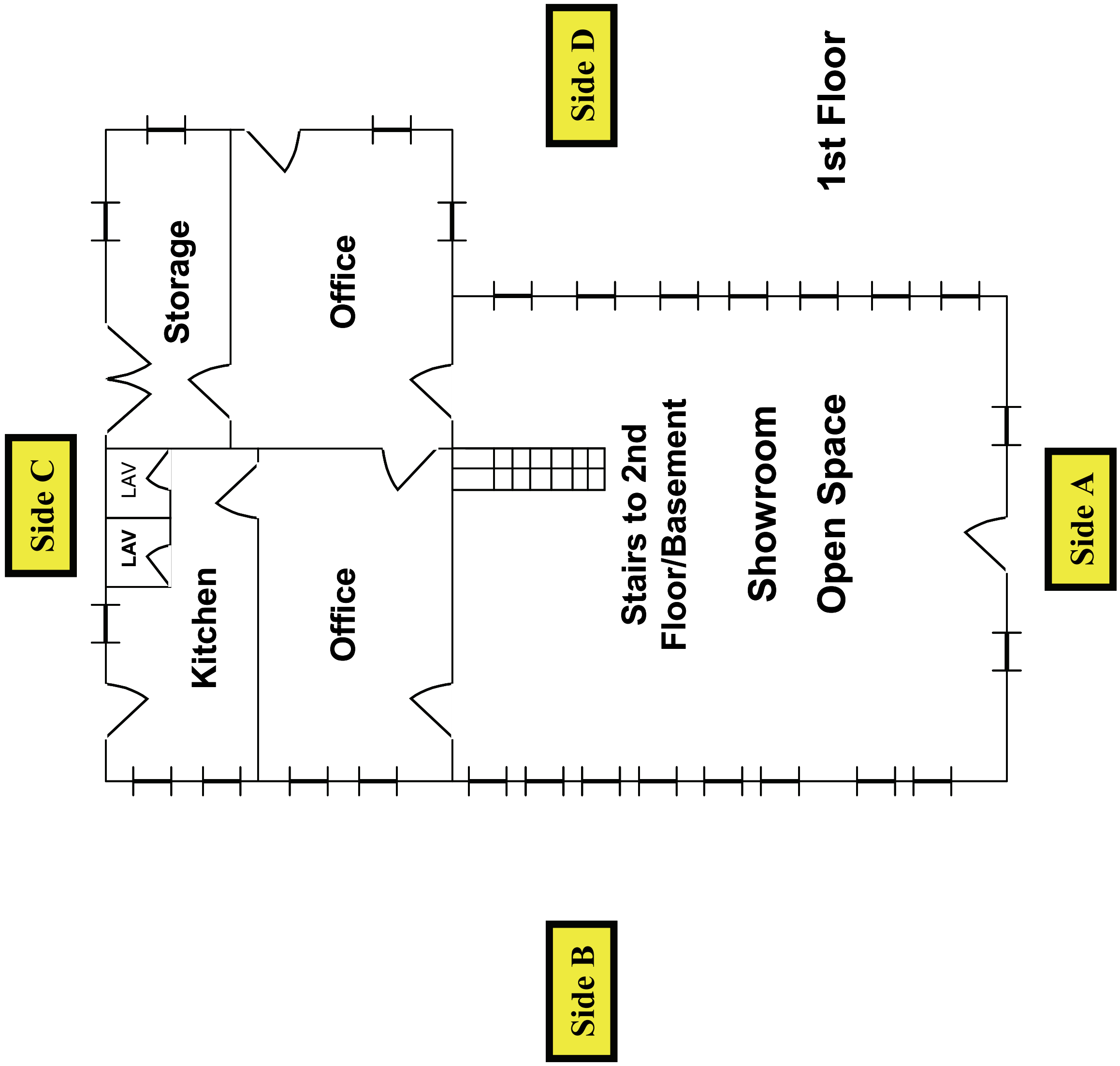


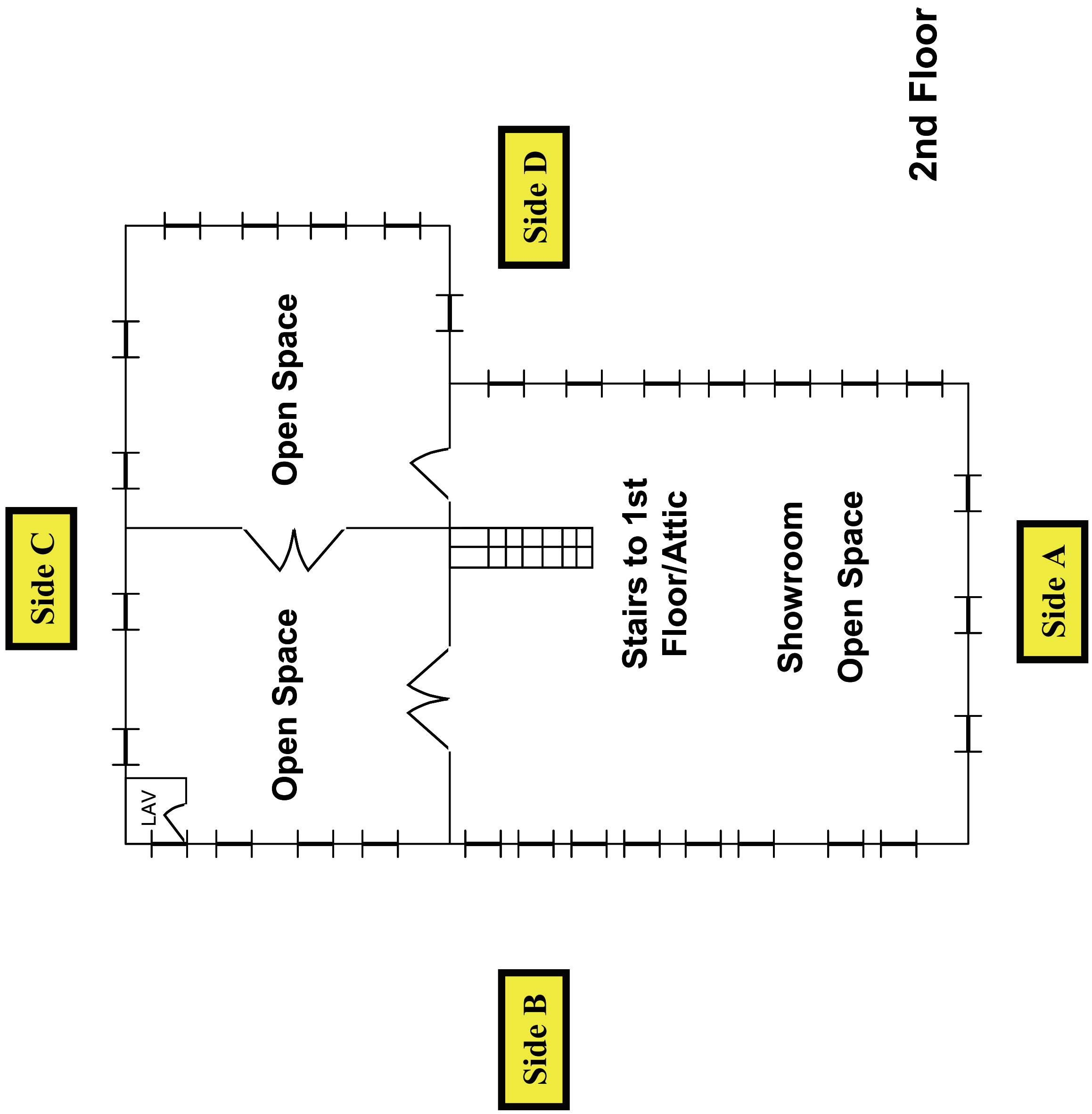
Iteration 2--Message 3

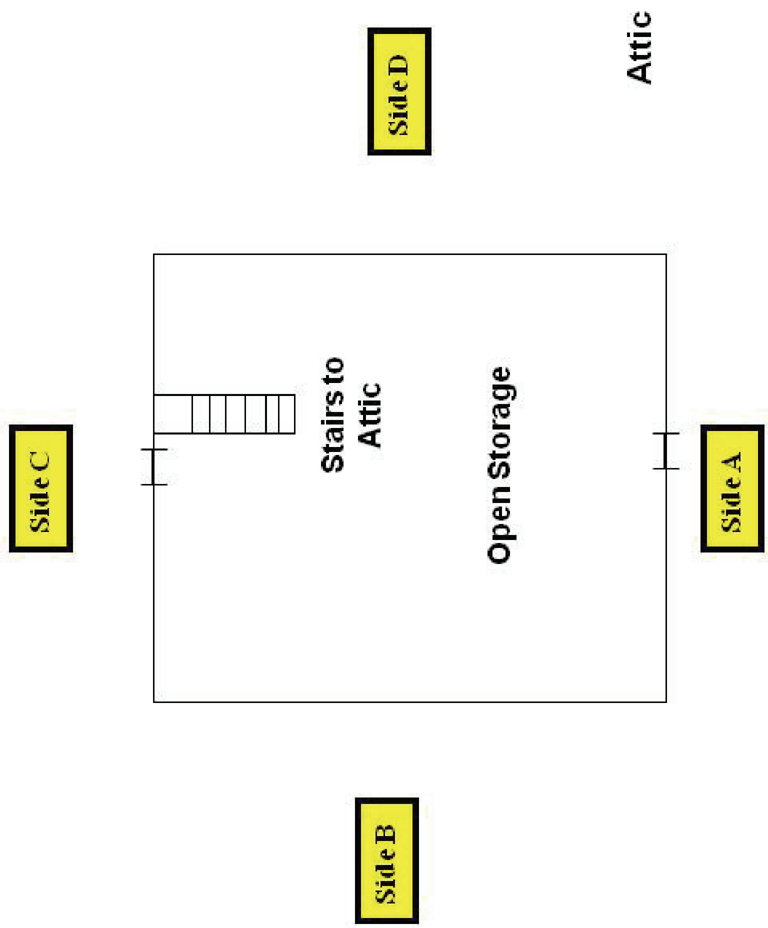


Iteration 2--Message 4

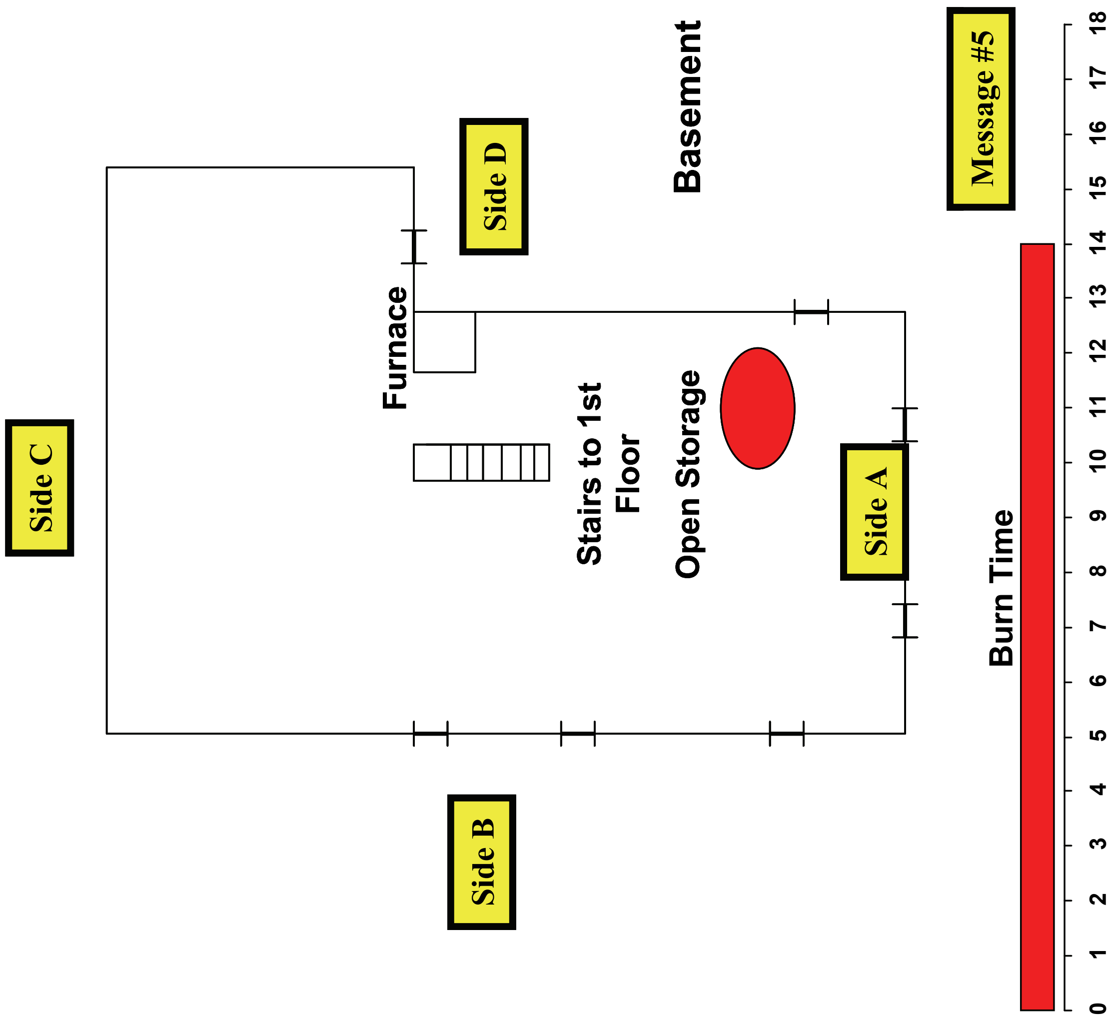


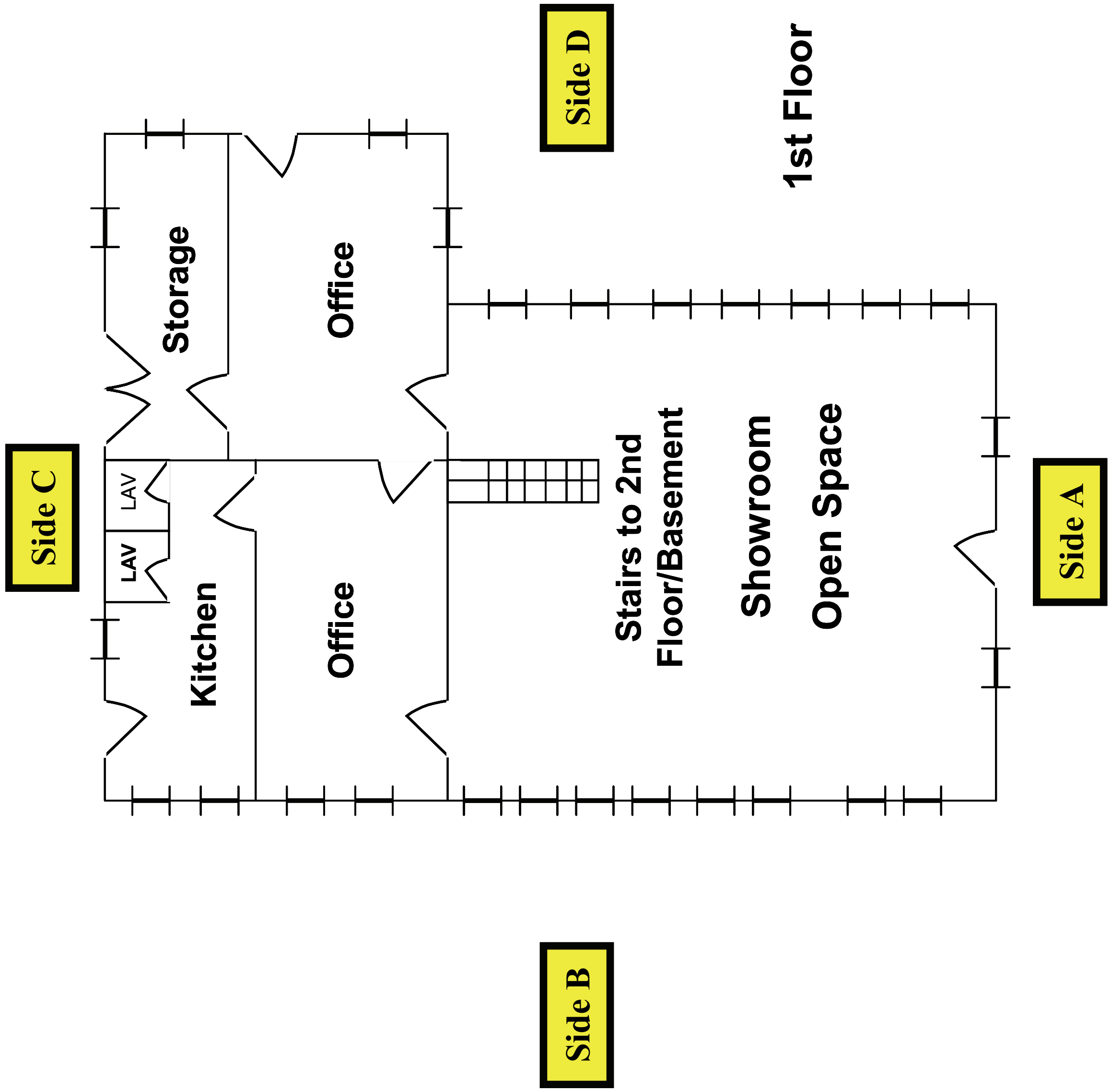

Side D
1st Floor
Storage
Office
Side C
LAV
LAV
Kitchen
Office
Stairs to 2nd Floor/Basement
Showroom
Open Space
Side A
Side B

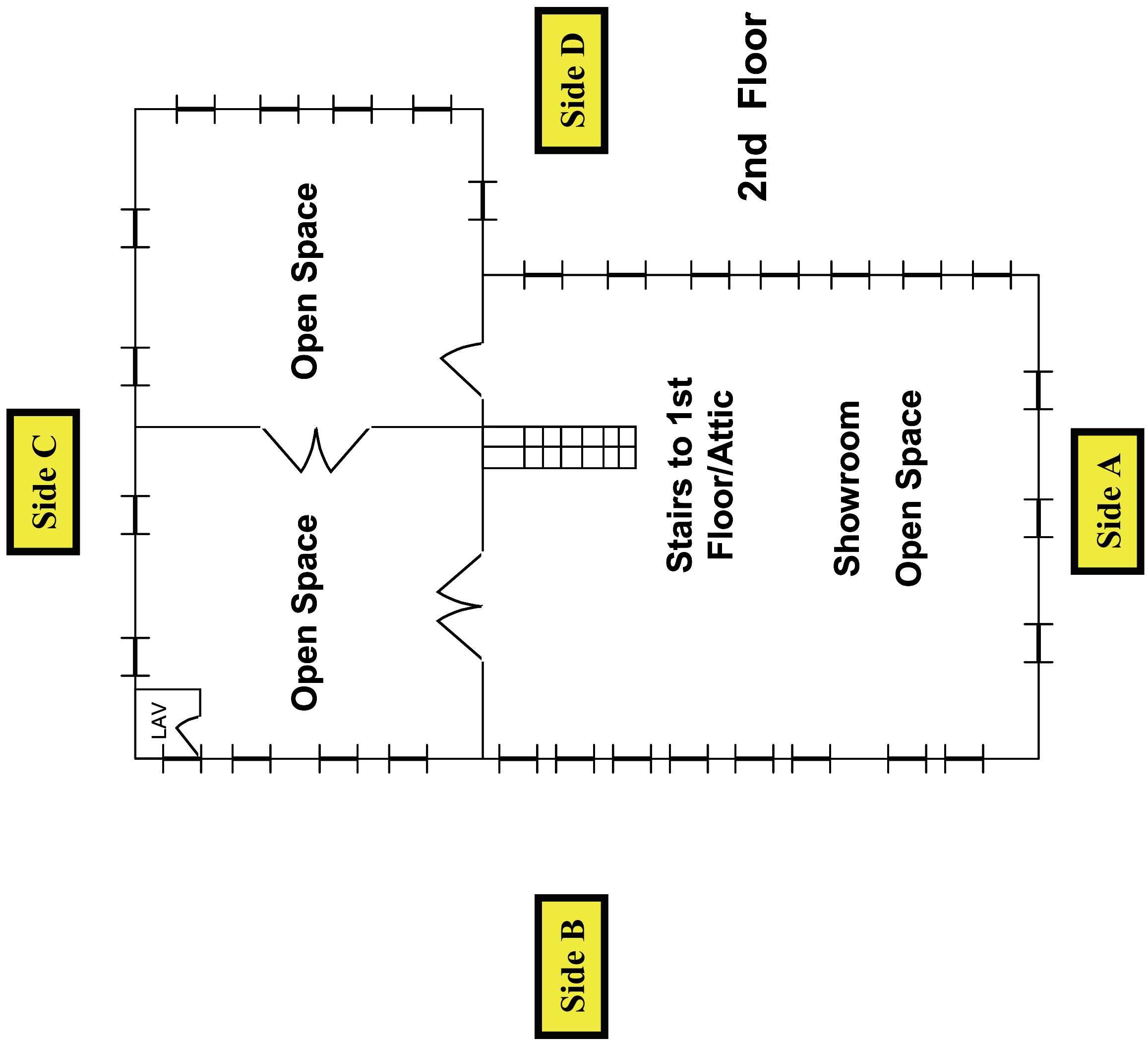

2nd Floor
Side A
Side B
Side C
Side D
Showroom
Open Space
Stairs to 1st
Floor/Attic
Open Space
Open Space
LAV

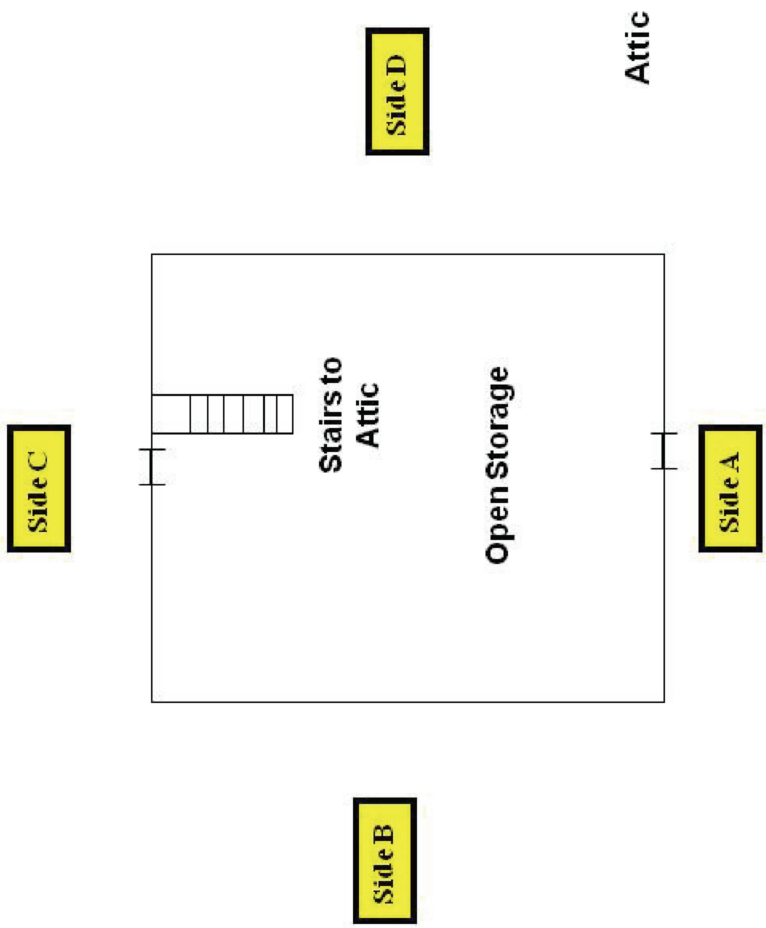

Attic
Side D
Stairs to
Attic
Open Storage
Side C
Side A
Side B

Iteration 3--Message 5

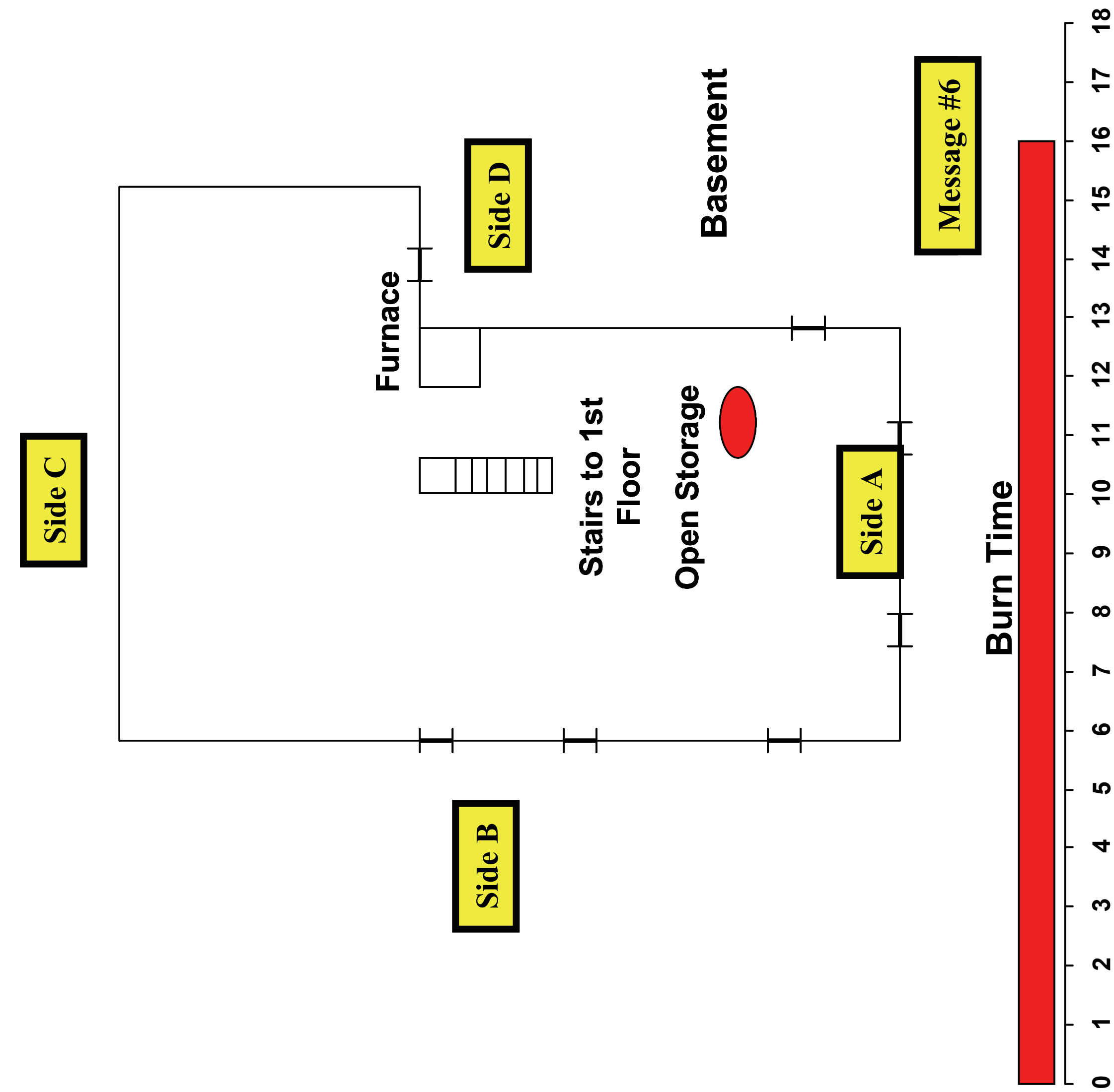



1st Floor
Side A
Side B
Side C
Side D
Showroom
Open Space
Stairs to 2nd
Floor/Basement
Office
Office
Storage
Kitchen
LAV
LAV

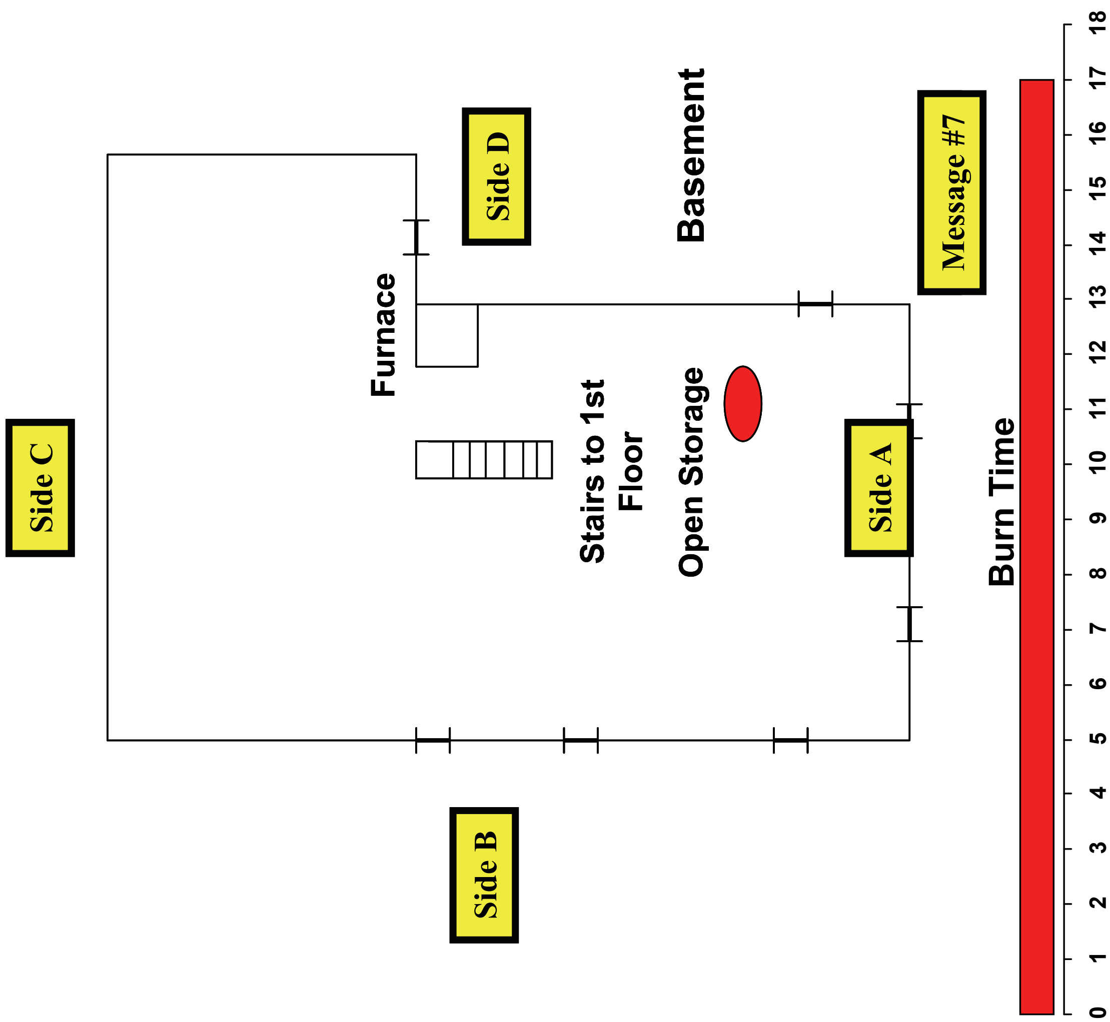

Side D
2nd Floor
Open Space
Side C
Open Space
LAV
Stairs to 1st Floor/Attic
Showroom
Open Space
Side A
Side B


Attic
Side D
Stairs to Attic
Open Storage
Side C
Side A
Side B

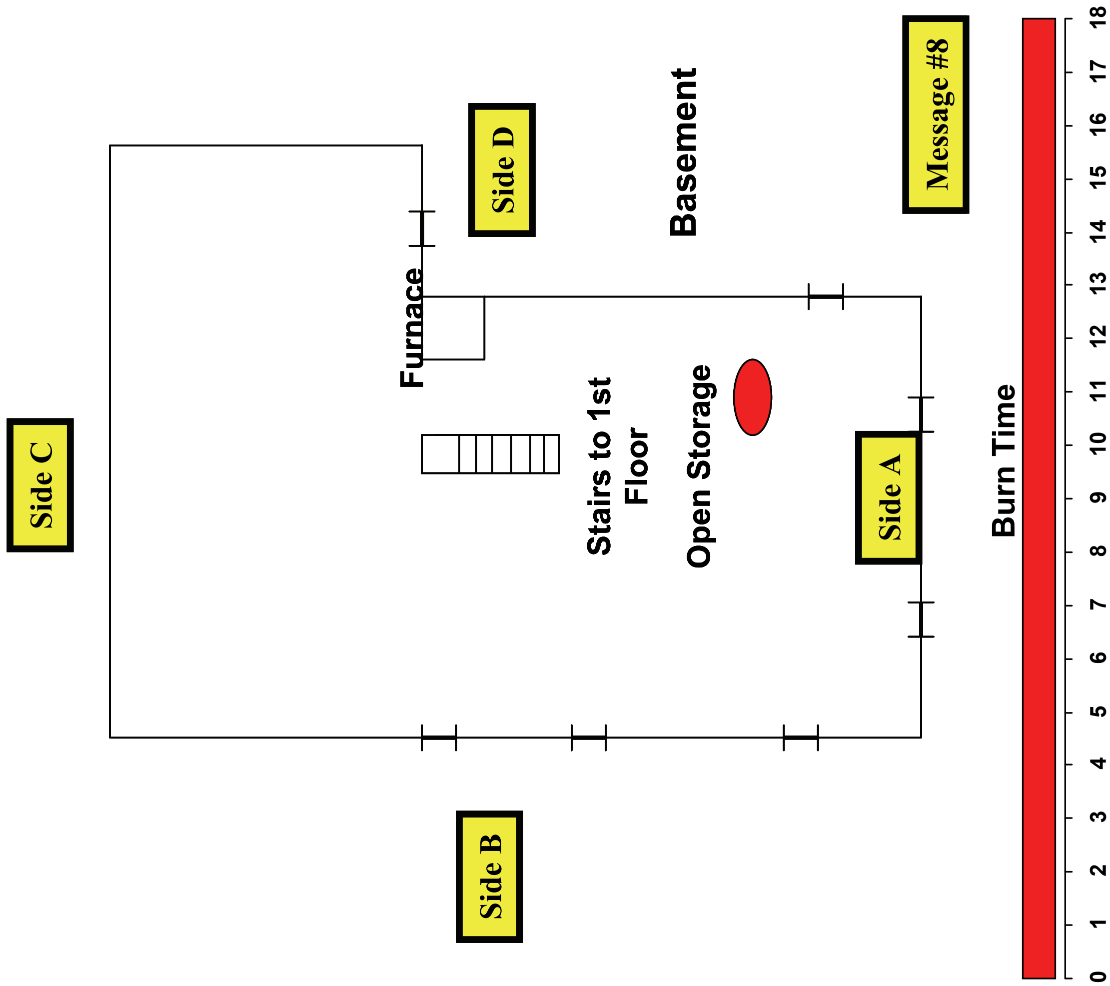
Iteration 4--Message 6

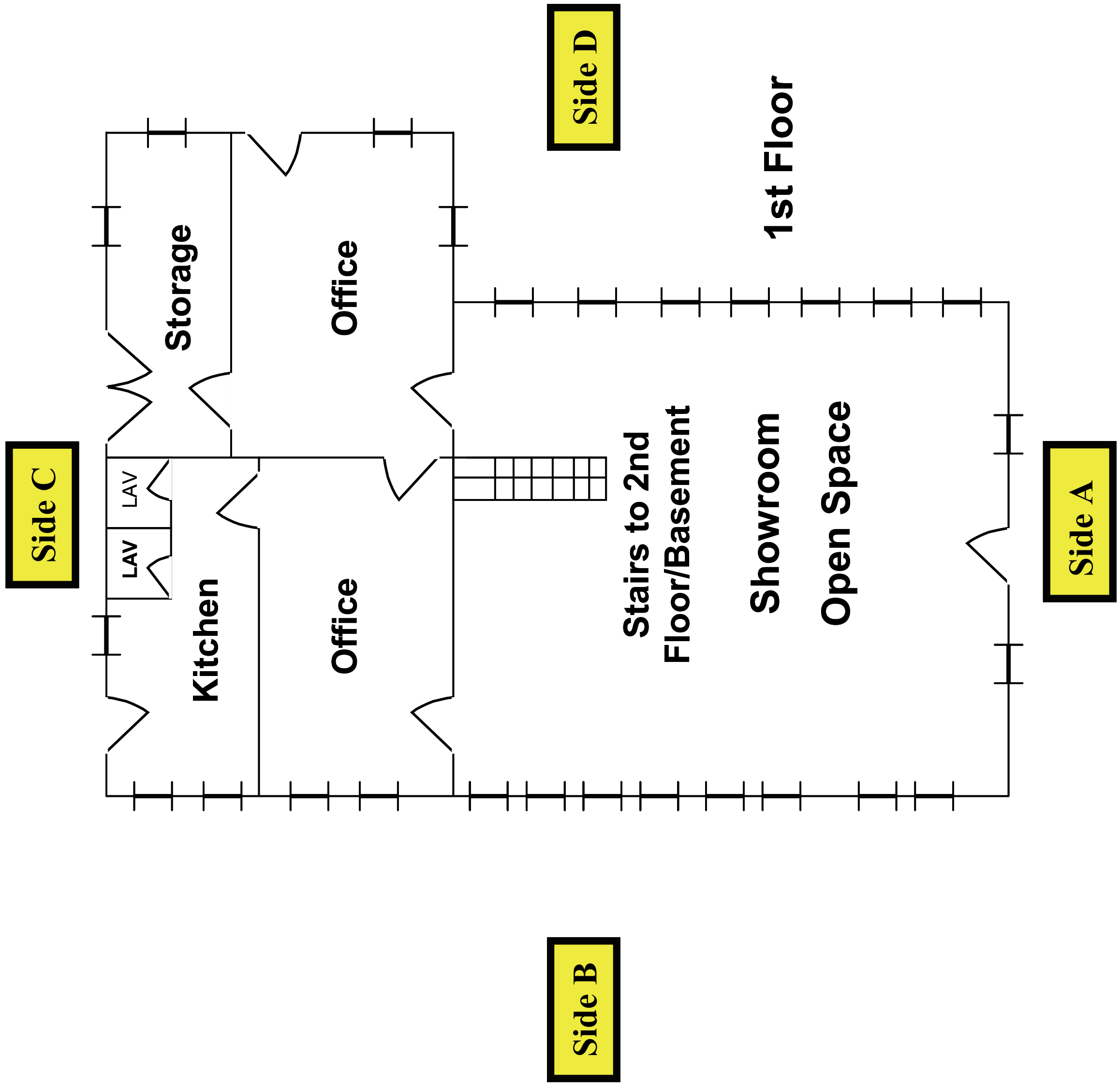


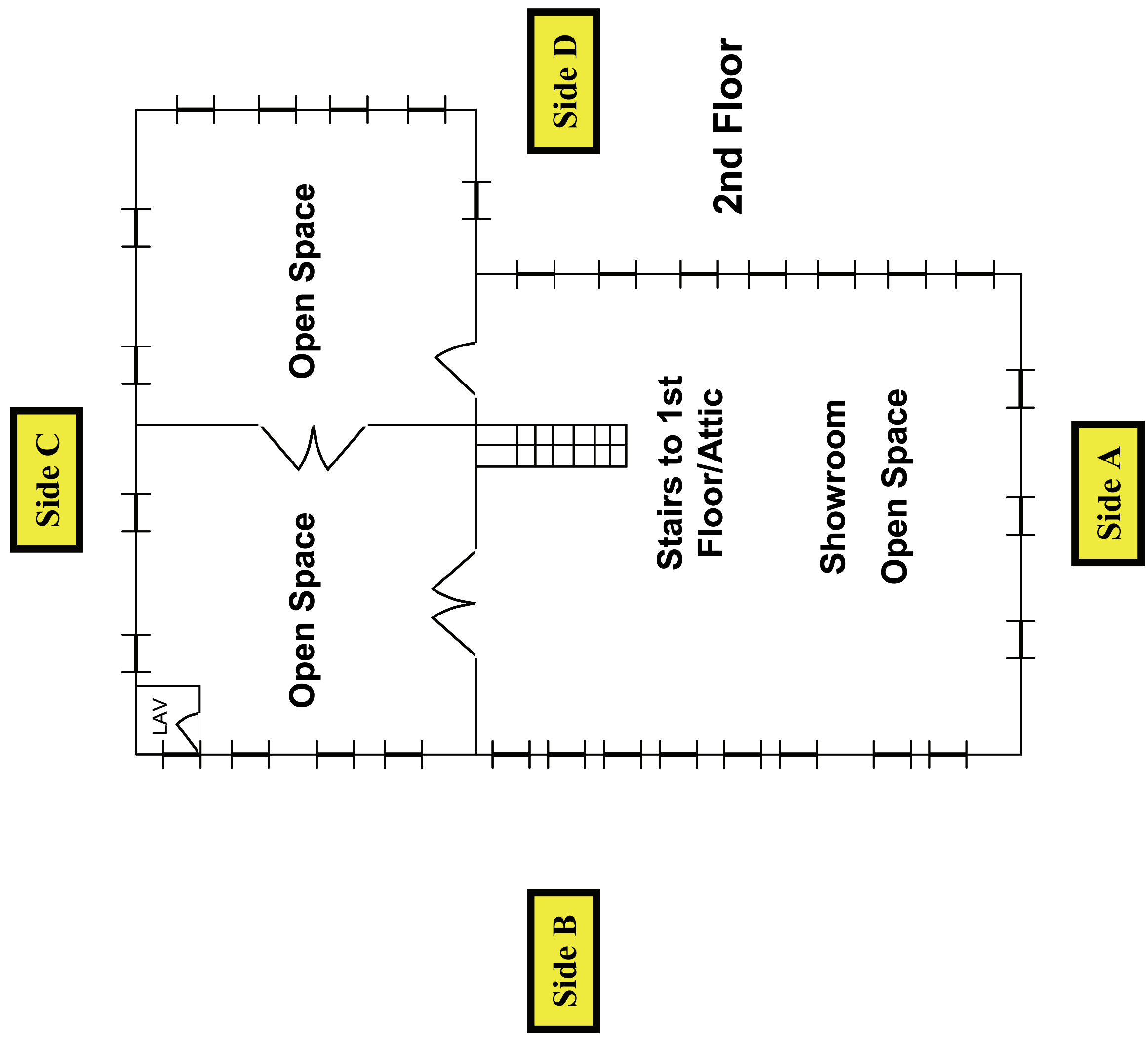
Iteration 4--Message 7

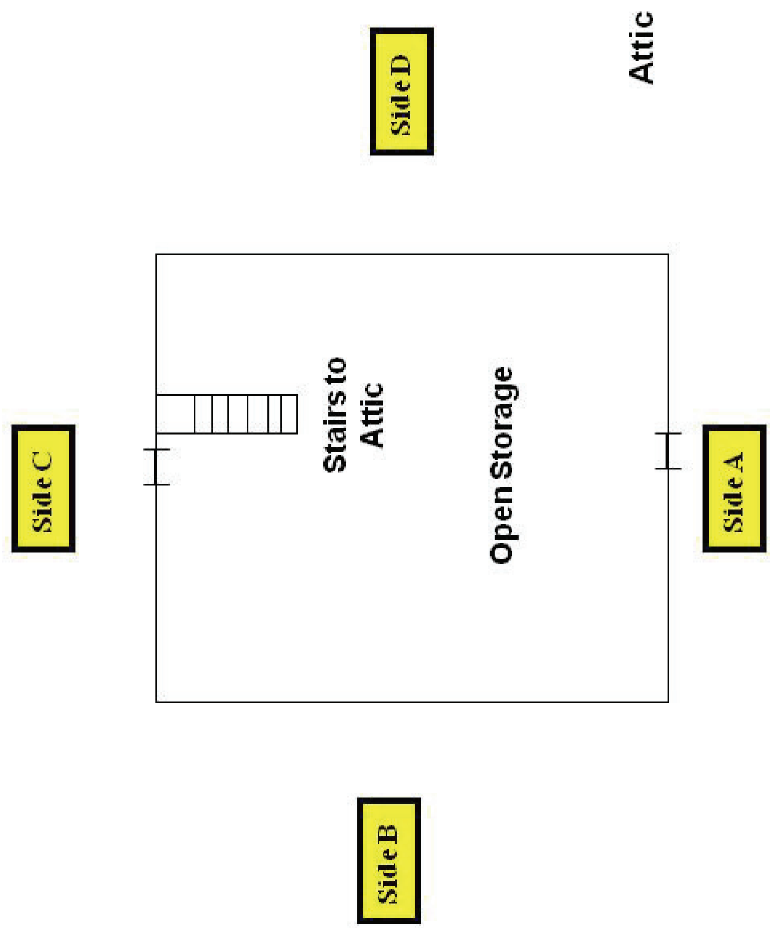


Iteration 4--Message 8




Side D
1st Floor
Storage
Office
Showroom
Open Space
Stairs to 2nd
Floor/Basement
Side C
LAV
LAV
Kitchen
Office
Side A
Side B


Side D
2nd Floor
Open Space
Open Space
Side C
LAV
Stairs to 1st Floor/Attic
Showroom
Open Space
Side A
Side B


Attic
Side D
Side C
Stairs to Attic
Open Storage
Side A
Side B

Activity 7.1 (cont'd)

Large Group Exercise #5: Shopping Center

Purpose

To allow you to demonstrate your knowledge, skills, and abilities (KSAs) you have gained as a result of attending this course. Conduct a walk-around of exposures A-B-C-D of the structures that will be seen in the exercise.

There can be up to seven structures used in the activity.

Directions

1. You will be working in small groups.

2. Each group will do each construction type. Exercise is designed to place the **ICO** as the Incident Commander (IC) until relieved by the next level of authority arriving at the incident. (This will be your instructor.)

3. For this simulation the **ICO** will have additional students assigned to Command and General Staff positions, which under normal field conditions would be the sole responsibility of the ICO.

4. Student group assignments for each group:

    a. ICO.

    b. ICOA--scribe.

    c. IISO.

    d. Initial Planning Section--Situation Unit.

    e. Initial Logistics Section--service and support.

5. Your group will record your predictions on an easel pad or paper.

6. Your group will select a spokesperson to explain to the class how fire would travel in this building.

7. Throughout the activity you will receive messages from the instructor.

8. In this portion of exercise your group is to concentrate on Column 1 Primary Factors Chart. You will have 10 minutes to complete this portion of the activity.

9. The ICOA-scribe shall develop a Primary Factors Exercise Chart on an easel pad for his/her assigned exercise scenario.

   a. Identify the most pertinent primary factors for each exercise scenario.

   b. Place findings on Column 1 of the Primary Factors Exercise Chart.

   c. Identify the most pertinent subfactors for each identified primary factor for exercise scenario. Place findings on Column 2 of the Primary Factors Exercise Chart.

   d. Identify pertinent precautions that will be taken to address each identified sub-factor for exercise scenario. Place findings on Column 3 of the Primary Factors Exercise Chart.

Activity 7.1 (cont'd)

Primary Factors Chart

Column #1
Primary Factor - Situation Awareness- Chart

Primary Factors	(Check appropriate boxes) Pertinent Sub-Factors (P)	P
Life Hazard	Occupants	
	Firefighters	
Location/Fire	Fire Building on Arrival– Burn Time	
	Exposures On Arrival - Burn Time	
	Fire Spread Considerations Radiation/Conduction/Convection	
Construction	Fire Building – Type 1-2-3-4-5 (Lightweight Awareness)	
	Exposures – Type 1-2-3-4-5 (Lightweight Awareness)	
Occupancy (Contents)	Fire Building – (Fuel Load)	
	Exposures (Fuel Load)	
Height	Fire Building (Front-Rear)	
	Exposures (Front-Rear)	
Area	Fire Building/Configuration	
	Proximity of Exposures /Configuration	
Structural Collapse	Fire Building – Burn Clock After Arrival	
	Exposures – Burn Clock After Arrival	
	Collapse Zone – Safe Corridors	
	Apparatus Placement	
Weather	Visibility	
	Temperature/Humidity	
	Wind – Direction/Velocity	
Resource Requirement	Apparatus/Personnel/Equipment - RIT	
	Water Supply/Suppression Agent	
Auxiliary Appliances	Fire Building Supplied	
	Exposures Supplied	
Topography	Front-Rear	
Explosions/ Back Draft	Proper Ventilation Flash-Over Time Awareness	
Time	Time of Day Time of Year Duration of Incident	

Column #2
Incident Objectives
Attainable/ Measurable/ Flexible

Examples of Incident Objectives:

- Safe Removal of All Occupants within 10 minutes.
- Contain and Control Fire to Room/Building of Origin within 10 minutes
- Contain, Control and Limit Fire in Exposures within 10 minutes
- Other.

List Incident Objectives:

1. ______________________________
____
2. ______________________________
____
3. ______________________________
____
4. ______________________________
____
5. ______________________________
____

Column #3
Activities (Strategies) / **Column #4 Evaluate Effect of Activities (Strategies) Every 10 Minutes**

Column #3 Activities (Strategies)	Effective	Ineffective
[R] Rescue • Interior/Exterior/Both		
[E] Exposure Protection • Exposure Examination		
[C/E] Confinement/Extinguishment • Hose Line Placement		
[O] Overhaul • Expose Hidden Fire		
[V] Ventilation • Removal of Occupants • Fire Control		
[S] Salvage • Water – Run-Off • Apply Covers		
Forcible Entry • Location • Method		
Special Equipment • Imaging Cameras		

List Incident Strategies	Assign Tactics:
For Objective # 1:	
For Objective # 2:	:
For Objective # 3:	
For Objective # 4:	
For Objective # 5:	
____________________	

Identify alternative strategies for firefighter safety when occupant safety has been determined not to be a Primary Factor.

- ______________________
- ______________________
- ______________________
- ______________________
- ______________________
- ______________________
- ______________________

Activity 7.1 (cont'd)

Primary Factors Exercise Chart

Pertinent Primary Factor	Pertinent Subfactor	Pertinent Precautions To Be Taken
1.	1. 2.	1. 2.
2.	1. 2. 3.	1. 2. 3.
3.	1. 2.	1. 2.
4.	1. 2.	1. 2.
5.	1. 2.	1. 2.
6.	1. 2.	1. 2.
7.	1. 2. 3. 4.	1. 2. 3. 4.
8.	1. 2. 3.	1. 2. 3.
9.	1. 2.	1. 2.
10.	1. 2.	1. 2.
11.	1.	1.
12.	1. 2.	1. 2.
13.	1. 2.	1. 2.

LARGE EXERCISE #5
Vital Building Information
Situation Report

<u>COMMERCIAL--TYPE V--FRAME</u>

Structure:	Shopping center, 40 by 100 feet 5 one-story occupancies 20 by 40 feet--various tenants
Building Construction:	Type V--frame
Roof Construction:	2- by 6-inch truss roof support system Common attic storage
Floors:	Concrete slab
Alarm System:	Smoke detectors installed
Occupants:	Restaurants/Offices
Special Concerns:	Commercial cooking facilities High-occupancy restaurant

Situation Report:

Fire Building:

It is October 15, Friday 1230 hours, temperature is 47 °F (8 °C), wind from south at 12 mph.

Upon arrival, several people are outside the building on Side A. The manager of Quizno's Sub reports an explosion occurred in Quizno's. He is suffering from severe burns of his arms, neck, and back. He said just before the explosion that he smelled gas. One employee is missing. Four Quizno customers are outside suffering from smoke inhalation. Occupants of Powell's Insurance and Chris' Steak House are exiting the building.

Exposures:

Each occupancy has attic storage. Attic access is located near the rear of the building.

Activity 7.1 (cont'd)

Objectives-Strategy-Tactics Chart

1. Use the enlarged Objectives-Strategy-Tactics Chart or easel pad.

2. Refer back the Primary Factors Exercise materials in Unit 4: The Analytical Sizeup Process if necessary.

3. Place Slide Iteration #2 for Sides A-B-C-D for each scenario chosen.

4. Receive and act on Exercise Message #2 and Plot Plan #2.

5. Concentrate on Columns 2 and 3 and develop the Objectives-Strategy-Tactics for the scenario.

6. ICOA scribe shall develop an easel pad for Objectives-Strategy-Tactics for assigned exercise scenario. (You have 20 minutes to complete.)

   a. Column 1: Identify the first operational period objectives for the scenario.

   b. Column 2: Identify the first operational period strategies for each objective.

   c. Column 3: Identify the first operational period tactics for each strategy.

   d. Column 4: Assign companies to perform tactics.

Each scenario has first alarm structural resources available at start of exercise:

- Engine 1
- Engine 2
- Engine 3
- Ladder 1
- Basic Life Support (BLS) 1

Each scenario will have working incident structural resources arrive 10 minutes into incident.

- **Engine 5**
- Engine 6
- **Squad 1**
- Engine 6 (Rapid Intervention Crew (RIC))
- Air Cascade-1 FF
- Safety Officer

Central City Fire EMS Dispatch Criteria

Assignment	Alarm Type	Engine	Ladder	Squad	Battalion Chief	EMS Unit	RIC	Safety Officer	Air Cascade
First Alarm	Structural	3	1			1 BLS			
Working Incident	Structural	2		1	1		1	1	1
First Alarm	Target Hazard	3	2	1	1	1 BLS			
Working Incident	Target Hazard	2				1 ALS	1	1	1
Second Alarm	Structural/ Target Hazard	2	1		1	1EMS		1	1
Third Alarm	Structural/ Target Hazard	2	1			1 MS			
Fourth Alarm	Structural/ Target Hazard	2	1		1				

Central City Fire/EMS Staffing:

- **Engine-Ladder-Squad Company--1 Officer--3 Firefighters**
- **Rapid Intervention Crew (RIC)--One Engine Company**
- **EMS BLS Unit--2 EMT Basic**
- **EMS ALS Unit--2 EMT Paramedic**
- **Air Cascade - 1 Firefighter**

A second alarm may be requested but will not arrive on scene before end of exercise.

Activity 7.1 (cont'd)

Objectives-Strategy-Tactics Chart

Objectives	Strategy (s)	Tactics	Assigned to:
Objective #1	**1.**	**1.** **2.** **3.**	**1.** **2.** **3.**
	2.	**1.** **2.** **3.**	**1.** **2.** **3.**
	3.	**1.** **2.** **3.**	**1.** **2.** **3.**
Objective #2	**1.**	**1.** **2.** **3.**	**1.** **2.** **3.**
	2.	**1.** **2.** **3.**	**1.** **2.** **3.**
	3.	**1.** **2.** **3.**	**1.** **2.** **3.**
Objective #3	**1.**	**1.** **2.** **3.**	**1.** **2.** **3.**
	2.	**1.** **2.** **3.**	**1.** **2.** **3.**
	3.	**1.** **2.** **3.**	**1.** **2.** **3.**

Activity 7.1 (cont'd)

ICS Form 201, *Incident Debriefing* and ICS Form 214, *Unit Log*

1. Use the enlarged ICS Form 214, *Unit Log* or easel pad.

2. The ICOA will maintain ICS Form 214 for all tactical decisions made by the ICO along with other pertinent messages and decisions made by the ICO during the exercise. Entries should be recorded under Time and Major Events columns.

3. Distribute ICS Form 214.

    a. IISO.

    b. Initial Planning Section (Situation Unit).

    c. Initial Logistics Section (Service and Support).

4. Distribute ICS Form 201, *Incident Debriefing* (enlarged to 11 by 17).

    a. Initial Planning Section (Situation Unit).

    b. Initial Logistics Section (Service and Support).

5. Begin exercise scenario message distribution.

6. Follow message distribution time frames until all messages have been distributed. (You have 30 minutes.)

Activity 7.1 (cont'd)

Preparing for Exercise Debriefing

You have 15 minutes for each group to prepare their debriefing materials for presentation.

1. ICO.
   a. Primary Factors Chart.
   b. Objectives-Strategy-Tactics Chart.
2. Initial Company Officer Assistant--ICS Form 214.
3. Initial Safety Officer--ICS Form 214.
4. Initial Planning Section.
5. Initial Logistics Section--ICS Form 201.

Activity 7.1 (cont'd)

ICS Form 214, *Unit Log*

UNIT LOG	1. Incident Name	2. Date Prepared	3. Time Prepared
4. Unit Name/Designators	5. Unit Leader (Name and Position)		6. Operational Period

7. Personnel Roster Assigned		
Name	ICS Position	Home Base

8. Activity Log	
Time	Major Events

9. Prepared by (Name and Position)

Instructions for completing the Unit Log (ICS Form 214)

ITEM NUMBER	ITEM TITLE	INSTRUCTIONS
1.	Incident Name	Print the name assigned to the incident.
2.	Date Prepared	Enter date prepared (month, day, year).
3.	Time Prepared	Enter time prepared (24-hour clock).
4.	Unit Name	Enter the title of the organizational unit or resource designator (Engine 1 - Safety Officer, Situation Unit – Logistics Section).
5.	Unit Leader	Enter the name of the individual in charge of the Unit.
6.	Operational Period	Enter the time span covered by the log (e.g., 1800 Oct. 12 to 0600 Oct. 13).
7.	Personnel Roster	List the name, position, and home base of each member assigned to the unit during the operational period.
8.	Activity Log	Enter the time and briefly describe each significant occurrence or event (e.g., task assignments, task completions, injuries, difficulties encountered, etc.).
9.	Prepared By	Enter the name and title of the person approving the log. Provide log to immediate supervisor at the end of each operational period.

Activity 7.1 (cont'd)

ICS Form 201, *Incident Debriefing*

INCIDENT DEBRIEFING	1. INCIDENT NAME	2. DATE PREPARED	3. TIME PREPARED
4. MAP SKETCH			
ICS 201 (12/93) **NFES1325**	PAGE 1	5. PREPARED BY (NAME AND POSITION)	

6. SUMMARY OF CURRENT ACTIONS		
ICS 201	PAGE 2	

7. CURRENT ORGANIZATION		
ICS 201 (12/93) **NFES1325**	PAGE 3	

8. RESOURCES SUMMARY				
RESOURCES ORDERED	**RESOURCE IDENTIFICATION**	**ETA**	**ON SCENE √**	**LOCATION/ASSIGNMENT**
ICS 201 (12/93) **NFES 1325**	PAGE 4			

Instructions for completing the Incident Briefing (ICS Form 201)

ITEM NUMBER	ITEM TITLE	INSTRUCTIONS
1.	Incident Name	Print the name assigned to the incident.
2.	Date Prepared	Enter date prepared (month, day, year).
3.	Time Prepared	Enter time prepared (24-hour clock).
4.	Map Sketch	Show perimeter and control lines, resources assignments, incident facilities, and other special information on a sketch map or attached to the topographic or orthophoto map.
5.	Resources Summary	Enter the following information about the resources allocated to the incident. Enter the number and type of resource ordered.
	Resources Ordered	Enter the number and type of resource ordered.
	Resource Identification	Enter the agency three-letter designator, S/T, Kind/ Type and resource designator.
	ETA/On Scene	Enter the estimated arrival time and place the arrival time or a checkmark in the "on scene" column upon arrival.
	Location/ Assignment	Enter the assigned location of the resource and/or the actual assignment.
6.	Current Organization	Enter on the organization chart the names of the individuals assigned to each position. Modify the chart as necessary.
7.	Summary of Current Actions	Enter the strategy and tactics used on the incident and note any specific problem areas.
8.	Prepared By	Enter the name and position of the person completing the form.
*Note		Additional pages may be added to ICS Form 201 if needed.

Activity 7.1 (cont'd)

Debriefing Procedures

1. The instructor will debrief exercise scenarios with each group.

2. The instructor will display the slides for your group's scenario when debriefing.

3. Assigned ICO for each group shall present the following:

    a. Primary Factors Chart.

    b. Objectives-Strategy-Tactics Chart.

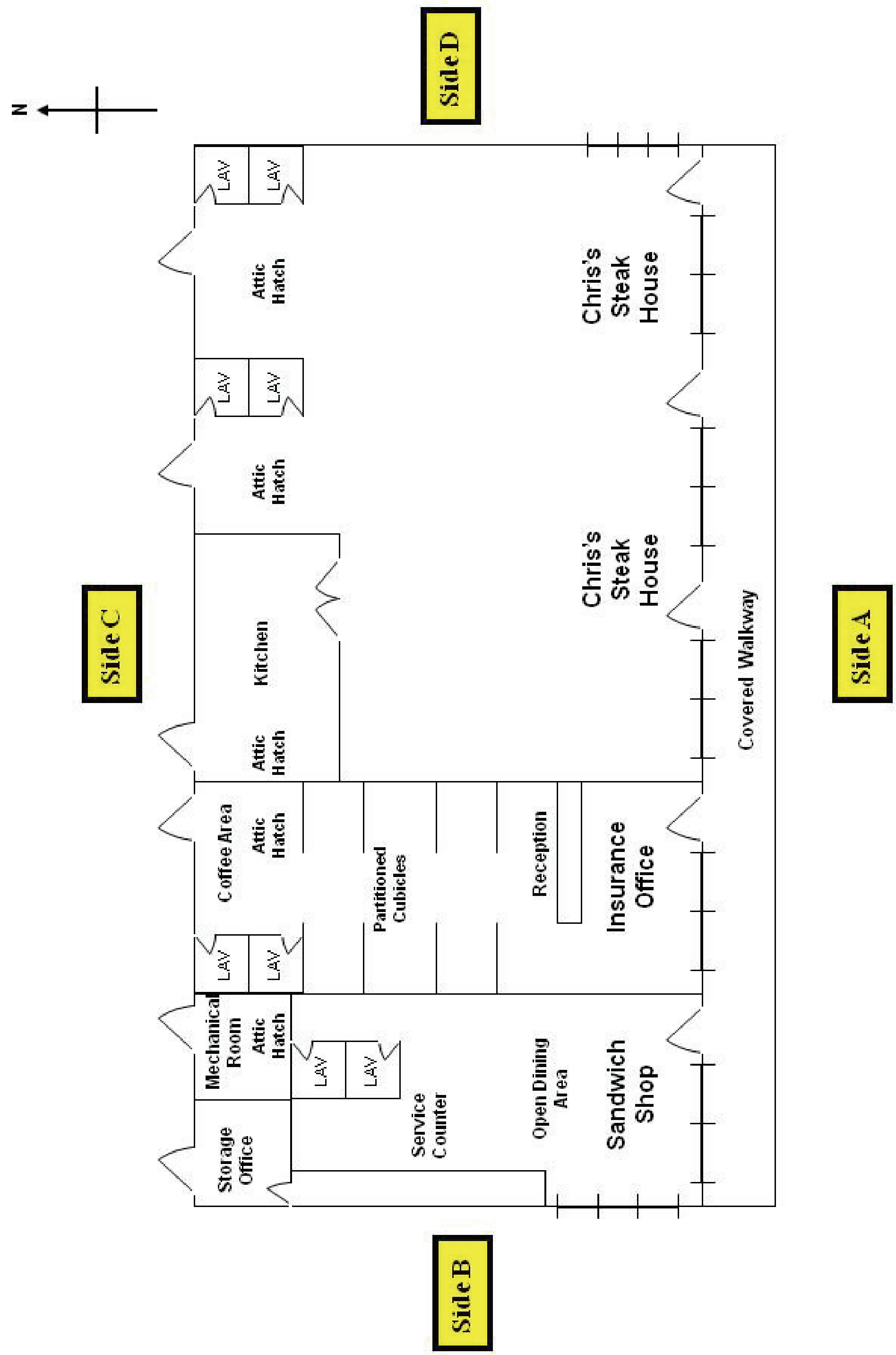
    c. ICS Form 214.

4. Each group will have 15 minutes to debrief.

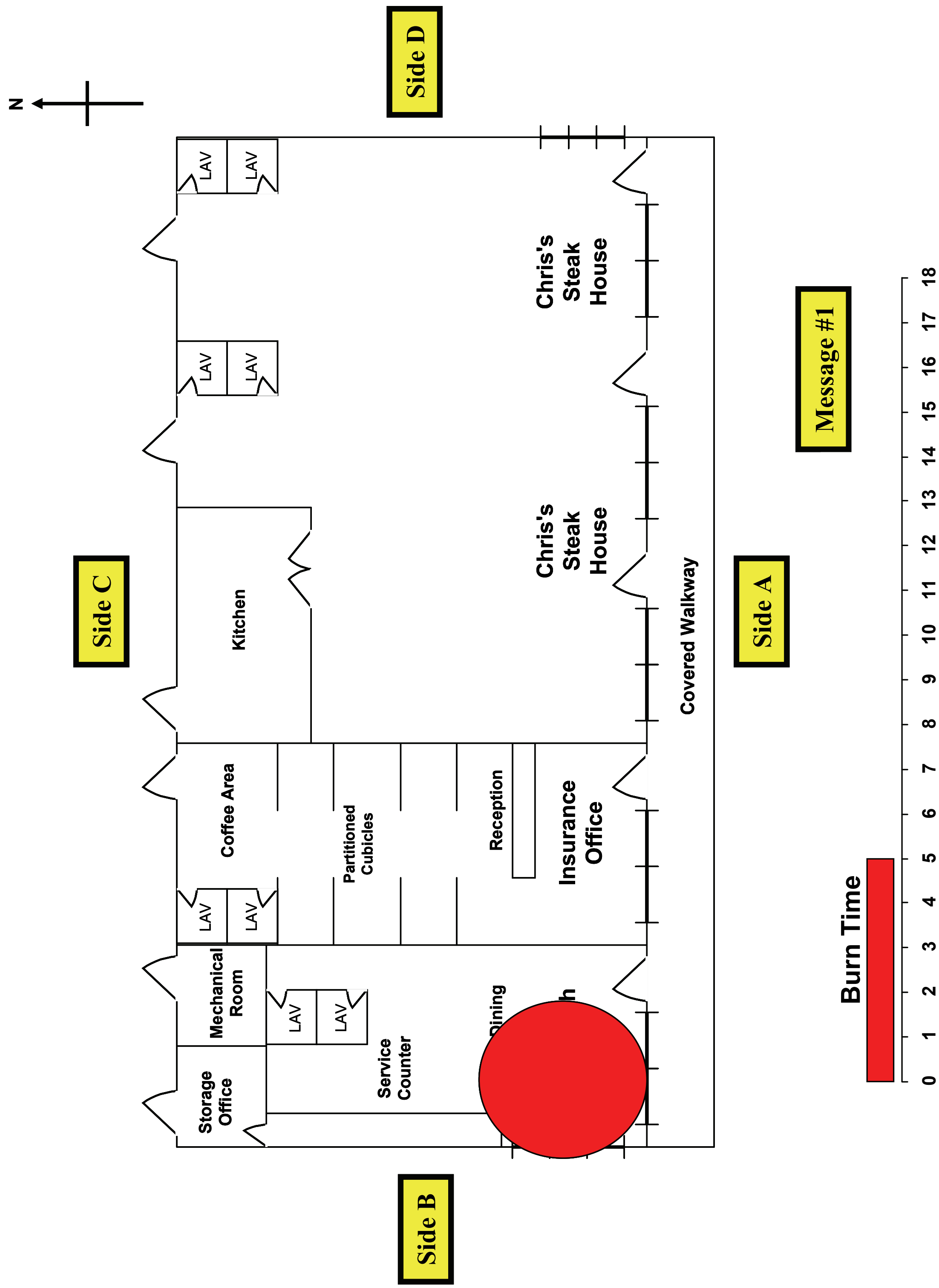
5. The instructor will address any specific issues that were omitted from charts and identify issues where improvement is required.

Activity 7.1 (cont'd)
Plot Plans
Exercise #5

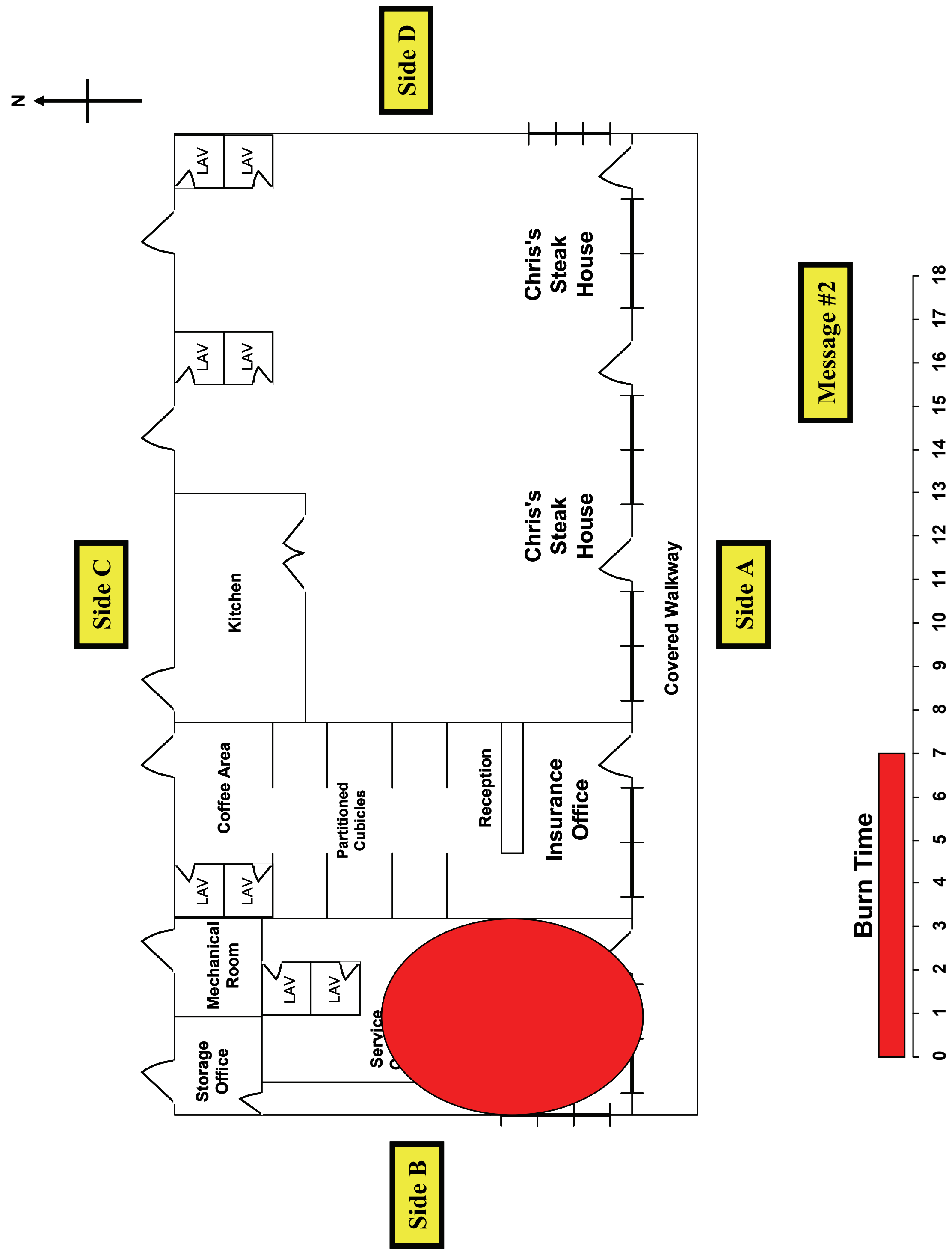
Shopping Center--Walkaround



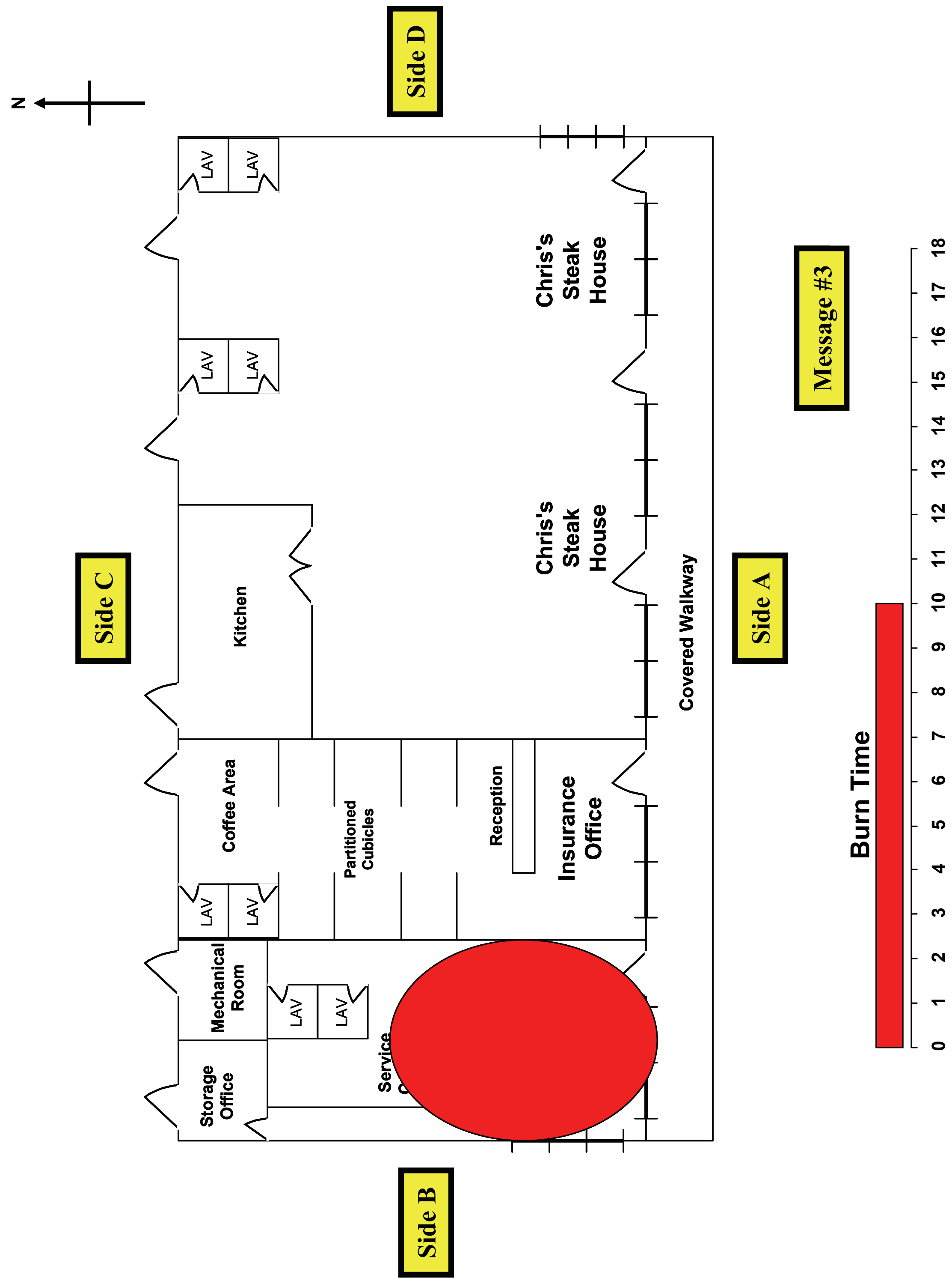
Iteration 1--Message 1



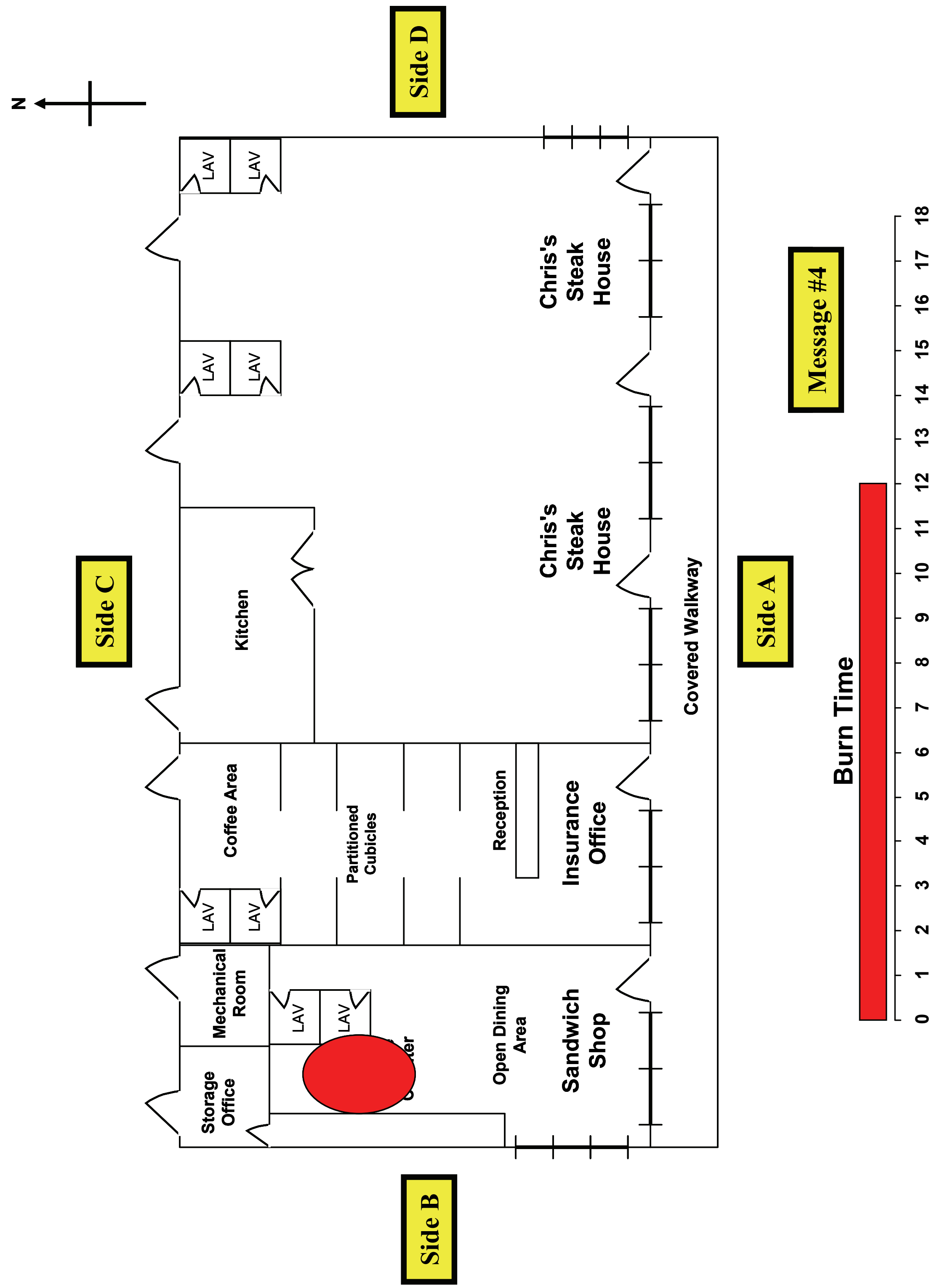
Iteration 2--Message 2



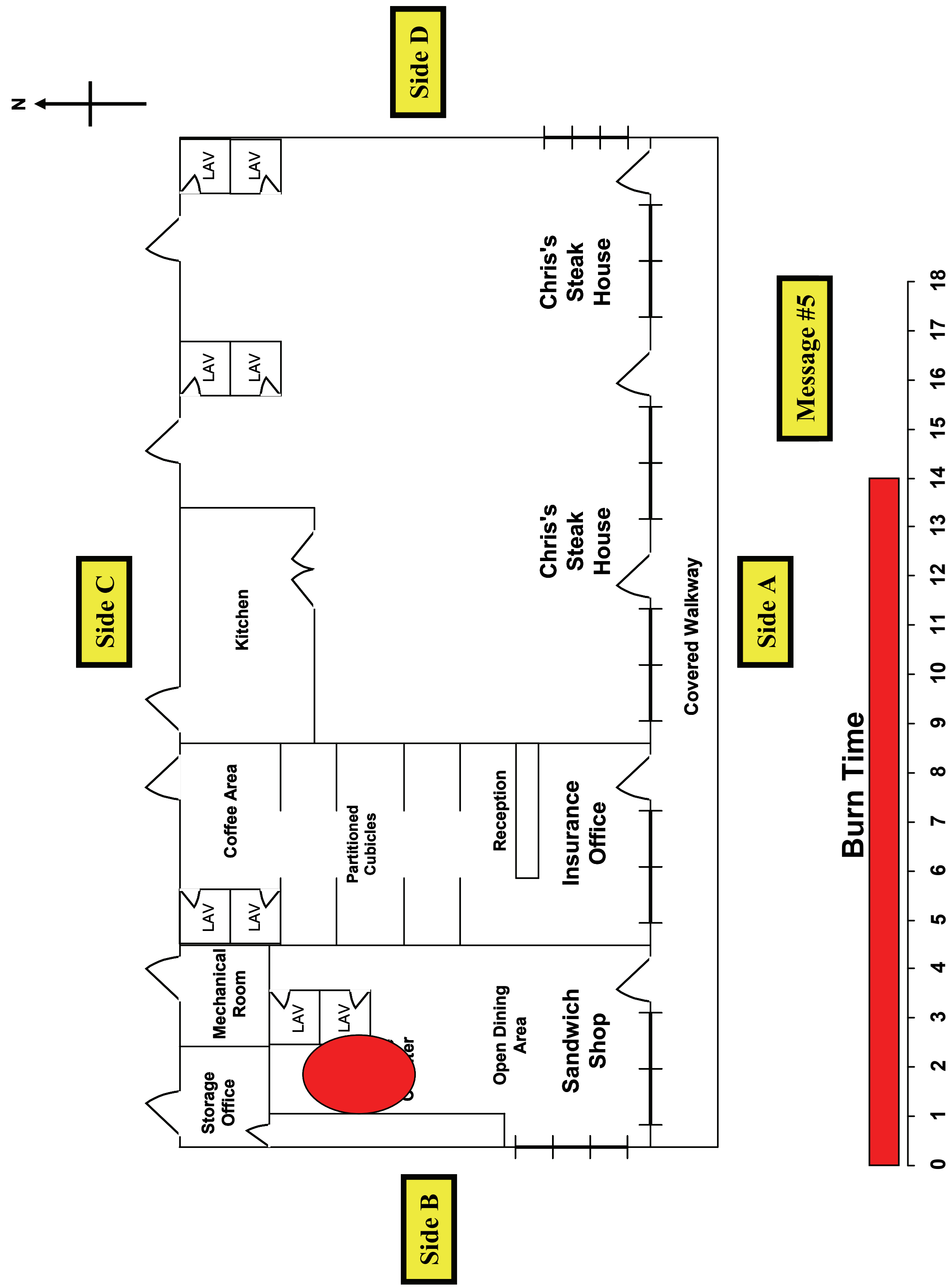
Iteration 2--Message 3



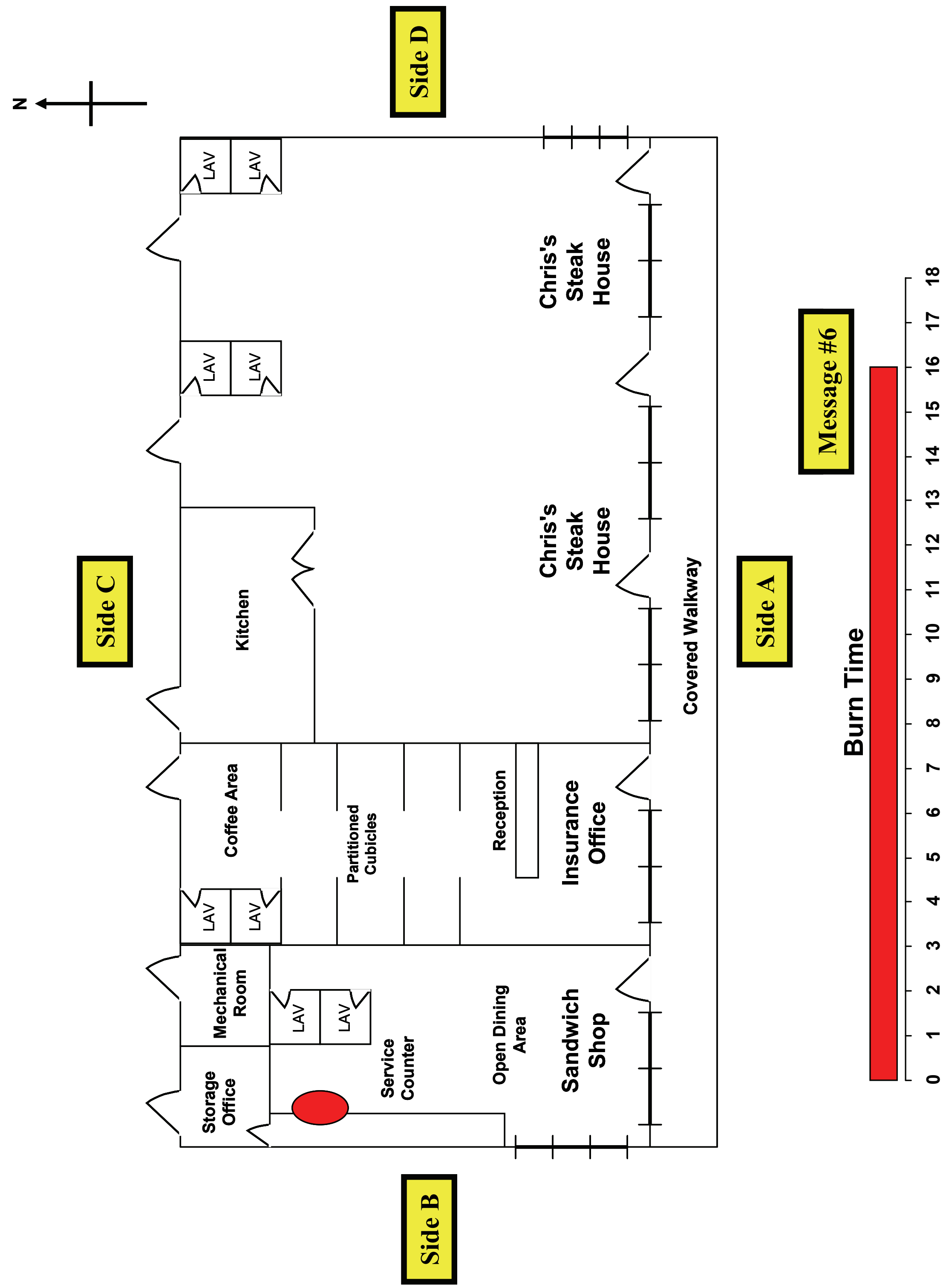
Iteration 3--Message 4



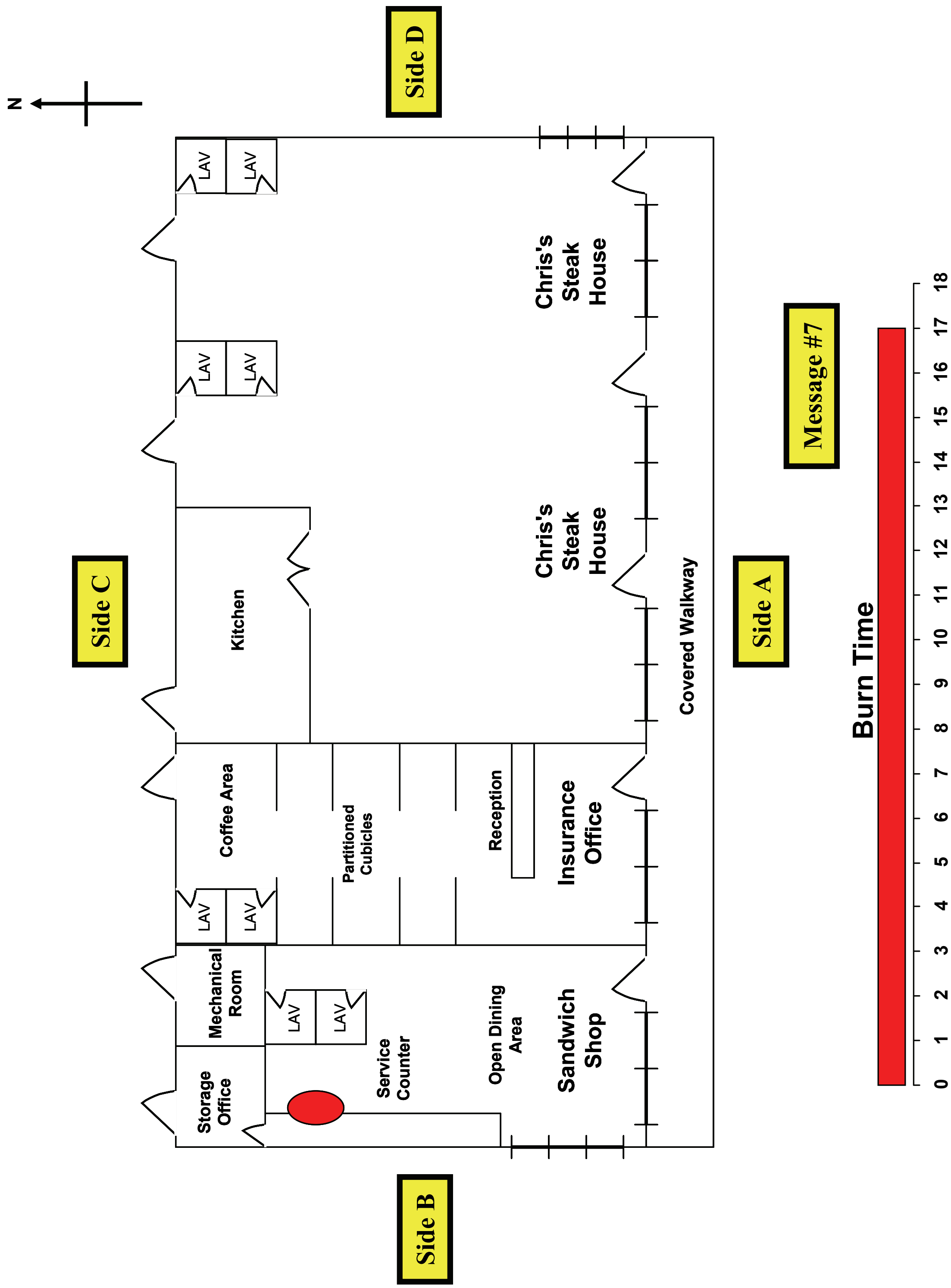
Iteration 3--Message 5



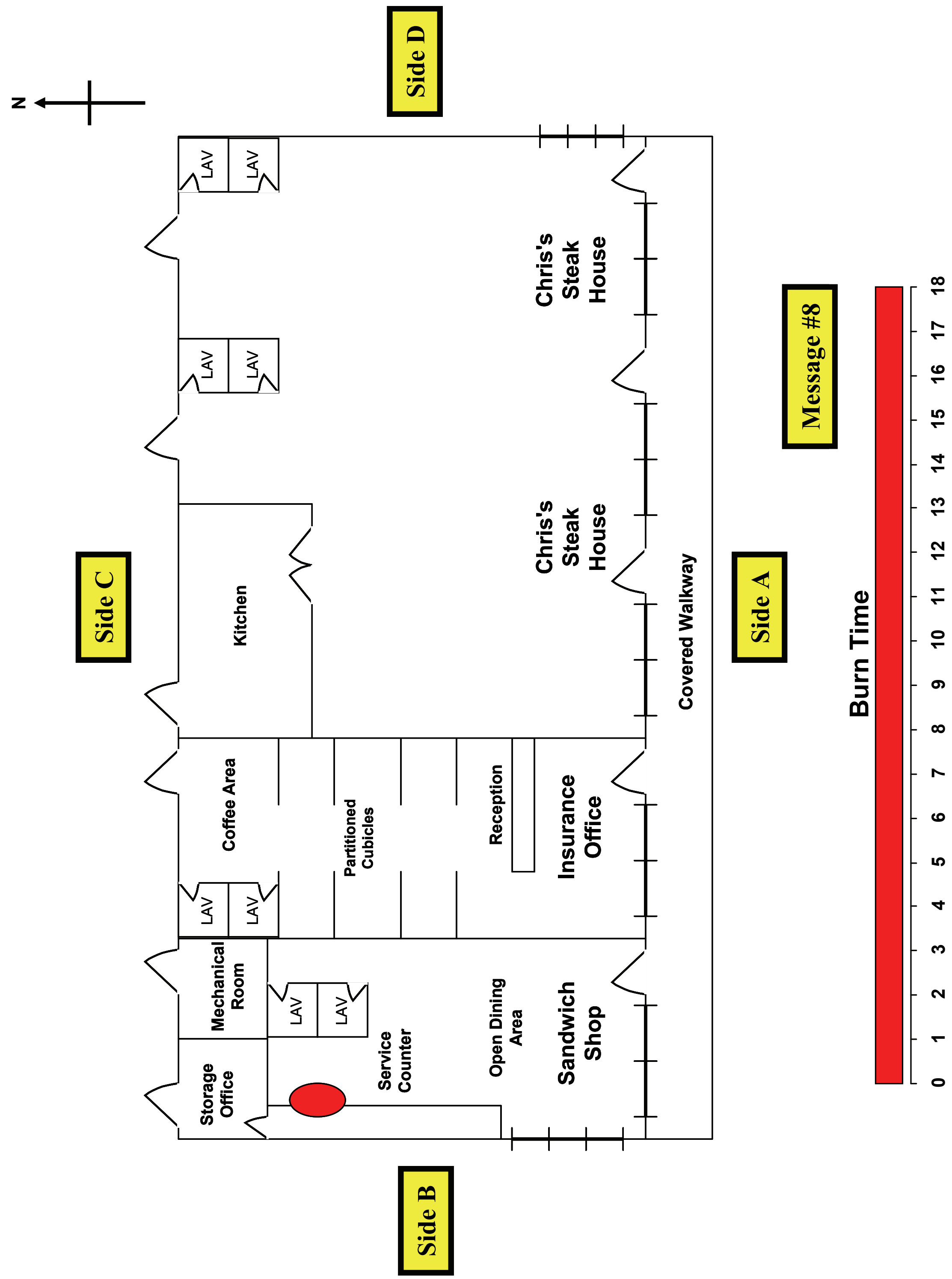
Iteration 4--Message 6



Iteration 4--Message 7



Iteration 4--Message 8



Activity 7.1 (cont'd)

Large Group Exercise #6: Bank

Purpose

To allow you to demonstrate your knowledge, skills, and abilities (KSAs) you have gained as a result of attending this course. Conduct a walk-around of exposures A-B-C-D of the structures that will be seen in the exercise.

There can be up to seven structures used in the activity.

Directions

1. You will be working in small groups.

2. Each group will do each construction type. Exercise is designed to place the **ICO** as the Incident Commander (IC) until relieved by the next level of authority arriving at the incident. (This will be your instructor.)

3. For this simulation the **ICO** will have additional students assigned to Command and General Staff positions, which under normal field conditions would be the sole responsibility of the ICO.

4. Student group assignments for each group:

   a. ICO.

   b. ICOA--scribe.

   c. IISO.

   d. Initial Planning Section--Situation Unit.

   e. Initial Logistics Section--service and support.

5. Your group will record your predictions on an easel pad or paper.

6. Your group will select a spokesperson to explain to the class how fire would travel in this building.

7. Throughout the activity you will receive messages from the instructor.

8. In this portion of exercise your group is to concentrate on Column 1 Primary Factors Chart. You will have 10 minutes to complete this portion of the activity.

9. The ICOA-scribe shall develop a Primary Factors Exercise Chart on an easel pad for his/her assigned exercise scenario.

   a. Identify the most pertinent primary factors for each exercise scenario.

   b. Place findings on Column 1 of the Primary Factors Exercise Chart.

   c. Identify the most pertinent subfactors for each identified primary factor for exercise scenario. Place findings on Column 2 of the Primary Factors Exercise Chart.

   d. Identify pertinent precautions that will be taken to address each identified sub-factor for exercise scenario. Place findings on Column 3 of the Primary Factors Exercise Chart.

Activity 7.1 (cont'd)

Primary Factors Chart

Column #1 — Primary Factor - Situation Awareness- Chart

Primary Factors	(Check appropriate boxes) Pertinent Sub-Factors (P)	P
Life Hazard	Occupants	
	Firefighters	
Location/Fire	Fire Building on Arrival– Burn Time	
	Exposures On Arrival - Burn Time	
	Fire Spread Considerations Radiation/Conduction/Convection	
Construction	Fire Building – Type 1-2-3-4-5 (Lightweight Awareness)	
	Exposures – Type 1-2-3-4-5 (Lightweight Awareness)	
Occupancy (Contents)	Fire Building – (Fuel Load)	
	Exposures (Fuel Load)	
Height	Fire Building (Front-Rear)	
	Exposures (Front-Rear)	
Area	Fire Building/Configuration	
	Proximity of Exposures /Configuration	
Structural Collapse	Fire Building – Burn Clock After Arrival	
	Exposures – Burn Clock After Arrival	
	Collapse Zone – Safe Corridors	
	Apparatus Placement	
Weather	Visibility	
	Temperature/Humidity	
	Wind – Direction/Velocity	
Resource Requirement	Apparatus/Personnel/Equipment - RIT	
	Water Supply/Suppression Agent	
Auxiliary Appliances	Fire Building Supplied	
	Exposures Supplied	
Topography	Front-Rear	
Explosions/ Back Draft	Proper Ventilation Flash-Over Time Awareness	
Time	Time of Day Time of Year Duration of Incident	

Column #2 — Incident Objectives Attainable/ Measurable/ Flexible

<u>Examples of Incident Objectives:</u>

- Safe Removal of All Occupants within 10 minutes.
- Contain and Control Fire to Room/Building of Origin within 10 minutes
- Contain, Control and Limit Fire in Exposures within 10 minutes
- Other.

<u>**List Incident Objectives:**</u>

1. ______________________________
____
2. ______________________________
____
3. ______________________________
____
4. ______________________________
____
5. ______________________________
____

Column #3 — Activities (Strategies) / **Column #4 — Evaluate Effect of Activities (Strategies) Every 10 Minutes**

Activities (Strategies)	Effective	Ineffective
[R] **Rescue** • Interior/Exterior/Both		
[E] **Exposure Protection** • Exposure Examination		
[C/E] **Confinement/Extinguishment** • Hose Line Placement		
[O] **Overhaul** • Expose Hidden Fire		
[V] **Ventilation** • Removal of Occupants • Fire Control		
[S] **Salvage** • Water – Run-Off • Apply Covers		
Forcible Entry • Location • Method		
Special Equipment • Imaging Cameras		

<u>List Incident Strategies</u>	<u>Assign Tactics:</u>
For Objective # 1:	
For Objective # 2:	:
For Objective # 3:	
For Objective # 4:	
For Objective # 5:	
________________	

Identify alternative strategies for firefighter safety when occupant safety has been determined not to be a Primary Factor.

- ____________________
- ____________________
- ____________________
- ____________________
- ____________________
- ____________________
- ____________________

Activity 7.1 (cont'd)

Primary Factors Exercise Chart

Pertinent Primary Factor	Pertinent Subfactor	Pertinent Precautions To Be Taken
1.	1. 2.	1. 2.
2.	1. 2. 3.	1. 2. 3.
3.	1. 2.	1. 2.
4.	1. 2.	1. 2.
5.	1. 2.	1. 2.
6.	1. 2.	1. 2.
7.	1. 2. 3. 4.	1. 2. 3. 4.
8.	1. 2. 3.	1. 2. 3.
9.	1. 2.	1. 2.
10.	1. 2.	1. 2.
11.	1.	1.
12.	1. 2.	1. 2.
13.	1. 2.	1. 2.

LARGE EXERCISE #6
Vital Building Information
Situation Report

COMMERCIAL--TYPE III--ORDINARY

Structure: Three-story--40 by 50 feet

Building Construction: Type III--ordinary

Roof Construction: 2- by 12-inch mansard roof with asphalt shingles

Floors: 2- by 6-inch flooring system tongue and groove

Alarm System: Smoke detectors installed

Occupants: Twenty employees and customers

Special Concerns: Bank security locations

Situation Report:

Fire Building:

It is Friday, December 23, 1230 hours, temperature 25 °F (-4 °C), wind from north at 9 mph.

Upon arrival, several employees and customers are outside the building. Three employees who attempted to fight the fire are suffering from minor burns and smoke inhalation. The bank manager reports a few employees were eating lunch in the third break/lunch room and they are unaccounted for. He reports that the fire is in the second floor copy/printing room.

Exposures:

No immediate exposures.

Activity 7.1 (cont'd)

Objectives-Strategy-Tactics Chart

1. Use the enlarged Objectives-Strategy-Tactics Chart or easel pad.

2. Refer back the Primary Factors Exercise materials in Unit 4: The Analytical Sizeup Process if necessary.

3. Place Slide Iteration #2 for Sides A-B-C-D for each scenario chosen.

4. Receive and act on Exercise Message #2 and Plot Plan #2.

5. Concentrate on Columns 2 and 3 and develop the Objectives-Strategy-Tactics for the scenario.

6. ICOA scribe shall develop an easel pad for Objectives-Strategy-Tactics for assigned exercise scenario. (You have 20 minutes to complete.)

    a. Column 1: Identify the first operational period objectives for the scenario.

    b. Column 2: Identify the first operational period strategies for each objective.

    c. Column 3: Identify the first operational period tactics for each strategy.

    d. Column 4: Assign companies to perform tactics.

Each scenario has first alarm structural resources available at start of exercise:

- Engine 1
- Engine 2
- Engine 3
- Ladder 1
- Basic Life Support (BLS) 1

Each scenario will have working incident structural resources arrive 10 minutes into incident.

- **Engine 5**
- Engine 6
- **Squad 1**
- Engine 6 (Rapid Intervention Crew (RIC))
- Air Cascade-1 FF
- Safety Officer

Central City Fire EMS Dispatch Criteria

Assignment	Alarm Type	Engine	Ladder	Squad	Battalion Chief	EMS Unit	RIC	Safety Officer	Air Cascade
First Alarm	Structural	3	1			1 BLS			
Working Incident	Structural	2		1	1		1	1	1
First Alarm	Target Hazard	3	2	1	1	1 BLS			
Working Incident	Target Hazard	2				1 ALS	1	1	1
Second Alarm	Structural/ Target Hazard	2	1		1	1EMS		1	1
Third Alarm	Structural/ Target Hazard	2	1			1 MS			
Fourth Alarm	Structural/ Target Hazard	2	1		1				

Central City Fire/EMS Staffing:

- **Engine-Ladder-Squad Company--1 Officer--3 Firefighters**
- **Rapid Intervention Crew (RIC)--One Engine Company**
- **EMS BLS Unit--2 EMT Basic**
- **EMS ALS Unit--2 EMT Paramedic**
- **Air Cascade - 1 Firefighter**

A second alarm may be requested but will not arrive on scene before end of exercise.

Activity 7.1 (cont'd)

Objectives-Strategy-Tactics Chart

Objectives	Strategy (s)	Tactics	Assigned to:
Objective #1	**1.**	**1.** **2.** **3.**	**1.** **2.** **3.**
	2.	**1.** **2.** **3.**	**1.** **2.** **3.**
	3.	**1.** **2.** **3.**	**1.** **2.** **3.**
Objective #2	**1.**	**1.** **2.** **3.**	**1.** **2.** **3.**
	2.	**1.** **2.** **3.**	**1.** **2.** **3.**
	3.	**1.** **2.** **3.**	**1.** **2.** **3.**
Objective #3	**1.**	**1.** **2.** **3.**	**1.** **2.** **3.**
	2.	**1.** **2.** **3.**	**1.** **2.** **3.**
	3.	**1.** **2.** **3.**	**1.** **2.** **3.**

Activity 7.1 (cont'd)

ICS Form 201, *Incident Debriefing* and ICS Form 214, *Unit Log*

1. Use the enlarged ICS Form 214, *Unit Log* or easel pad.

2. The ICOA will maintain ICS Form 214 for all tactical decisions made by the ICO along with other pertinent messages and decisions made by the ICO during the exercise. Entries should be recorded under Time and Major Events columns.

3. Distribute ICS Form 214.

    a. IISO.

    b. Initial Planning Section (Situation Unit).

    c. Initial Logistics Section (Service and Support).

4. Distribute ICS Form 201, *Incident Debriefing* (enlarged to 11 by 17).

    a. Initial Planning Section (Situation Unit).

    b. Initial Logistics Section (Service and Support).

5. Begin exercise scenario message distribution.

6. Follow message distribution time frames until all messages have been distributed. (You have 30 minutes.)

Activity 7.1 (cont'd)

Preparing for Exercise Debriefing

You have 15 minutes for each group to prepare their debriefing materials for presentation.

1. ICO.

    a. Primary Factors Chart.

    b. Objectives-Strategy-Tactics Chart.

2. Initial Company Officer Assistant--ICS Form 214.

3. Initial Safety Officer--ICS Form 214.

4. Initial Planning Section.

5. Initial Logistics Section--ICS Form 201.

Activity 7.1 (cont'd)

ICS Form 214, *Unit Log*

UNIT LOG	1. Incident Name	2. Date Prepared	3. Time Prepared
4. Unit Name/Designators	5. Unit Leader (Name and Position)		6. Operational Period

7. Personnel Roster Assigned

Name	ICS Position	Home Base

8. Activity Log

Time	Major Events

9. Prepared by (Name and Position)

Instructions for completing the Unit Log (ICS Form 214)

ITEM NUMBER	ITEM TITLE	INSTRUCTIONS
1.	Incident Name	Print the name assigned to the incident.
2.	Date Prepared	Enter date prepared (month, day, year).
3.	Time Prepared	Enter time prepared (24-hour clock).
4.	Unit Name	Enter the title of the organizational unit or resource designator (Engine 1 - Safety Officer, Situation Unit – Logistics Section).
5.	Unit Leader	Enter the name of the individual in charge of the Unit.
6.	Operational Period	Enter the time span covered by the log (e.g., 1800 Oct. 12 to 0600 Oct. 13).
7.	Personnel Roster	List the name, position, and home base of each member assigned to the unit during the operational period.
8.	Activity Log	Enter the time and briefly describe each significant occurrence or event (e.g., task assignments, task completions, injuries, difficulties encountered, etc.).
9.	Prepared By	Enter the name and title of the person approving the log. Provide log to immediate supervisor at the end of each operational period.

Activity 7.1 (cont'd)

ICS Form 201, *Incident Debriefing*

INCIDENT DEBRIEFING	1. INCIDENT NAME	2. DATE PREPARED	3. TIME PREPARED
4. MAP SKETCH			
ICS 201 (12/93) **NFES1325**	PAGE 1	5. PREPARED BY (NAME AND POSITION)	

6. SUMMARY OF CURRENT ACTIONS		
ICS 201	PAGE 2	

7. CURRENT ORGANIZATION		
ICS 201 (12/93) **NFES1325**	PAGE 3	

8. RESOURCES SUMMARY				
RESOURCES ORDERED	**RESOURCE IDENTIFICATION**	**ETA**	**ON SCENE √**	**LOCATION/ASSIGNMENT**

ICS 201 (12/93) **NFES 1325**	PAGE 4	

Instructions for completing the Incident Briefing (ICS Form 201)

ITEM NUMBER	ITEM TITLE	INSTRUCTIONS
1.	Incident Name	Print the name assigned to the incident.
2.	Date Prepared	Enter date prepared (month, day, year).
3.	Time Prepared	Enter time prepared (24-hour clock).
4.	Map Sketch	Show perimeter and control lines, resources assignments, incident facilities, and other special information on a sketch map or attached to the topographic or orthophoto map.
5.	Resources Summary	Enter the following information about the resources allocated to the incident. Enter the number and type of resource ordered.
	Resources Ordered	Enter the number and type of resource ordered.
	Resource Identification	Enter the agency three-letter designator, S/T, Kind/ Type and resource designator.
	ETA/On Scene	Enter the estimated arrival time and place the arrival time or a checkmark in the "on scene" column upon arrival.
	Location/ Assignment	Enter the assigned location of the resource and/or the actual assignment.
6.	Current Organization	Enter on the organization chart the names of the individuals assigned to each position. Modify the chart as necessary.
7.	Summary of Current Actions	Enter the strategy and tactics used on the incident and note any specific problem areas.
8.	Prepared By	Enter the name and position of the person completing the form.
*Note		Additional pages may be added to ICS Form 201 if needed.

Activity 7.1 (cont'd)

Debriefing Procedures

1. The instructor will debrief exercise scenarios with each group.

2. The instructor will display the slides for your group's scenario when debriefing.

3. Assigned ICO for each group shall present the following:

   a. Primary Factors Chart.

   b. Objectives-Strategy-Tactics Chart.

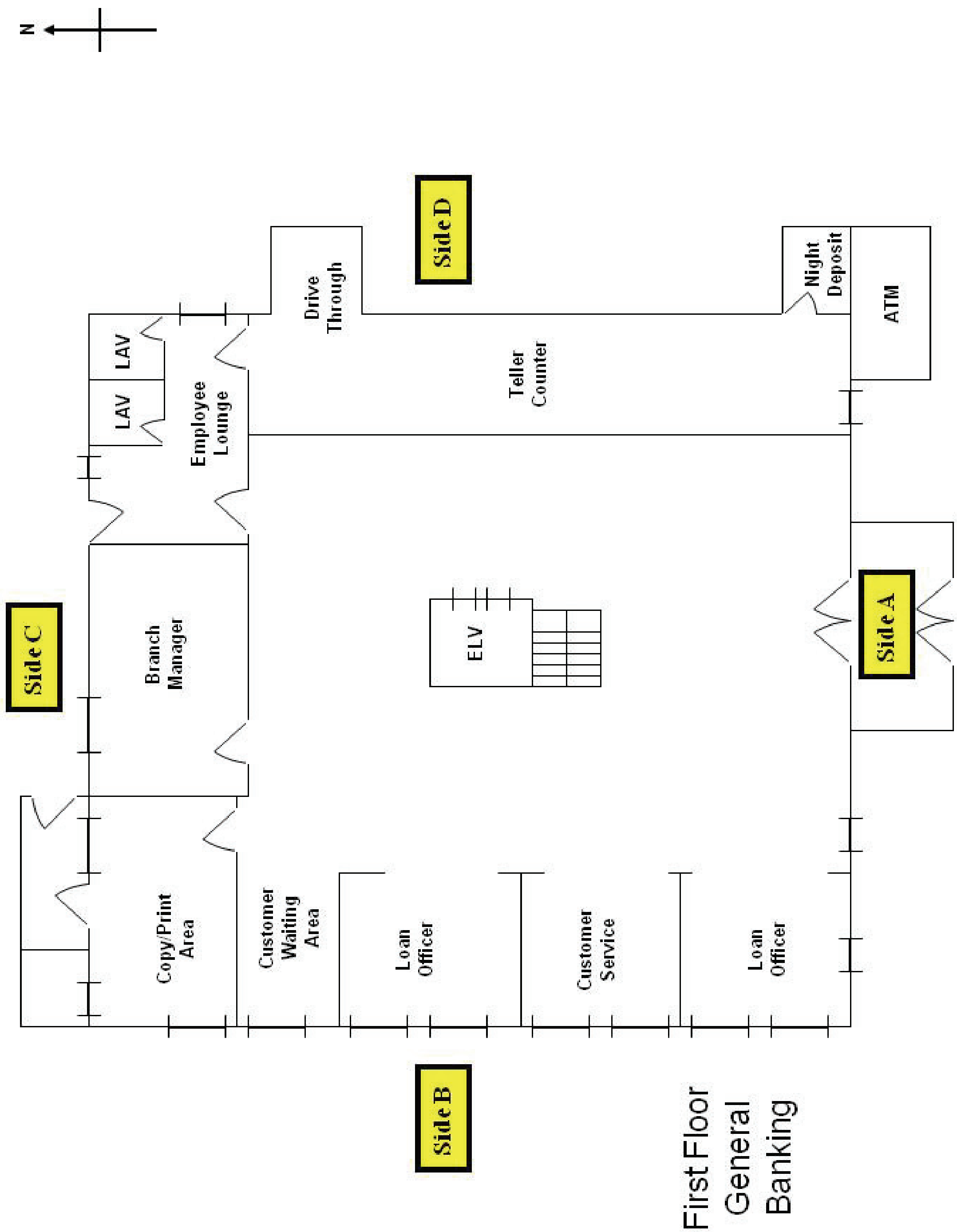
   c. ICS Form 214.

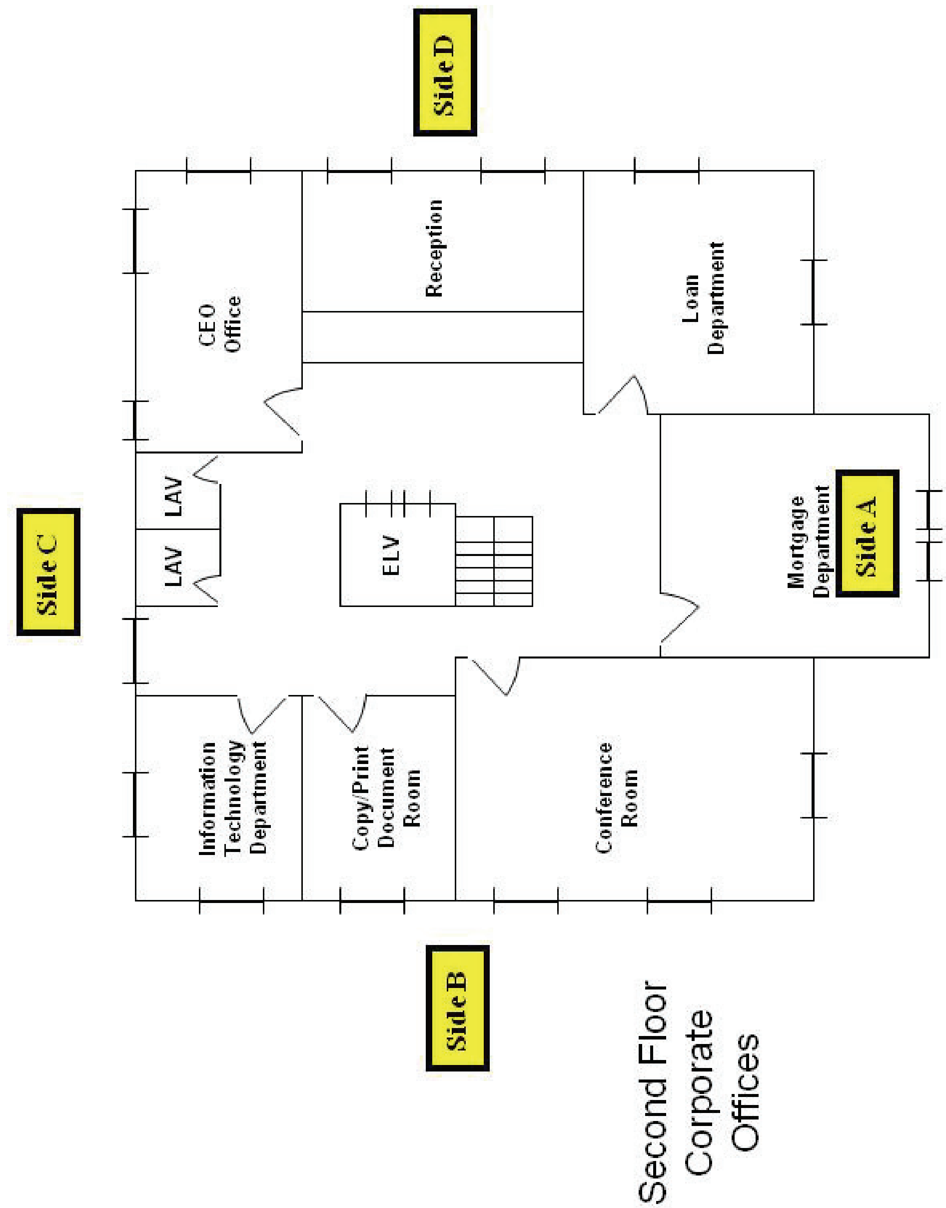
4. Each group will have 15 minutes to debrief.

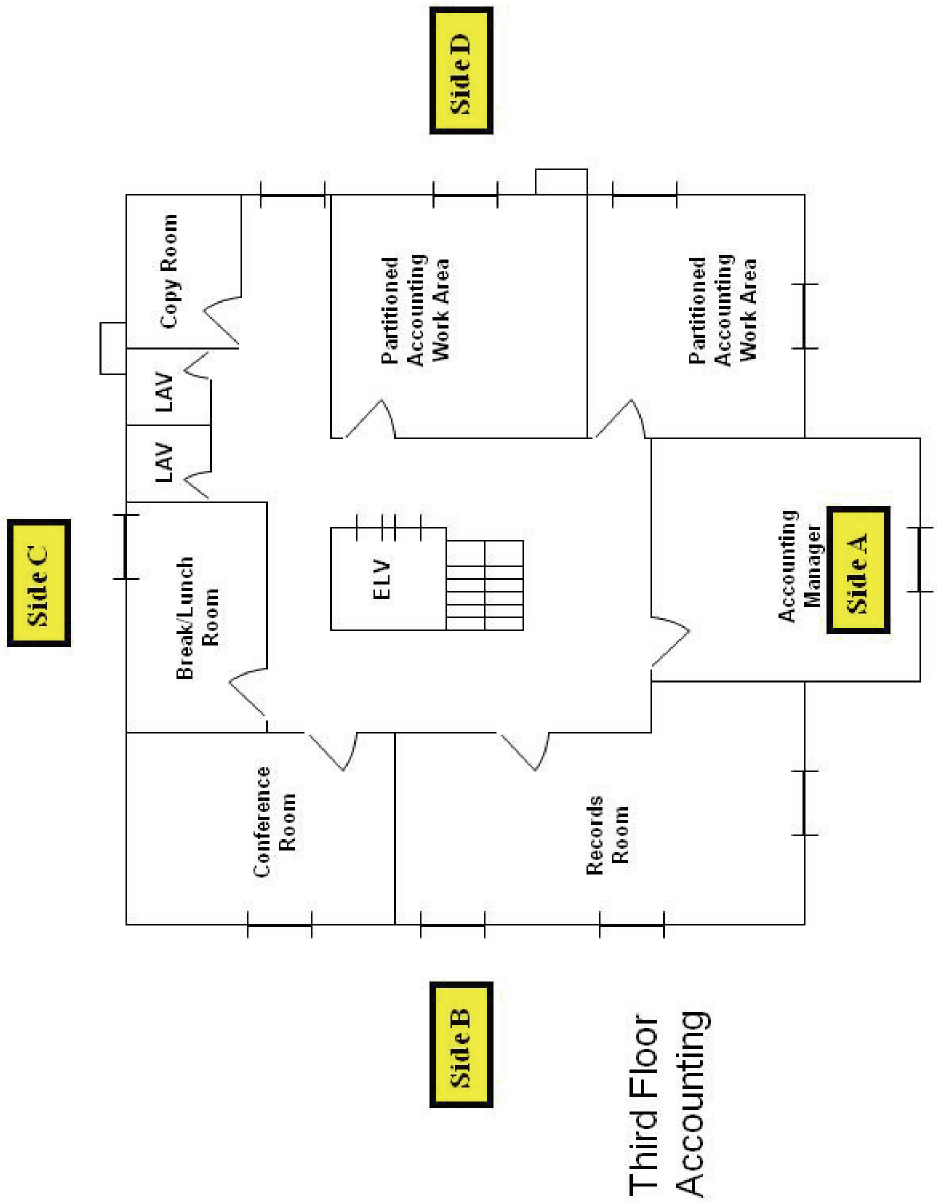
5. The instructor will address any specific issues were omitted from charts and identify issues where improvement is required.

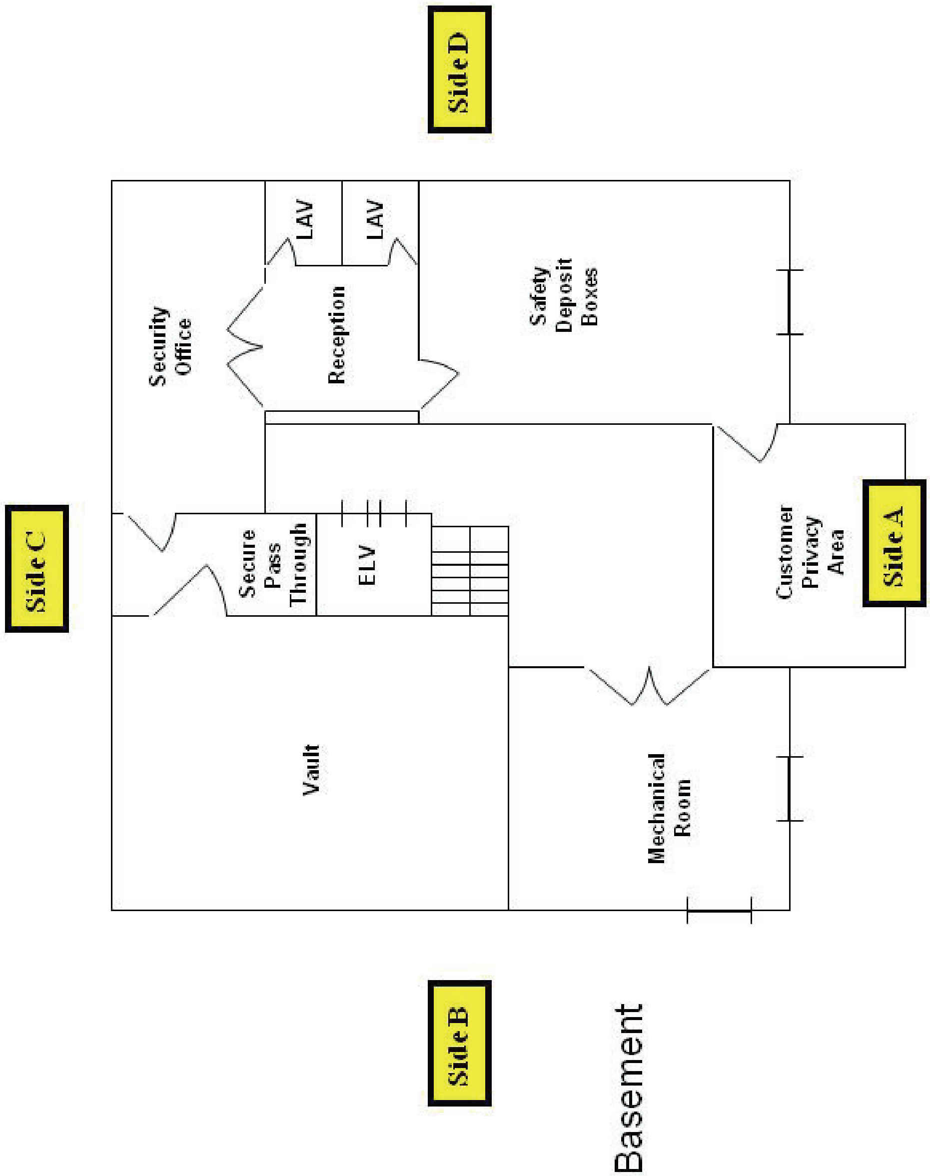
Activity 7.1 (cont'd)
Plot Plans
Exercise #6

Bank--Walkaround

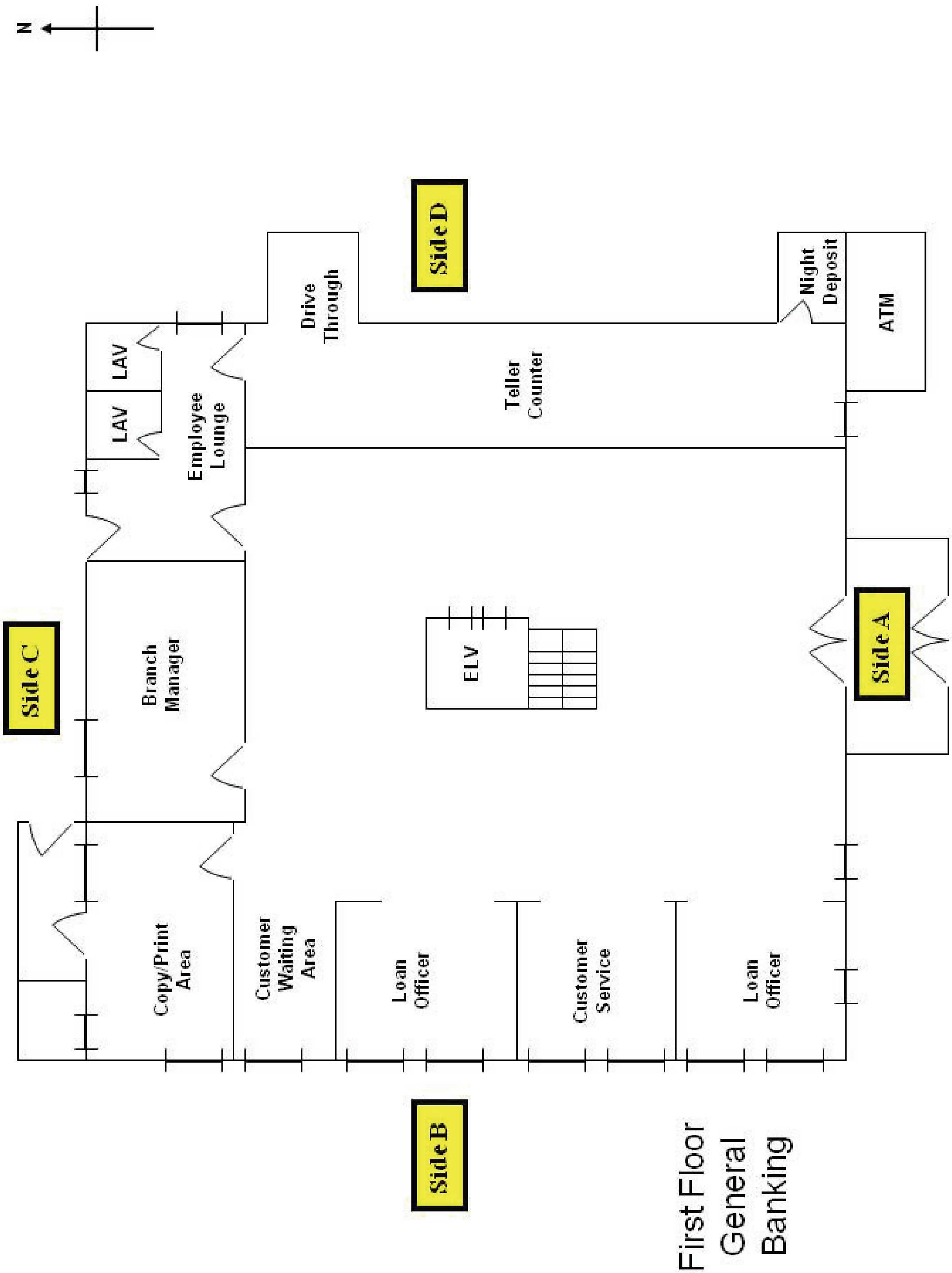


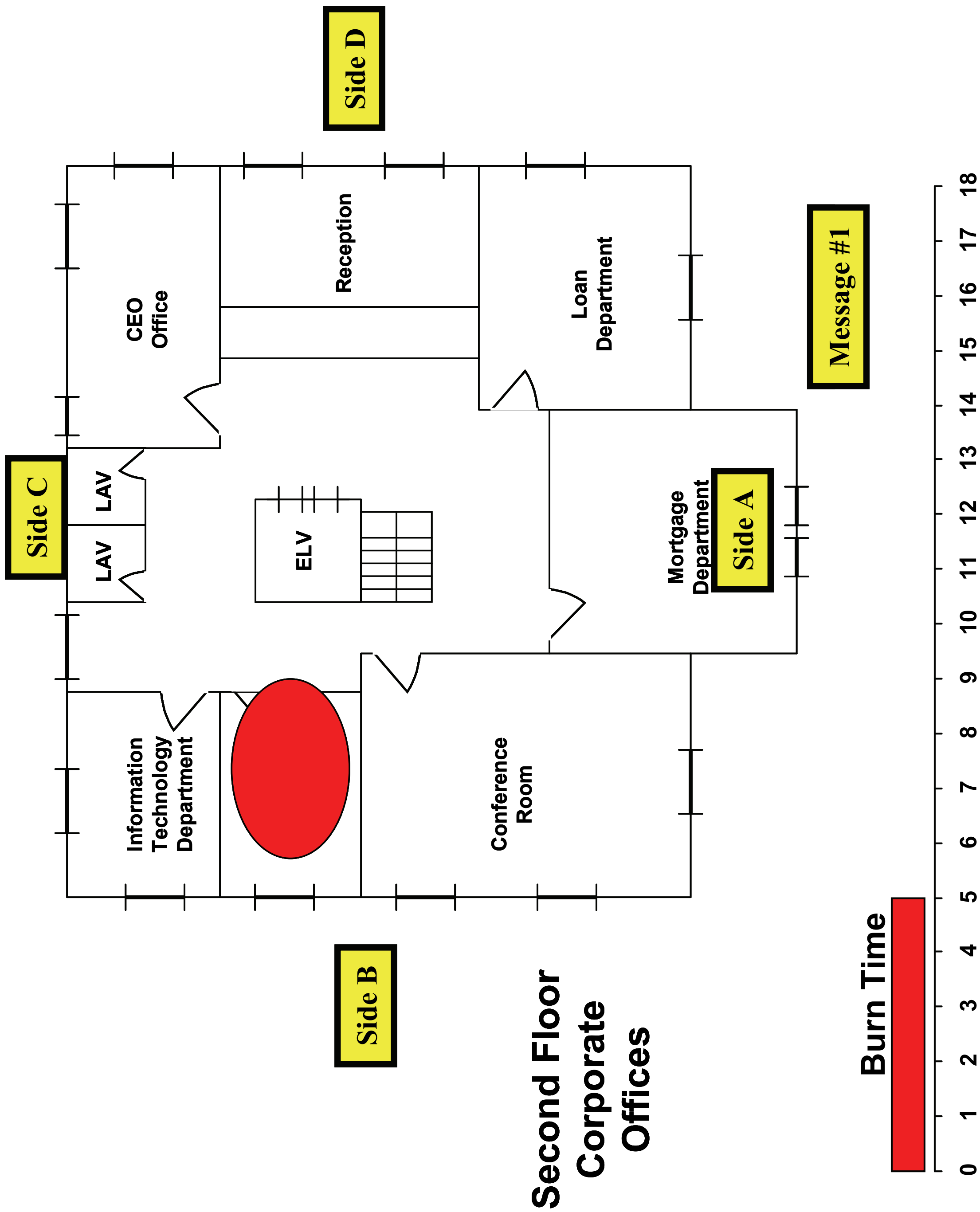

Side D
Side C
Side B
Side A
CEO Office
Reception
Loan Department
LAV
LAV
ELV
Mortgage Department
Information Technology Department
Copy/Print Document Room
Conference Room
Second Floor Corporate Offices

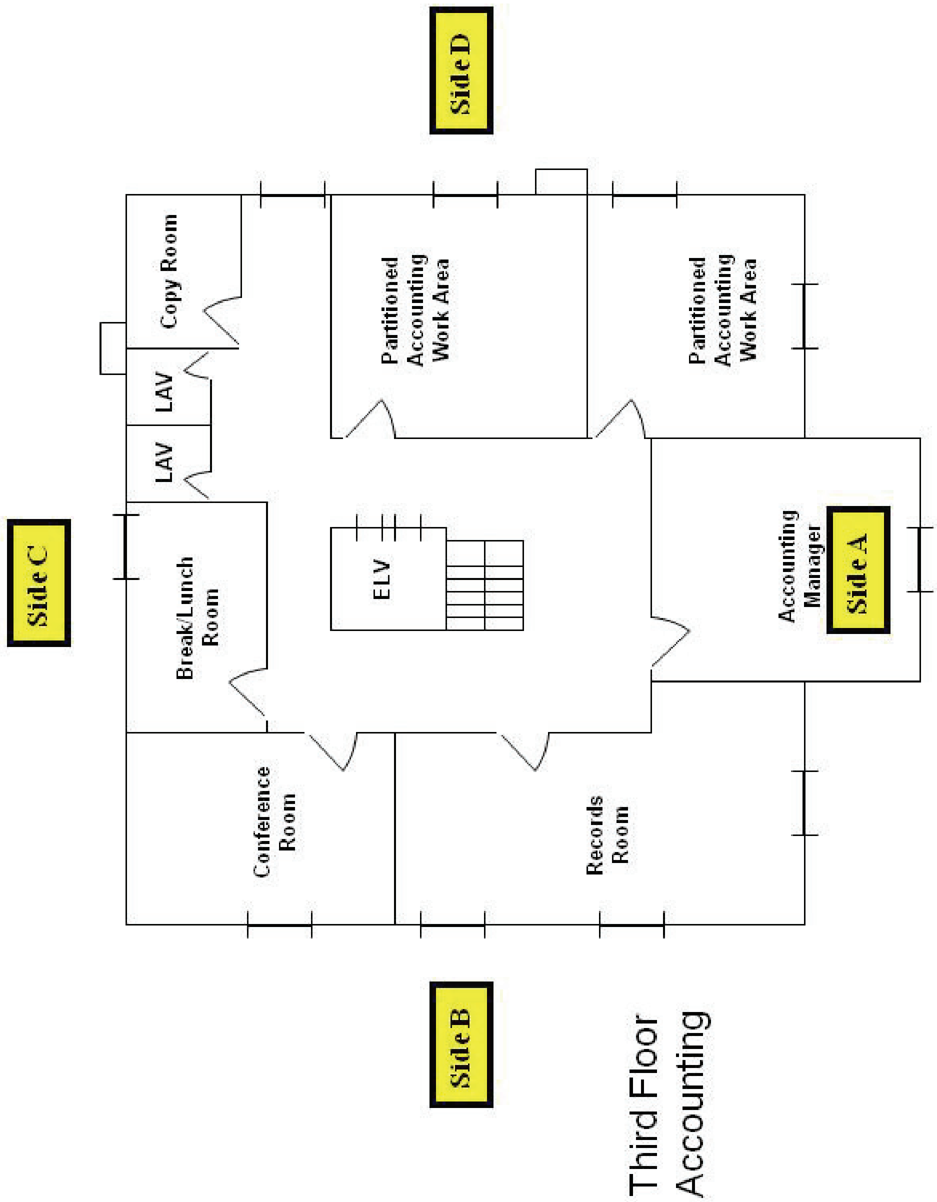

Side D
Side C
Side A
Side B
Copy Room
LAV
LAV
Partitioned Accounting Work Area
Partitioned Accounting Work Area
Break/Lunch Room
ELV
Accounting Manager
Conference Room
Records Room
Third Floor Accounting

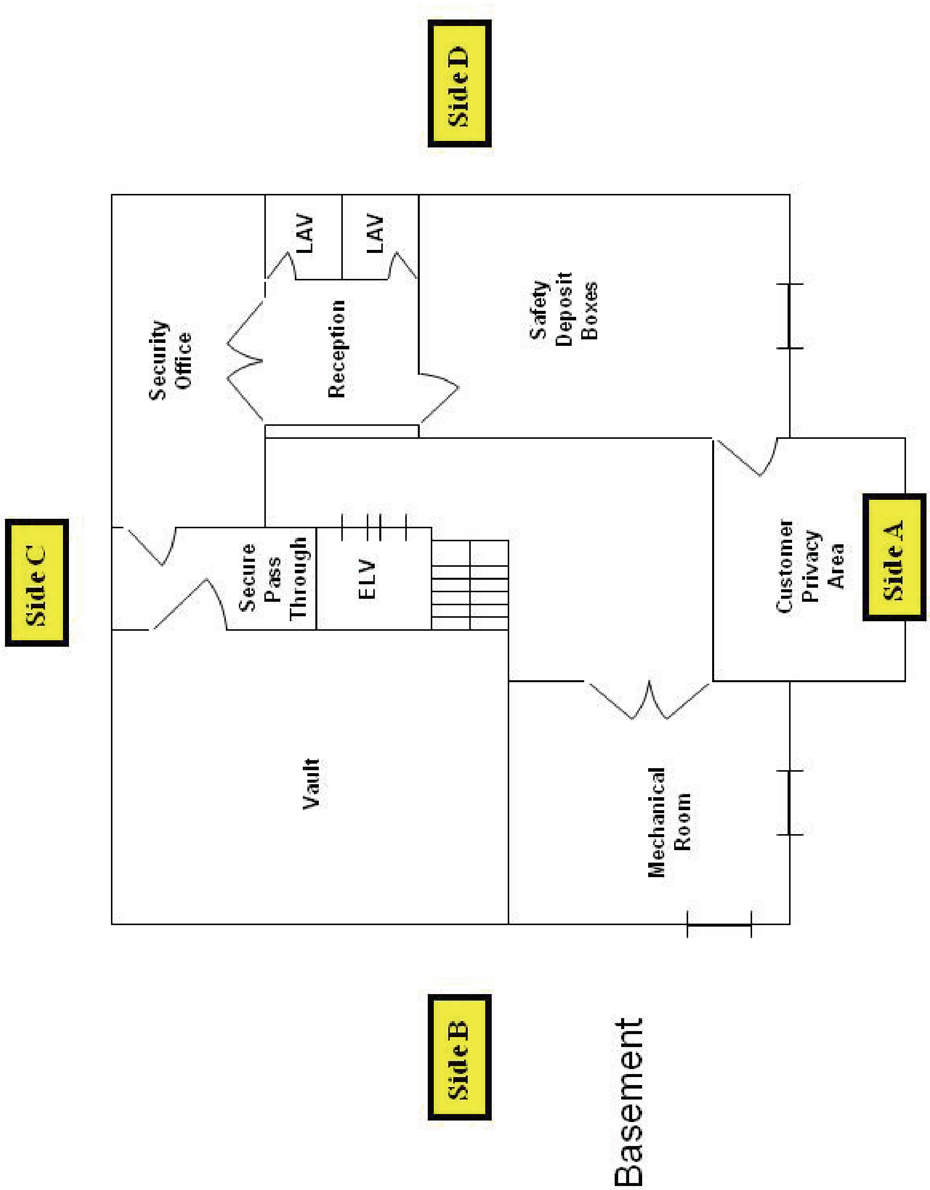

Side D
LAV
LAV
Security Office
Reception
Safety Deposit Boxes
Side C
Secure Pass Through
ELV
Customer Privacy Area
Side A
Vault
Mechanical Room
Side B
Basement

Iteration 1--Message 1

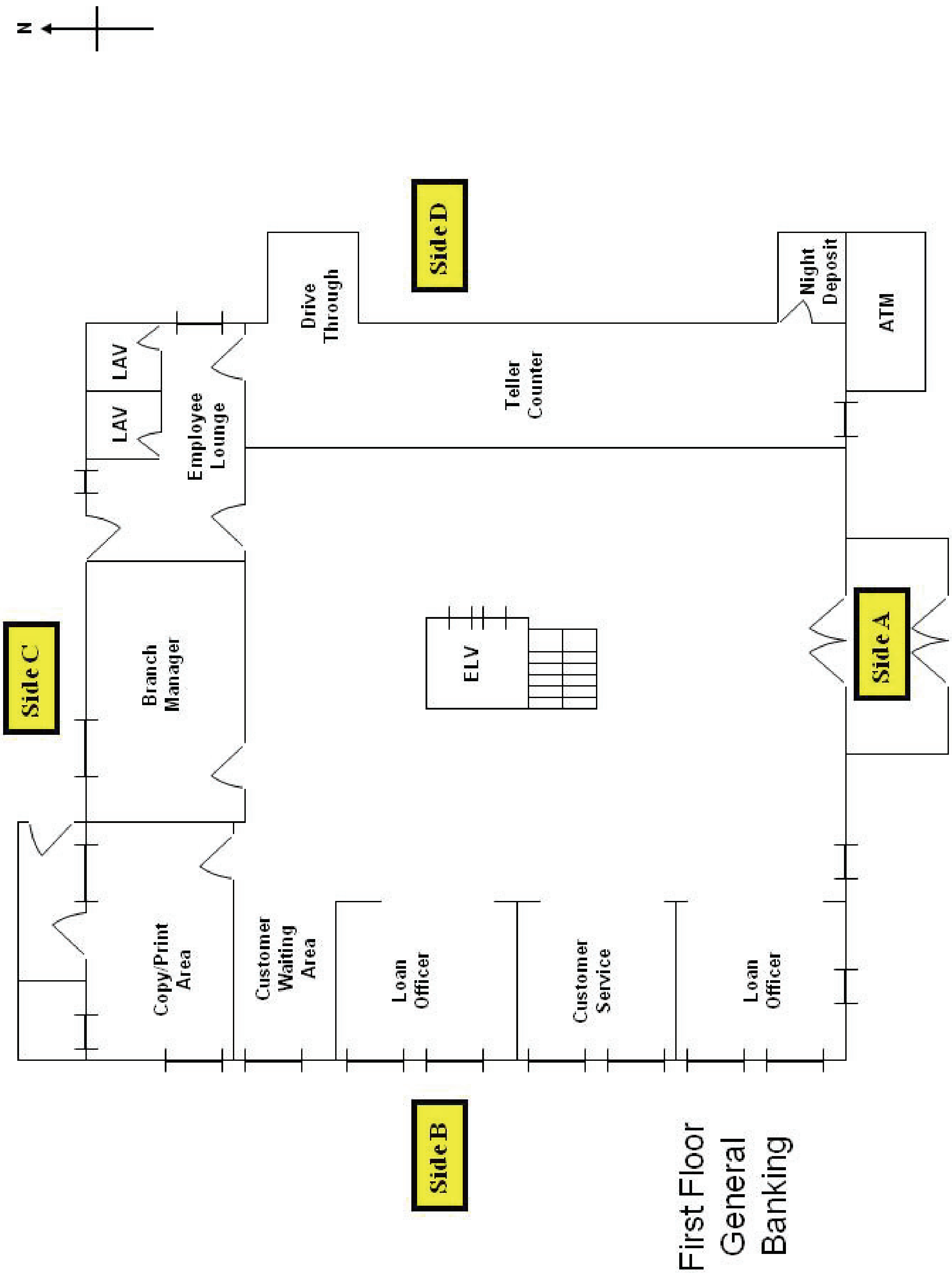


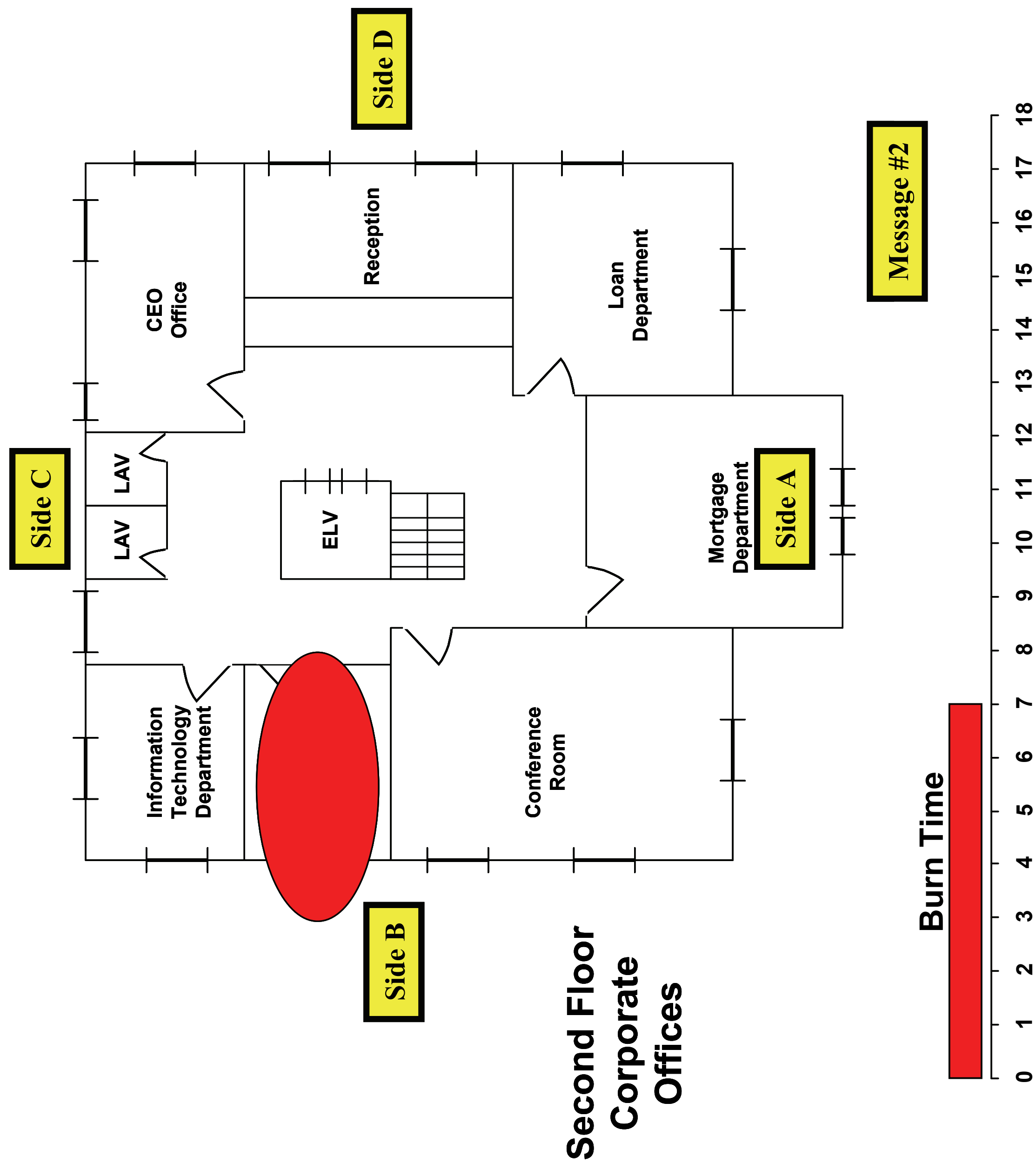

Side D
Side C
Side B
Side A
Message #1
CEO Office
Reception
Loan Department
LAV
LAV
ELV
Mortgage Department
Information Technology Department
Conference Room
Second Floor Corporate Offices
Burn Time
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18

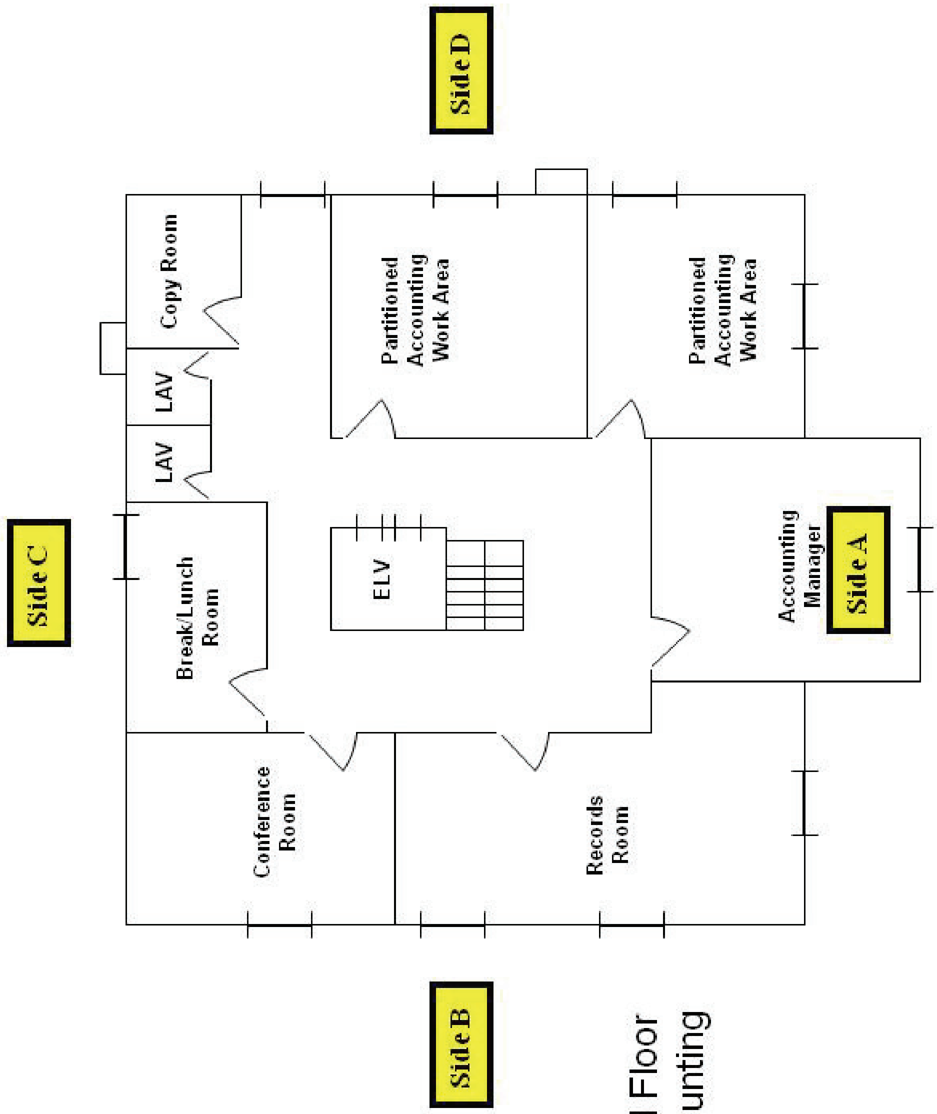

Side D
Copy Room
LAV
LAV
Partitioned Accounting Work Area
Partitioned Accounting Work Area
Side C
Break/Lunch Room
ELV
Accounting Manager
Side A
Conference Room
Records Room
Side B
Third Floor Accounting


Side D
Side C
Side A
Side B
Security Office
LAV
LAV
Reception
Safety Deposit Boxes
Secure Pass Through
ELV
Customer Privacy Area
Vault
Mechanical Room
Basement

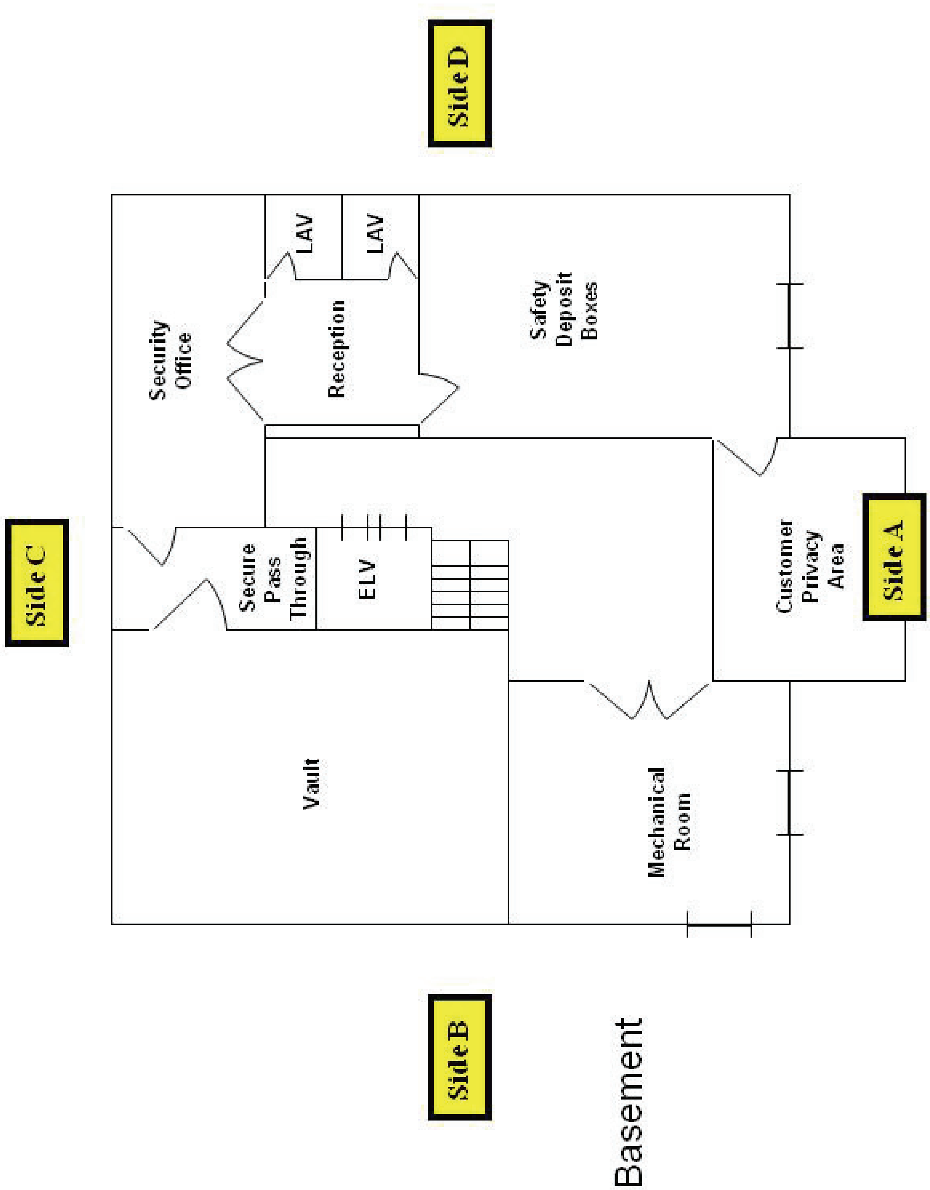
Iteration 2--Message 2



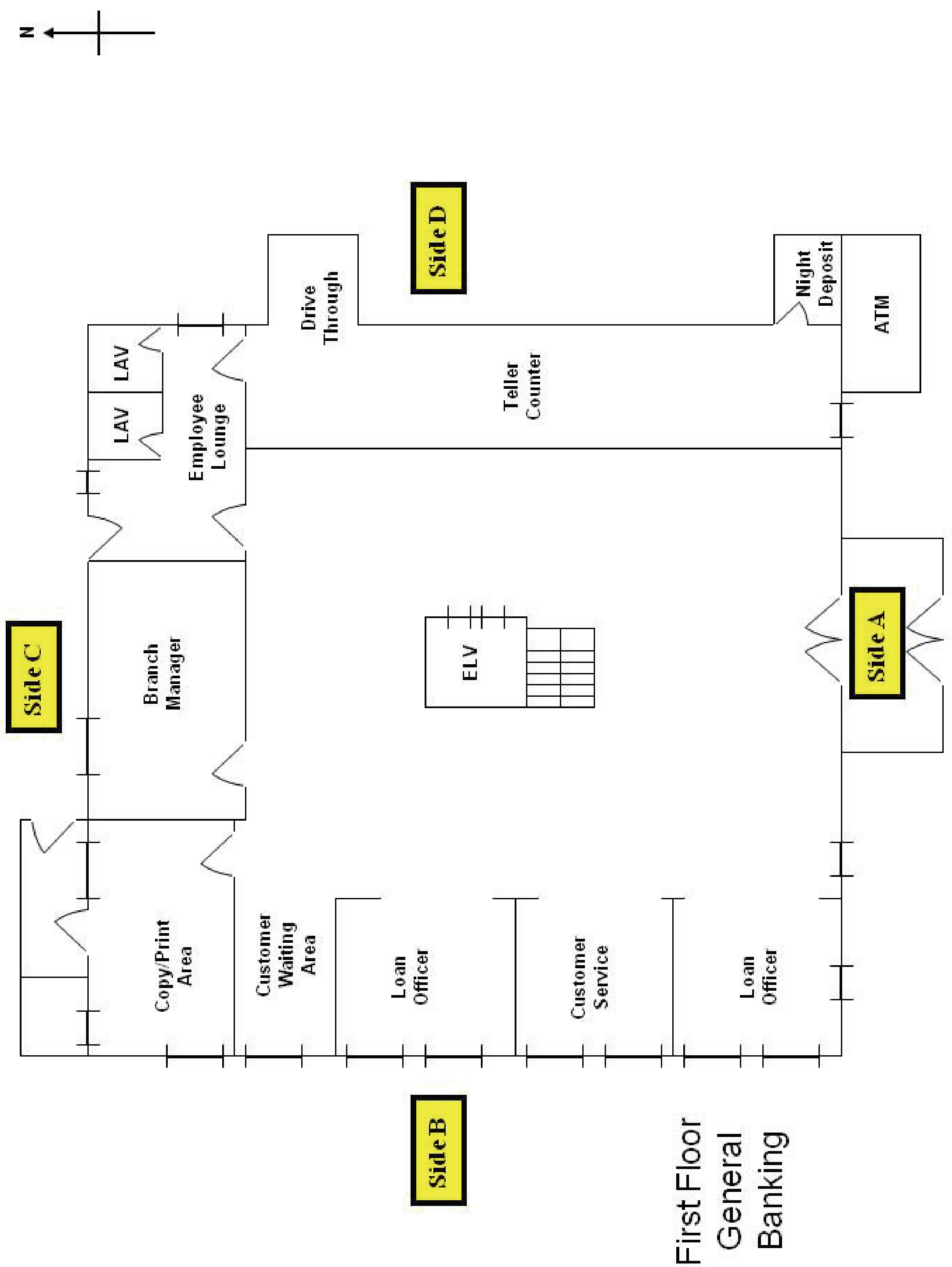

Side D
Side C
Side B
Side A
Message #2
CEO Office
Reception
Loan Department
LAV
LAV
ELV
Mortgage Department
Information Technology Department
Conference Room
Second Floor Corporate Offices
Burn Time
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

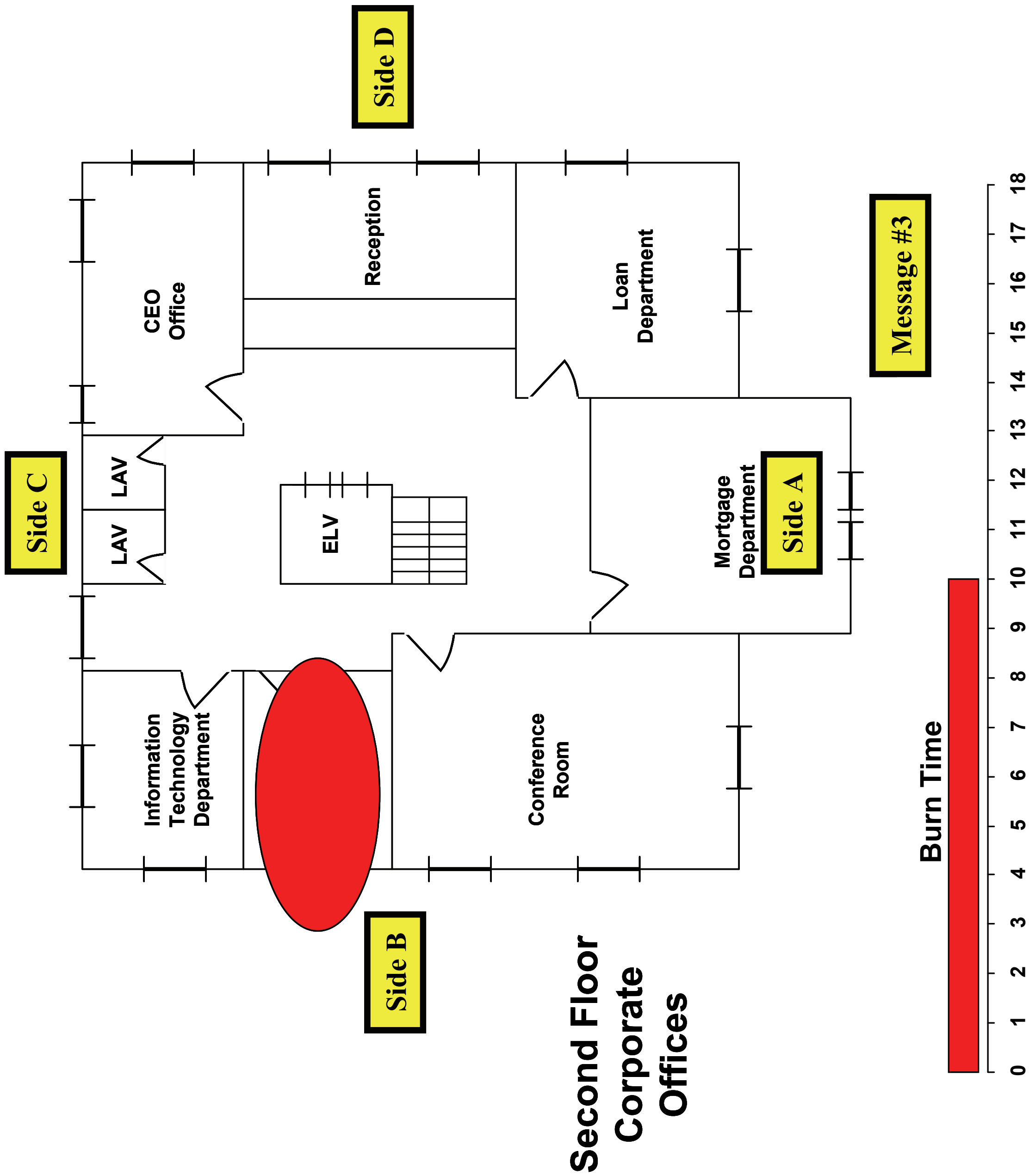


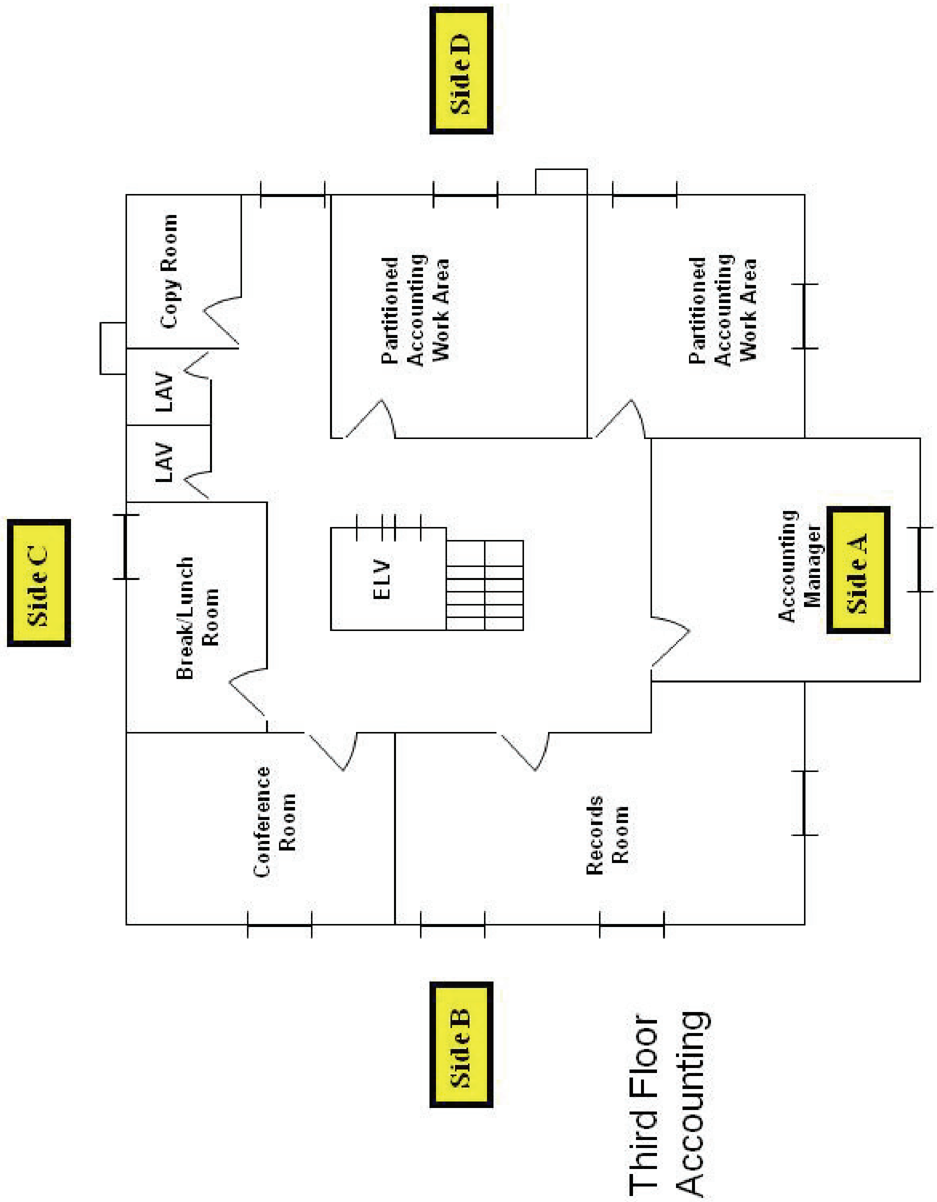
Third Floor Accounting

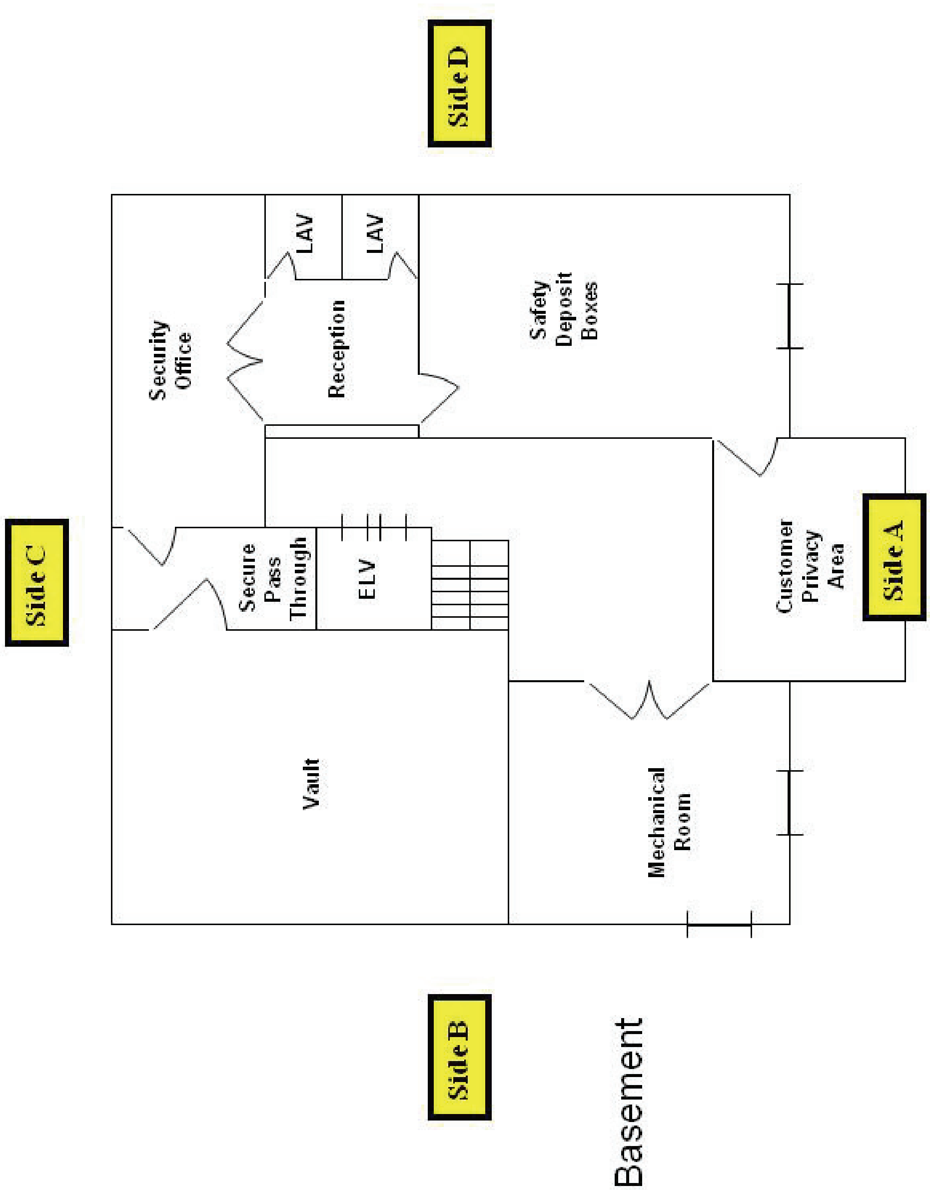

Side D
Side C
Side B
Side A
LAV
LAV
Security Office
Reception
Safety Deposit Boxes
Secure Pass Through
ELV
Customer Privacy Area
Vault
Mechanical Room
Basement

Iteration 2--Message 3

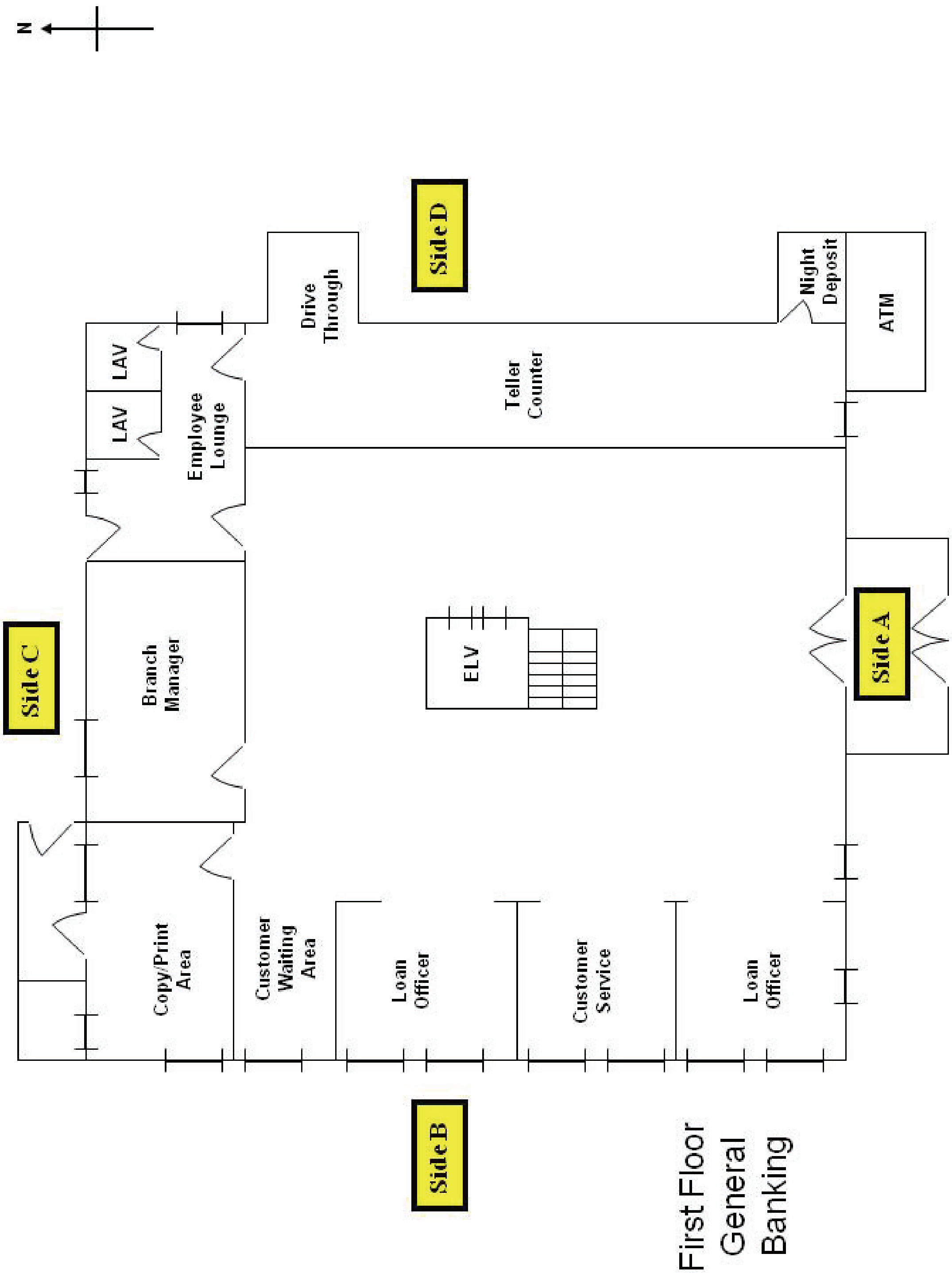


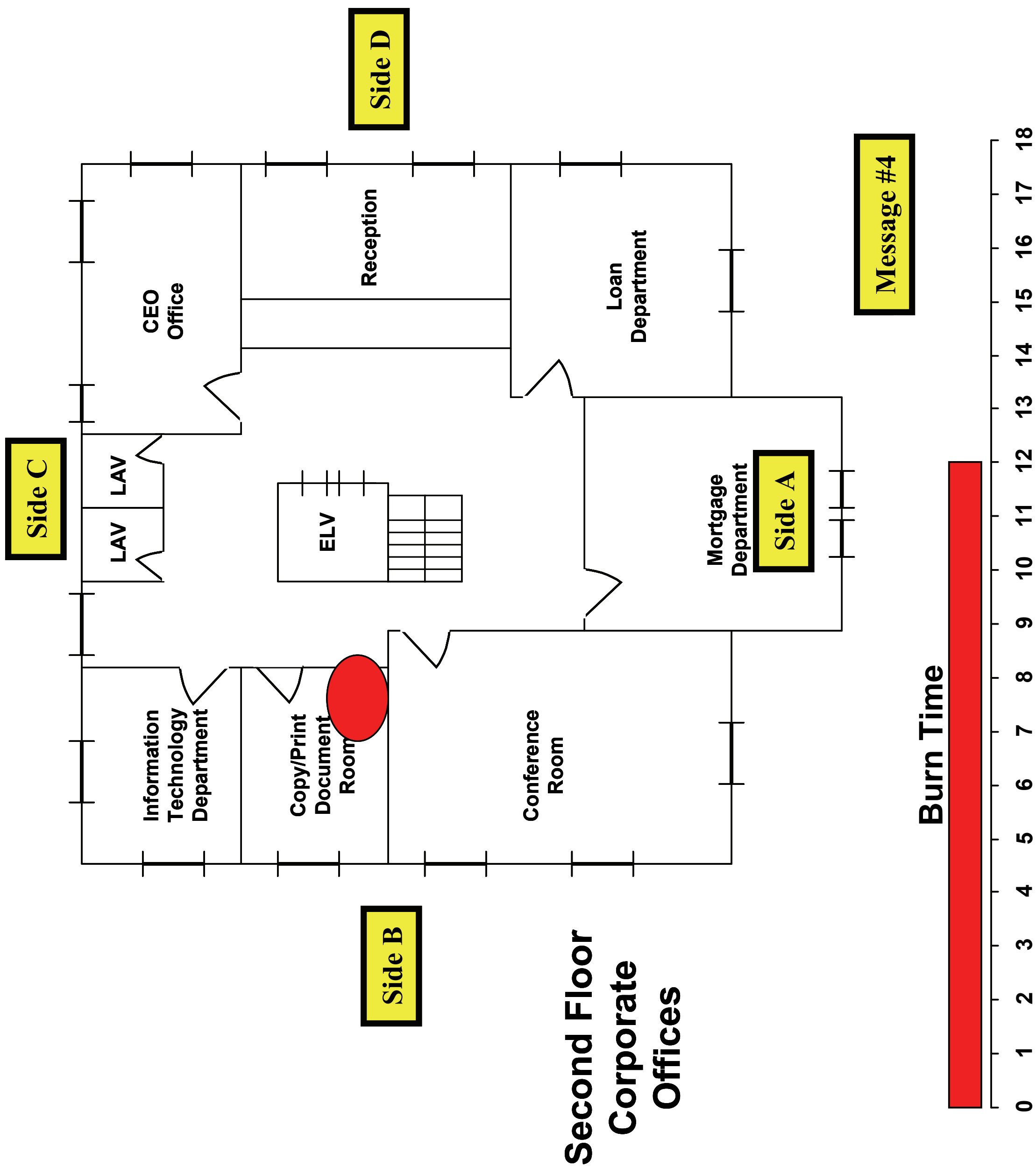

Side D
Side C
Side B
Side A
Message #3
CEO Office
Reception
Loan Department
LAV
LAV
ELV
Mortgage Department
Information Technology Department
Conference Room
Second Floor Corporate Offices
Burn Time
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

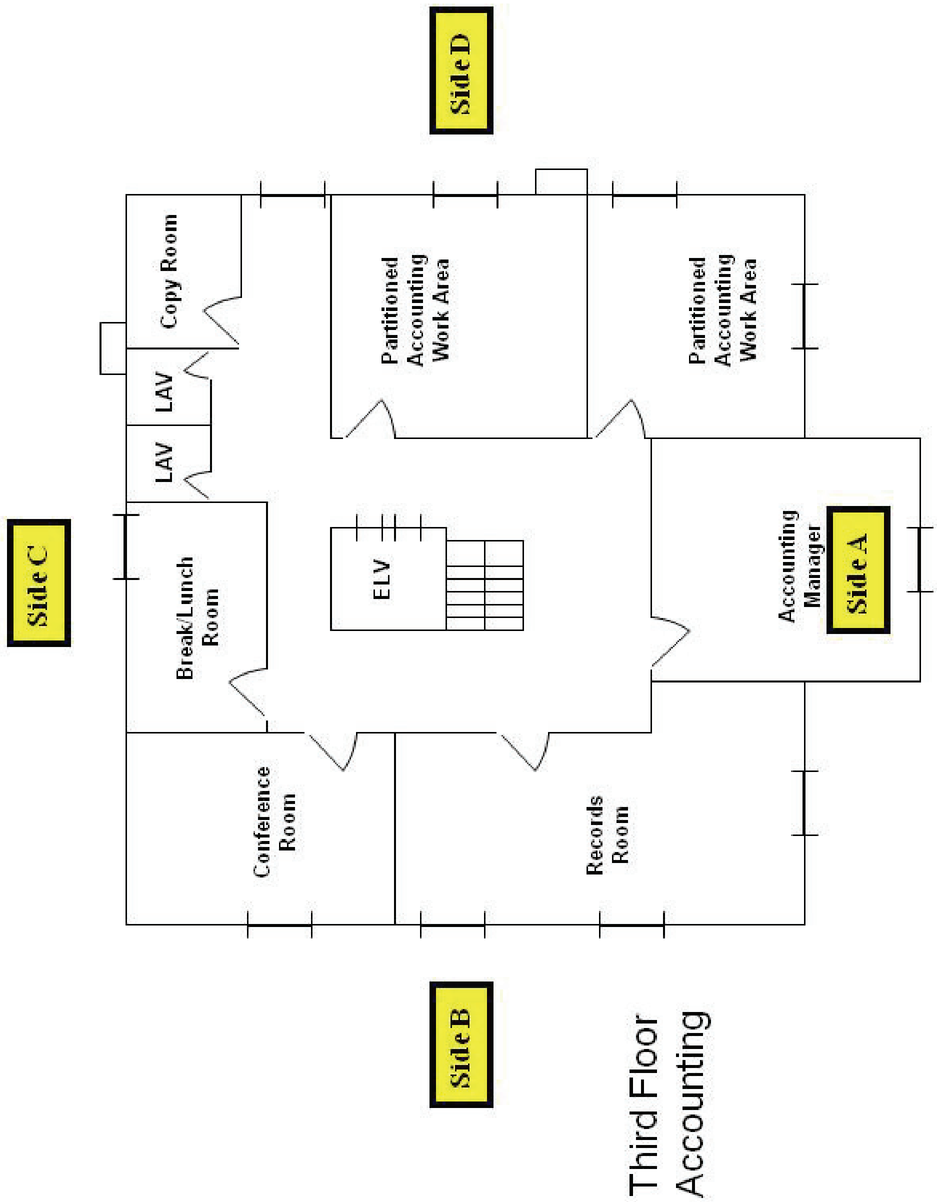

Side D
Side C
Side B
Side A
Copy Room
LAV
LAV
Partitioned Accounting Work Area
Partitioned Accounting Work Area
Break/Lunch Room
ELV
Accounting Manager
Conference Room
Records Room
Third Floor Accounting

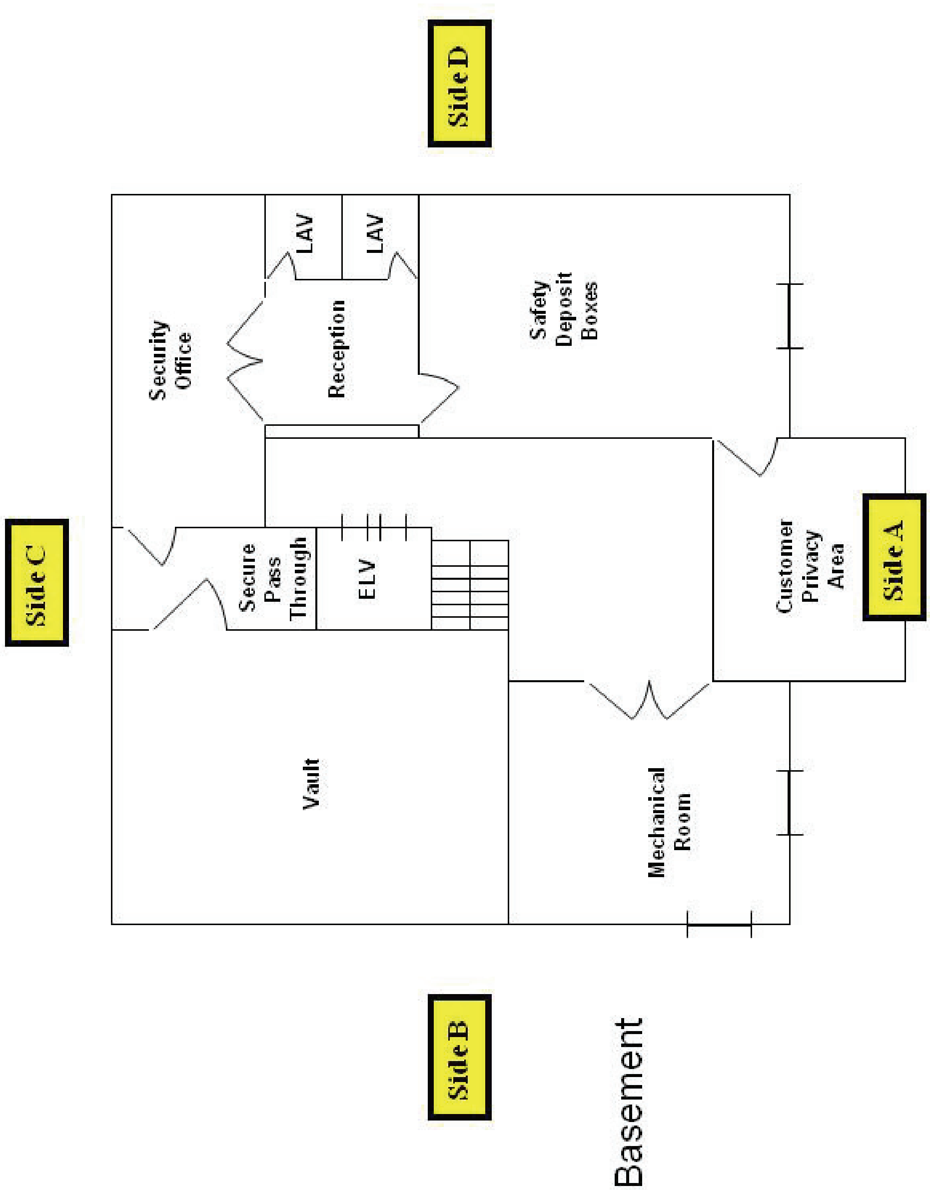

Side D
LAV
LAV
Security Office
Reception
Safety Deposit Boxes
Side C
Secure Pass Through
ELV
Customer Privacy Area
Side A
Vault
Mechanical Room
Side B
Basement

Iteration 3--Message 4

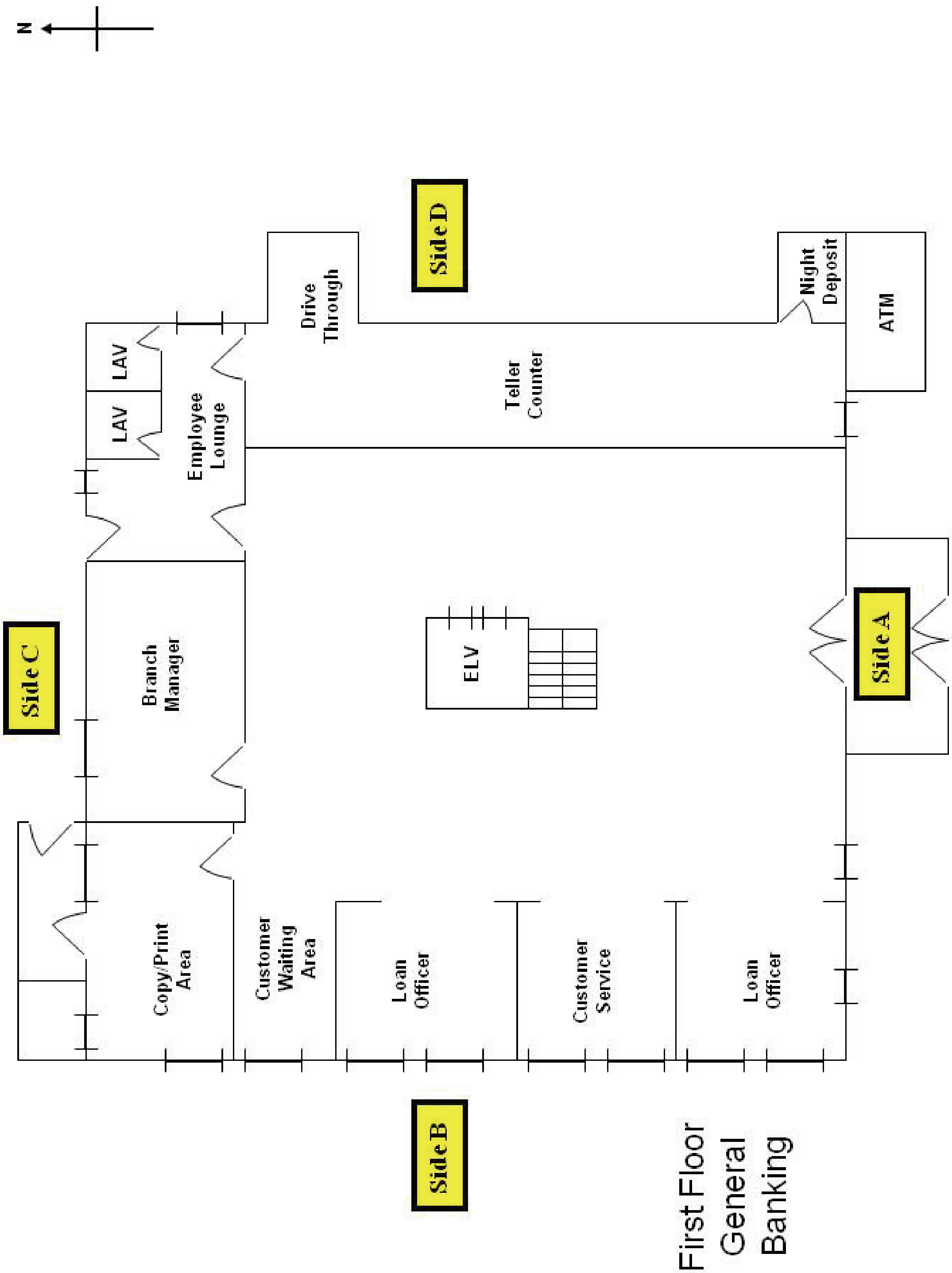


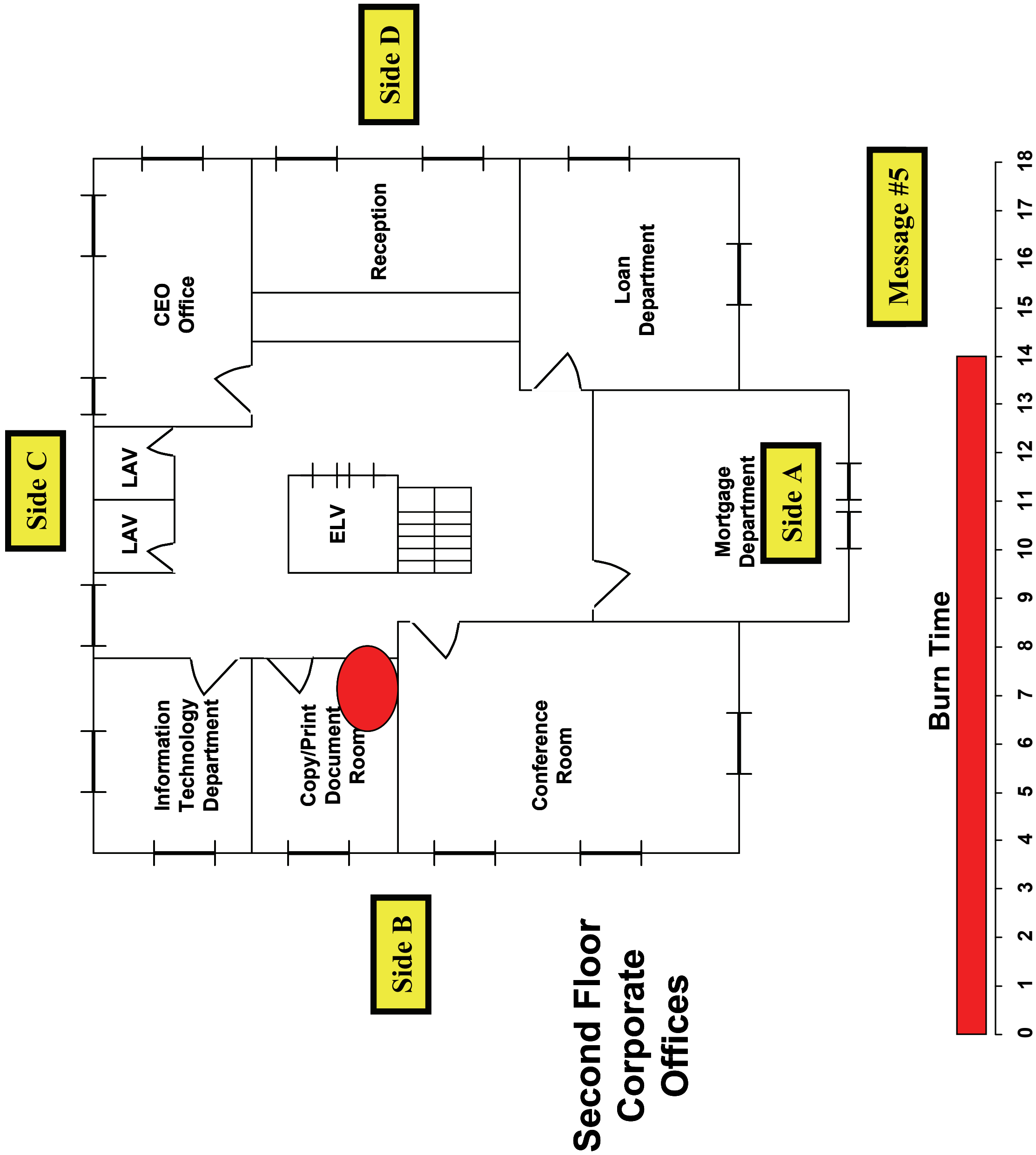

Side D
Side C
Side B
Side A
Message #4
CEO Office
Reception
Loan Department
LAV
LAV
ELV
Mortgage Department
Information Technology Department
Copy/Print Document Room
Conference Room
Second Floor Corporate Offices
Burn Time
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

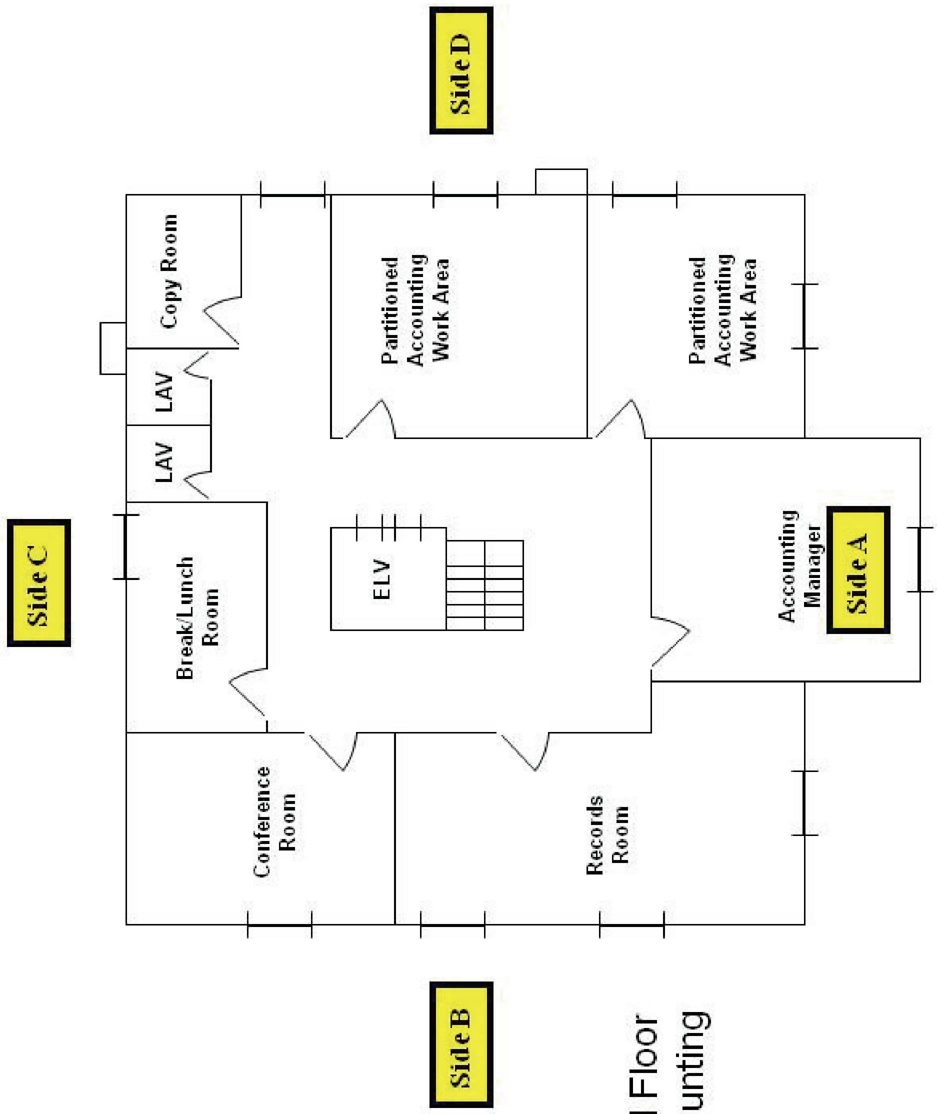

Side D
Side C
Side A
Side B
Copy Room
LAV
LAV
Partitioned Accounting Work Area
Partitioned Accounting Work Area
Break/Lunch Room
ELV
Accounting Manager
Conference Room
Records Room
Third Floor Accounting


Side D
Side C
Side A
Side B
LAV
LAV
Security Office
Reception
Safety Deposit Boxes
Customer Privacy Area
Secure Pass Through
ELV
Vault
Mechanical Room
Basement

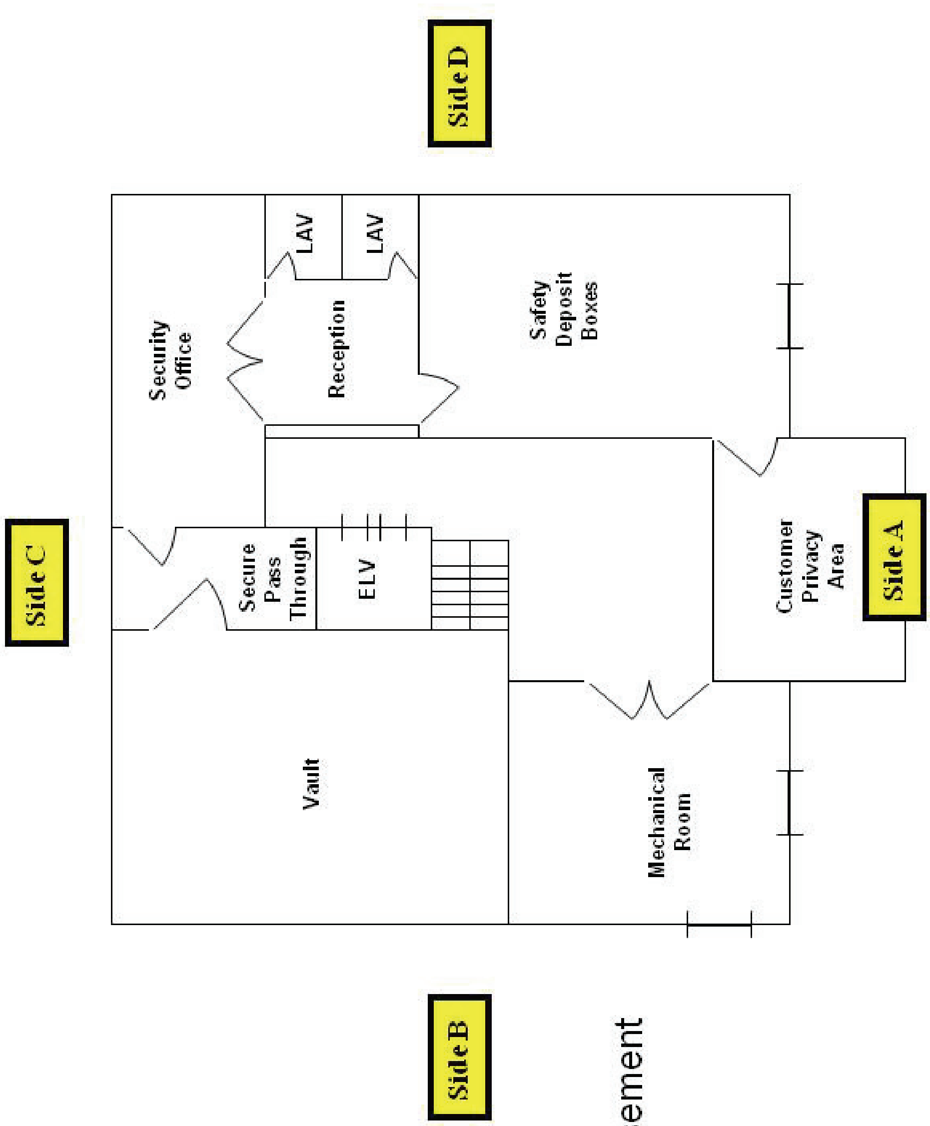
Iteration 3--Message 5




Side D
Side C
Side B
Side A
Message #5
CEO Office
Reception
Loan Department
LAV
LAV
ELV
Mortgage Department
Information Technology Department
Copy/Print Document Room
Conference Room
Second Floor Corporate Offices
Burn Time
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18

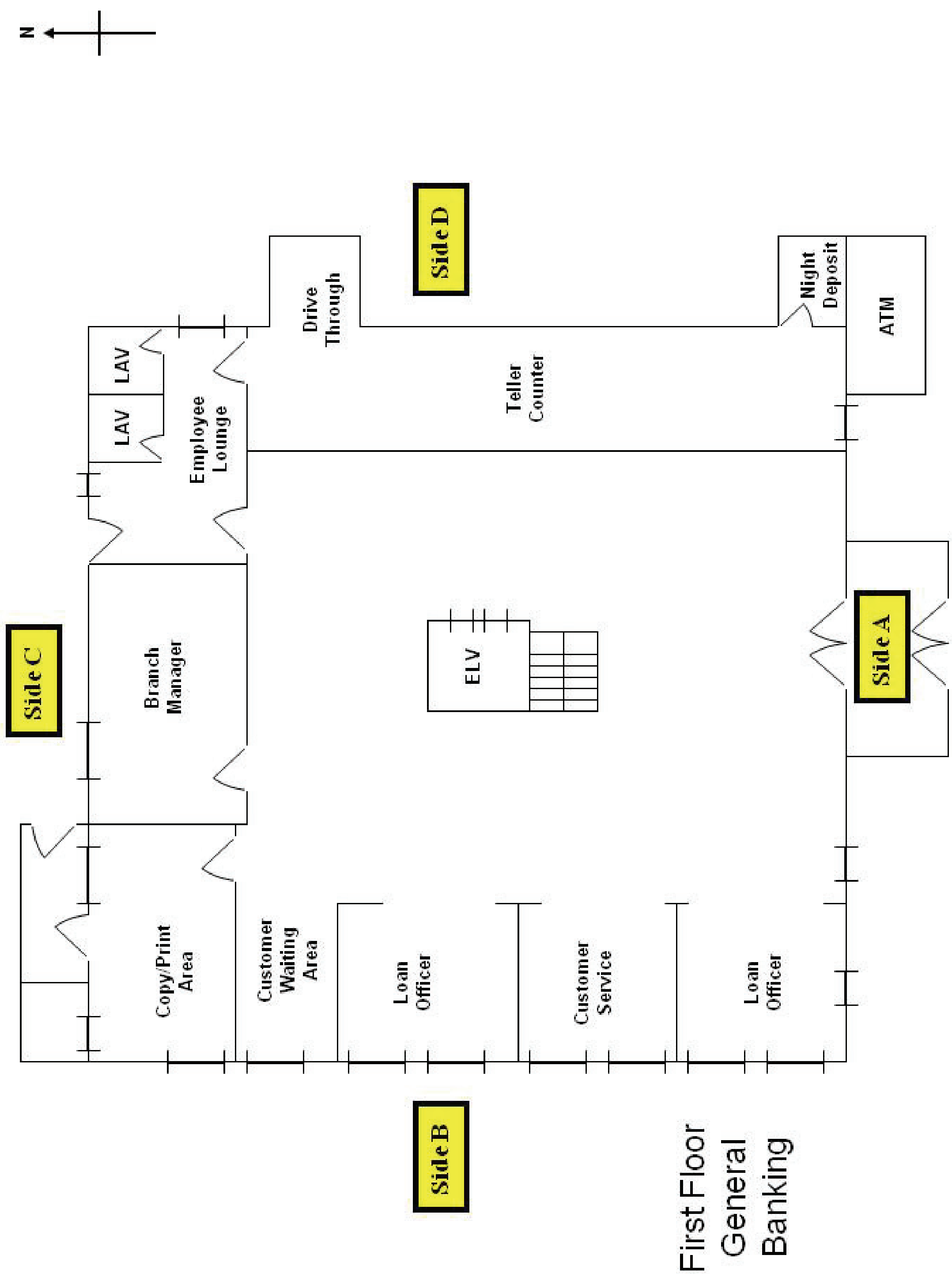


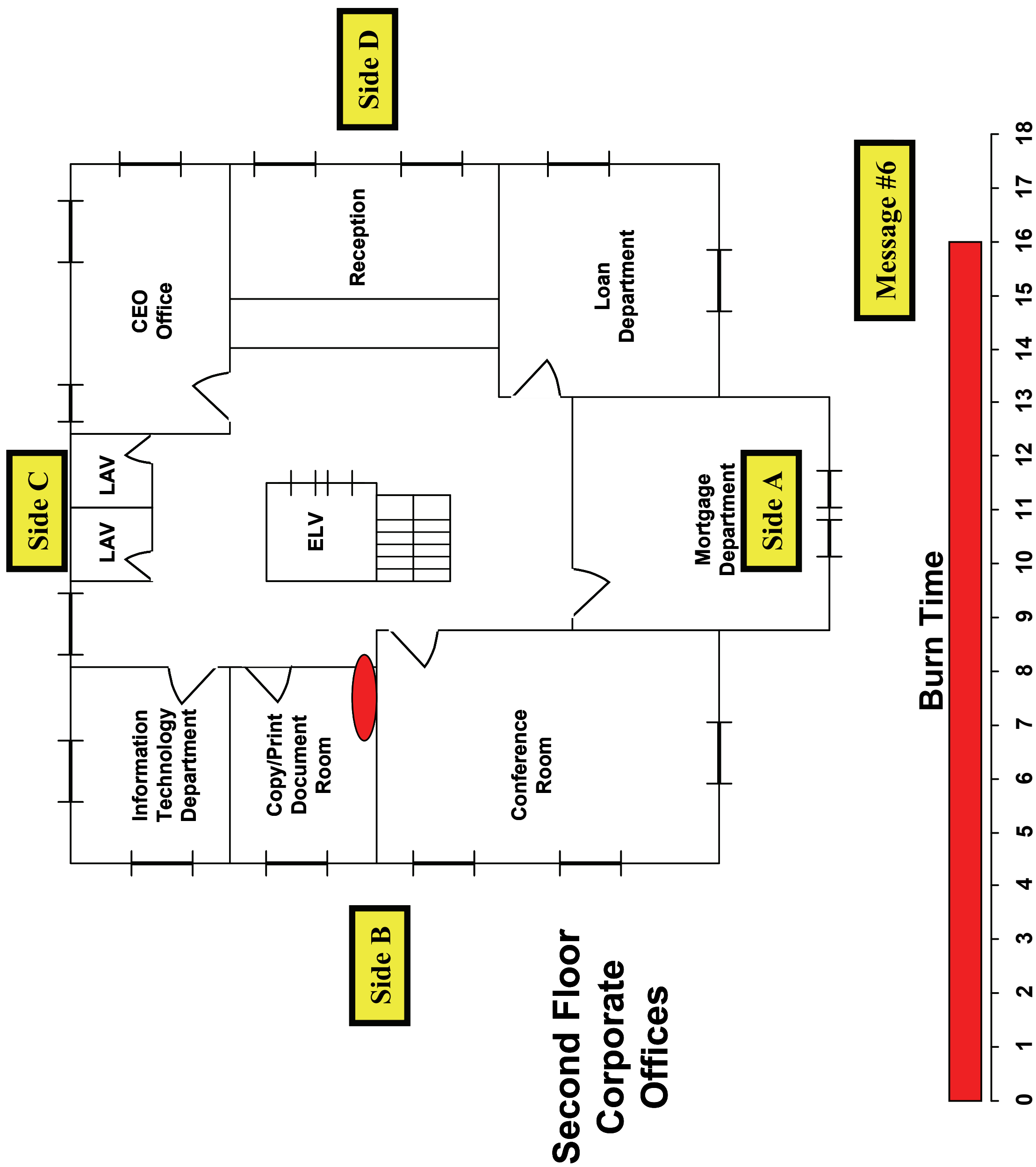
Third Floor Accounting

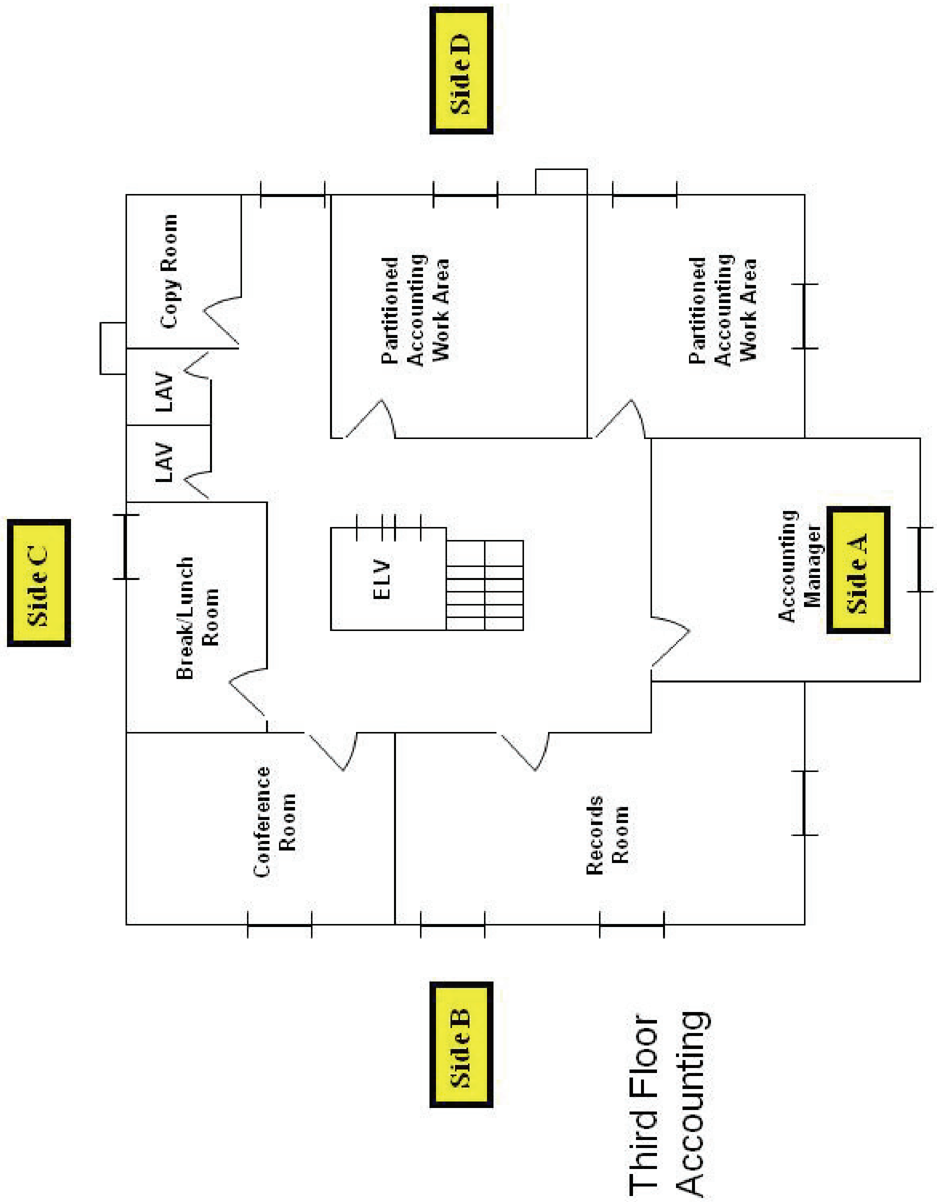

Side D
Side C
Side B
Side A
LAV
LAV
Security Office
Reception
Safety Deposit Boxes
Secure Pass Through
ELV
Customer Privacy Area
Vault
Mechanical Room

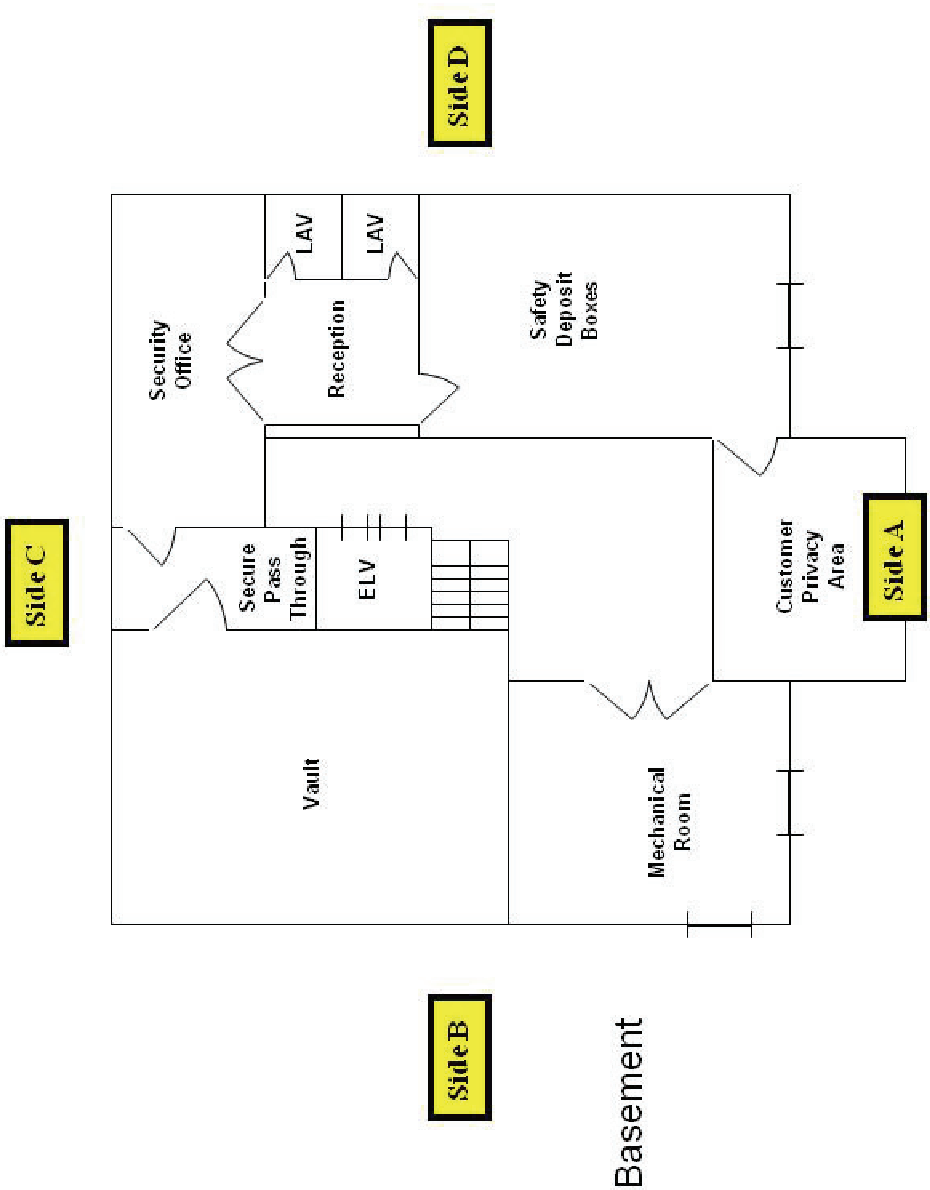
Basement

Iteration 4--Message 6

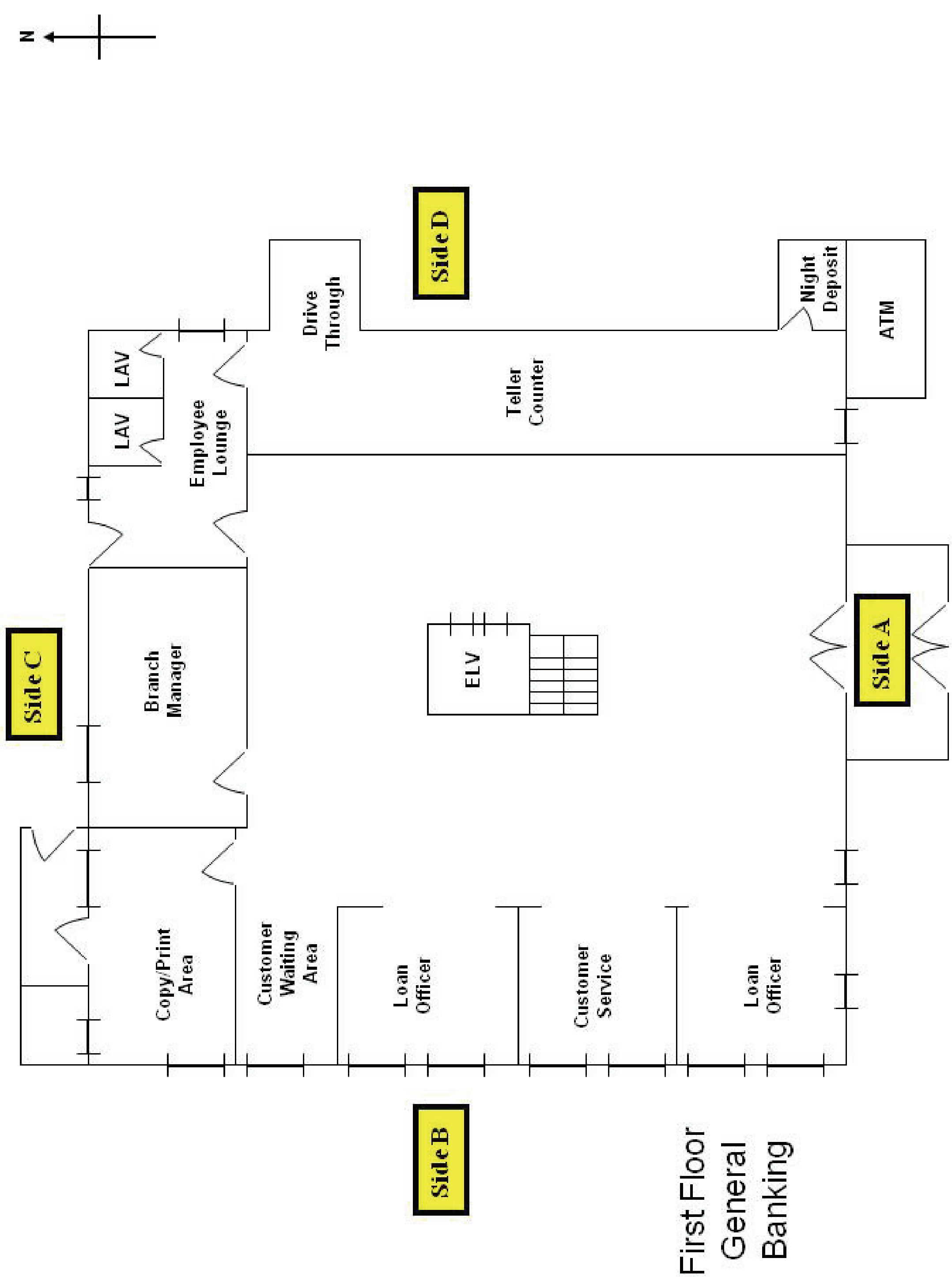


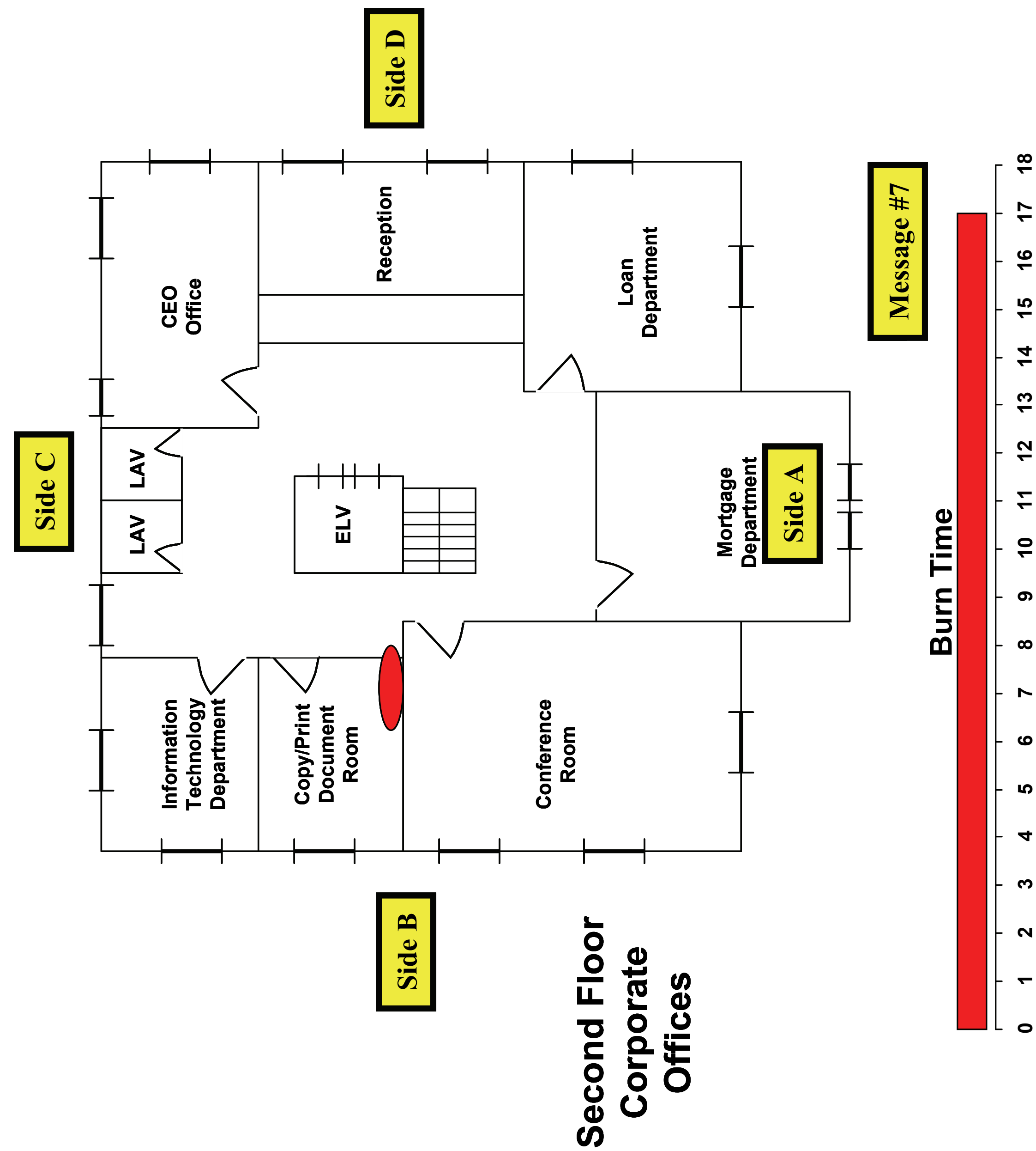

Side D
Side C
Side B
Side A
Message #6
CEO Office
Reception
Loan Department
LAV
LAV
ELV
Mortgage Department
Information Technology Department
Copy/Print Document Room
Conference Room
Second Floor Corporate Offices
Burn Time
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

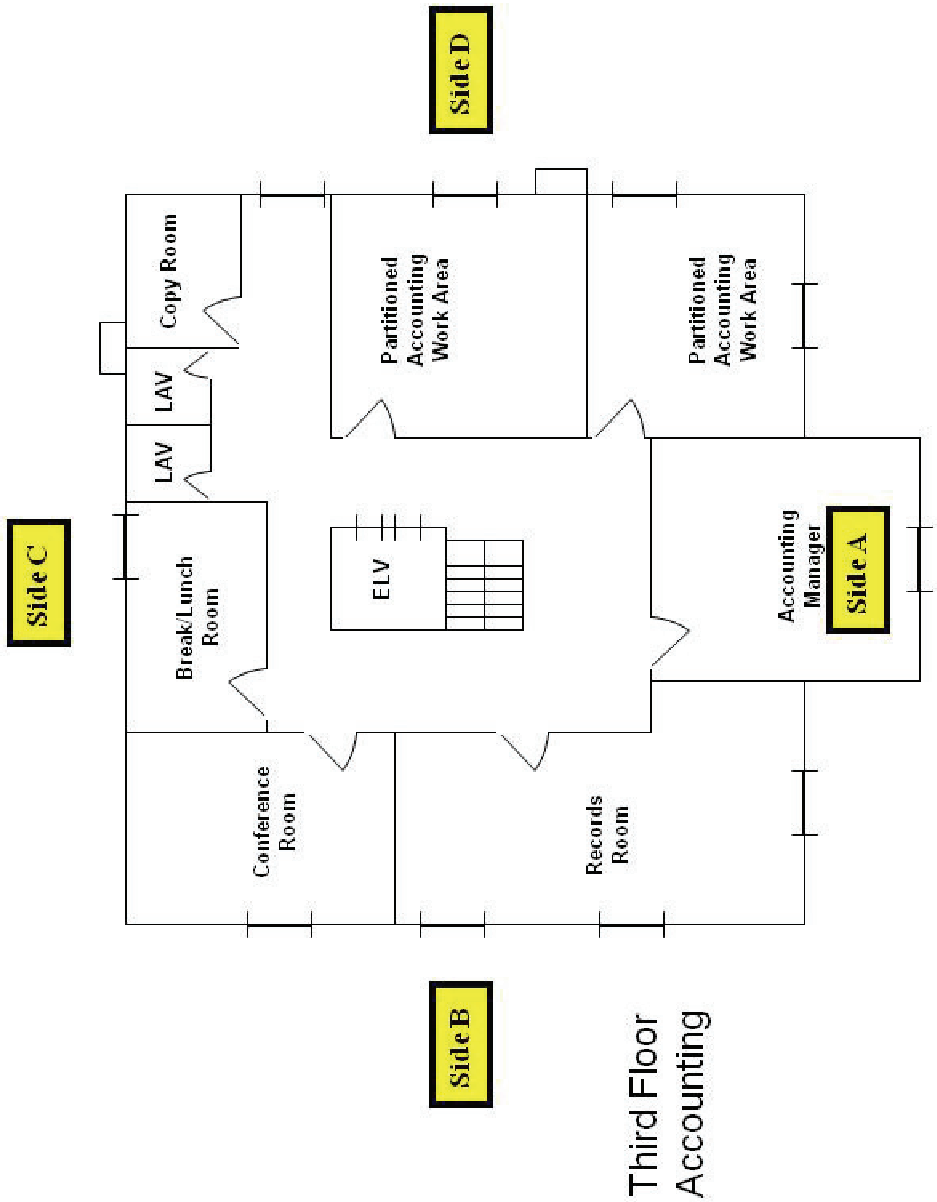

Side D
Side C
Copy Room
LAV
LAV
Partitioned Accounting Work Area
Partitioned Accounting Work Area
Break/Lunch Room
ELV
Accounting Manager
Side A
Conference Room
Records Room
Side B
Third Floor Accounting

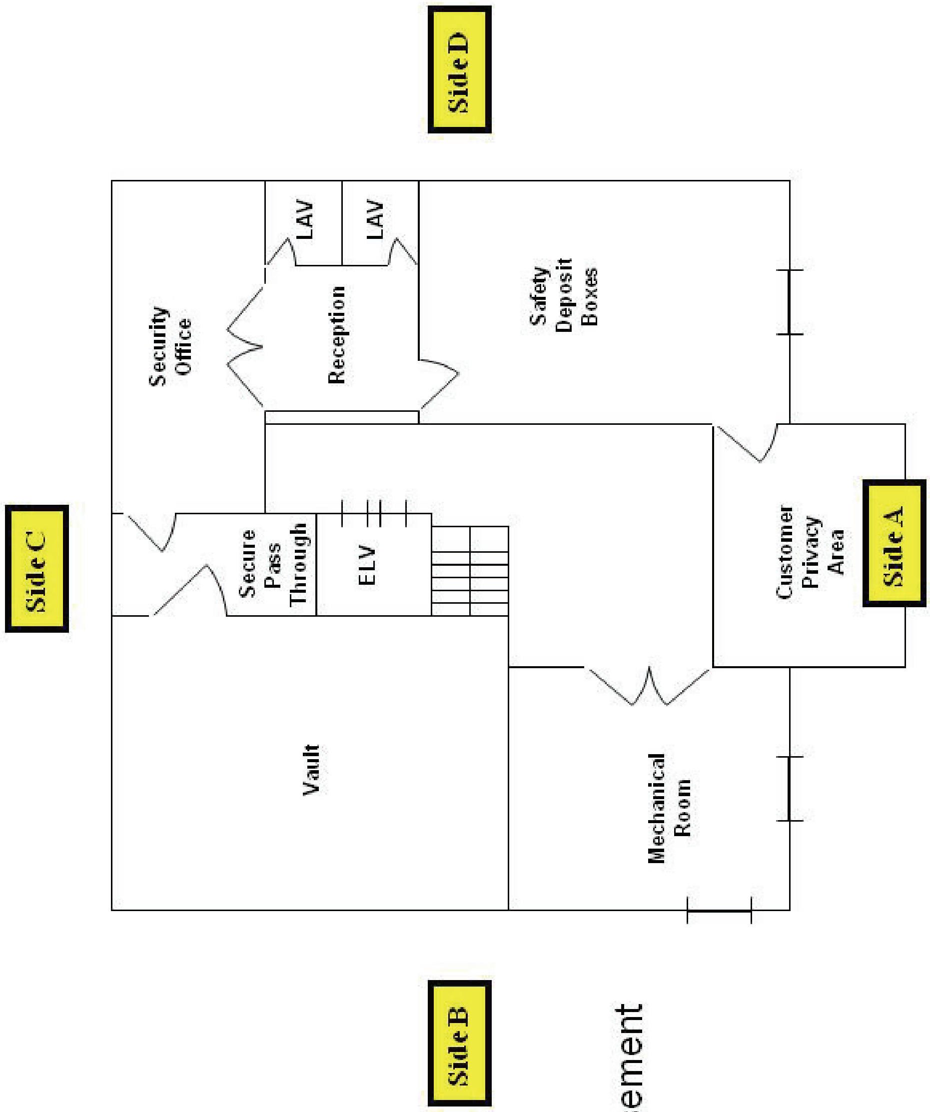

Side D
Side C
Side B
Side A
LAV
LAV
Security Office
Reception
Safety Deposit Boxes
Secure Pass Through
ELV
Customer Privacy Area
Vault
Mechanical Room
Basement

Iteration 4--Message 7



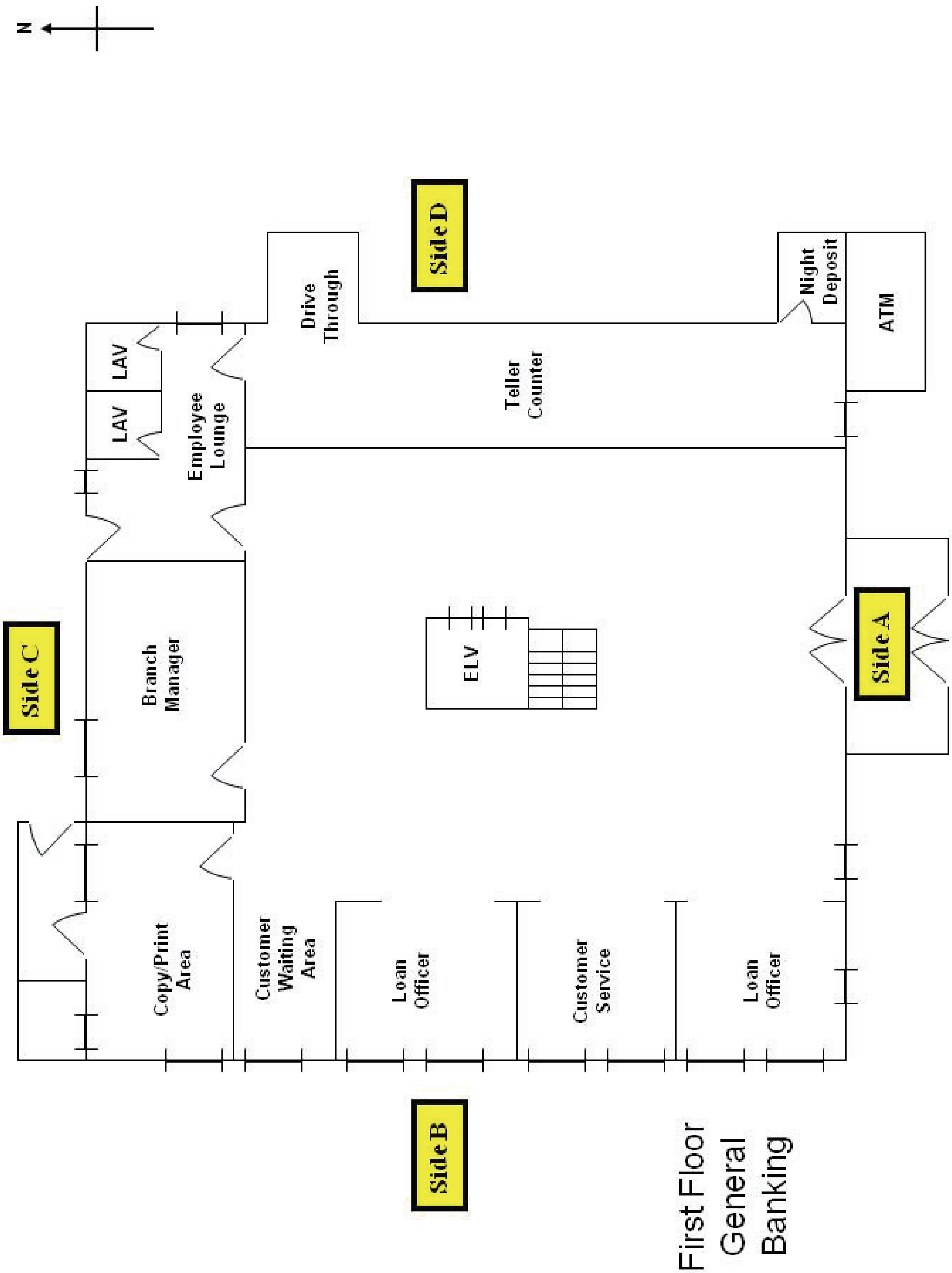

Side D
Side C
Side B
Side A
Message #7
CEO Office
Reception
Loan Department
LAV
LAV
ELV
Mortgage Department
Information Technology Department
Copy/Print Document Room
Conference Room
Second Floor Corporate Offices
Burn Time
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

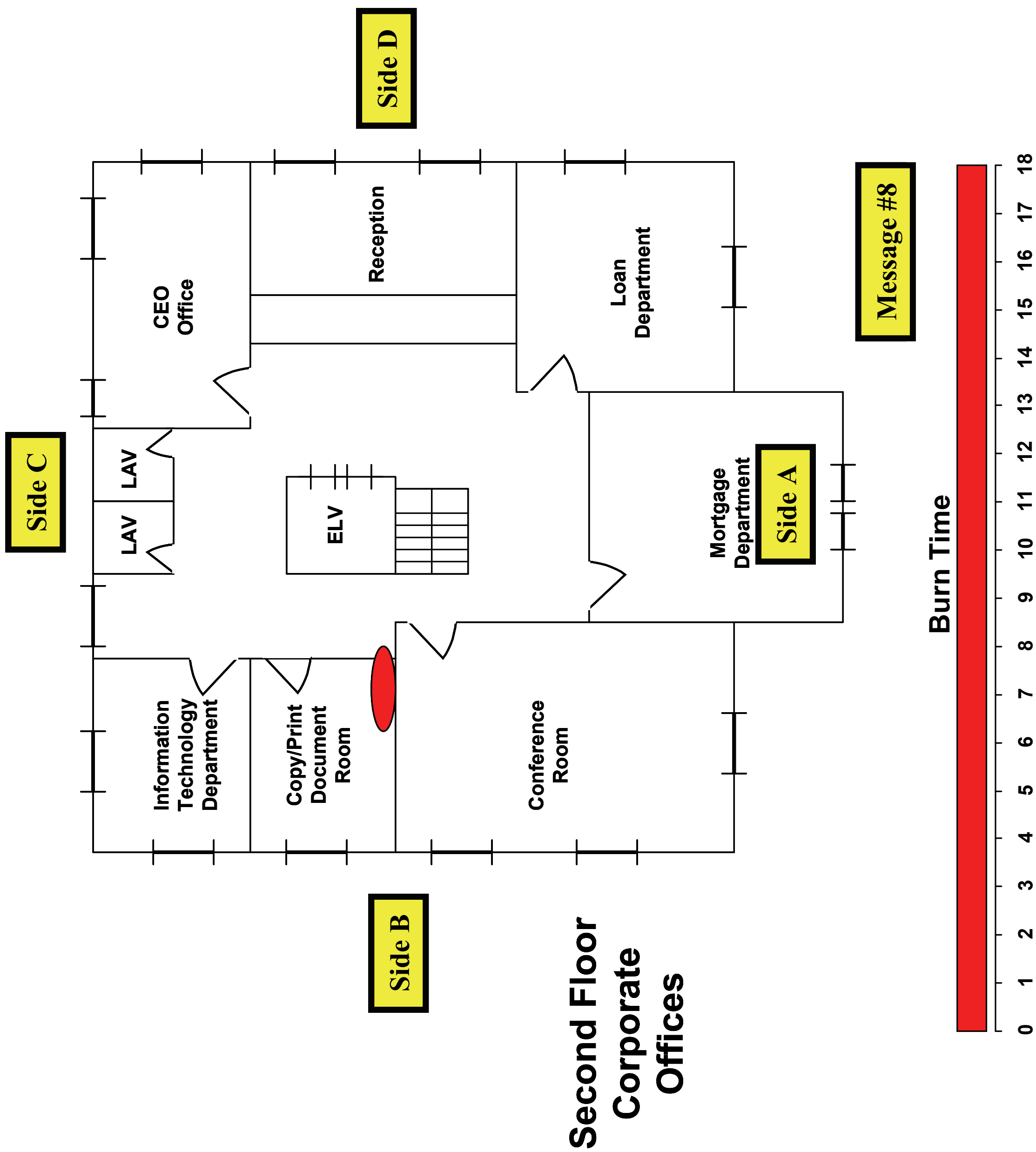

Side D
Side C
Side B
Side A
Copy Room
LAV
LAV
Partitioned Accounting Work Area
Partitioned Accounting Work Area
Break/Lunch Room
ELV
Accounting Manager
Conference Room
Records Room
Third Floor Accounting

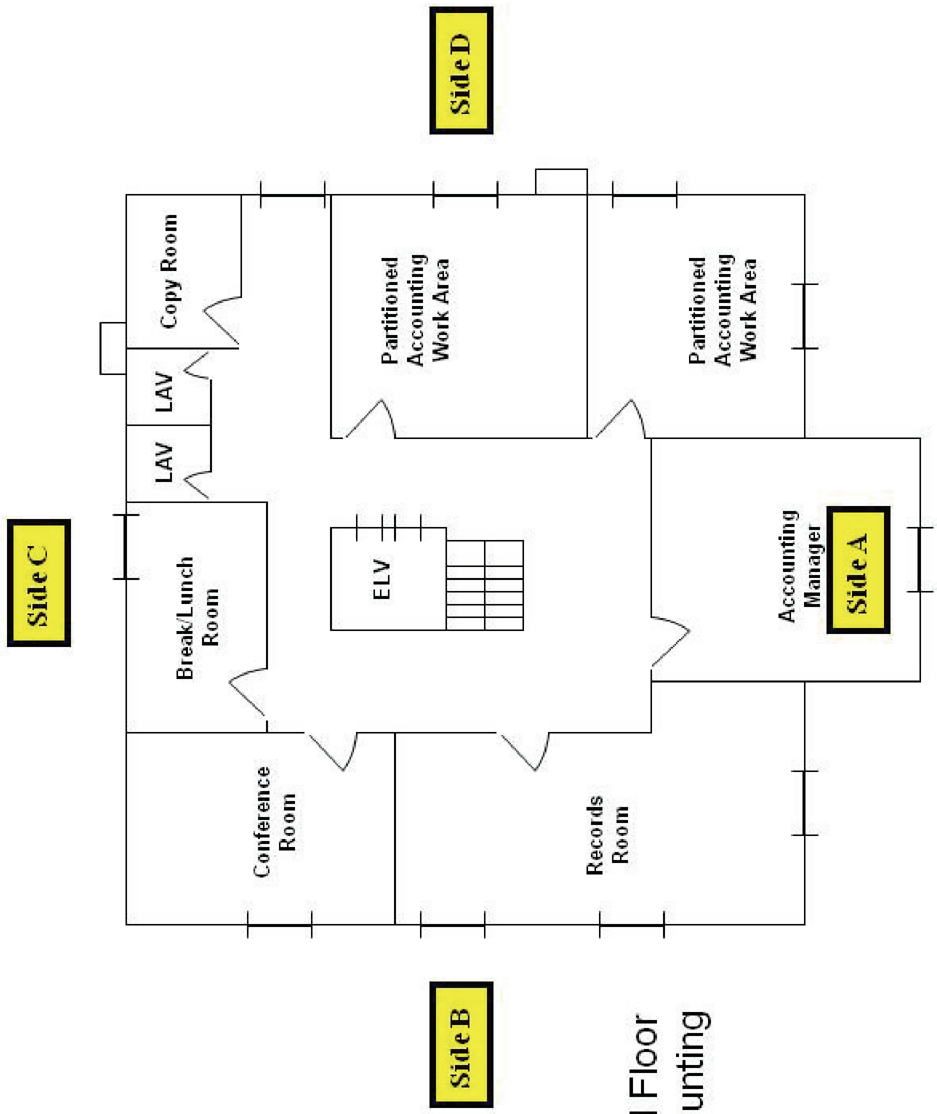

Side D
Side C
Side B
Side A
LAV
LAV
Security Office
Reception
Safety Deposit Boxes
Secure Pass Through
ELV
Customer Privacy Area
Vault
Mechanical Room

Basement

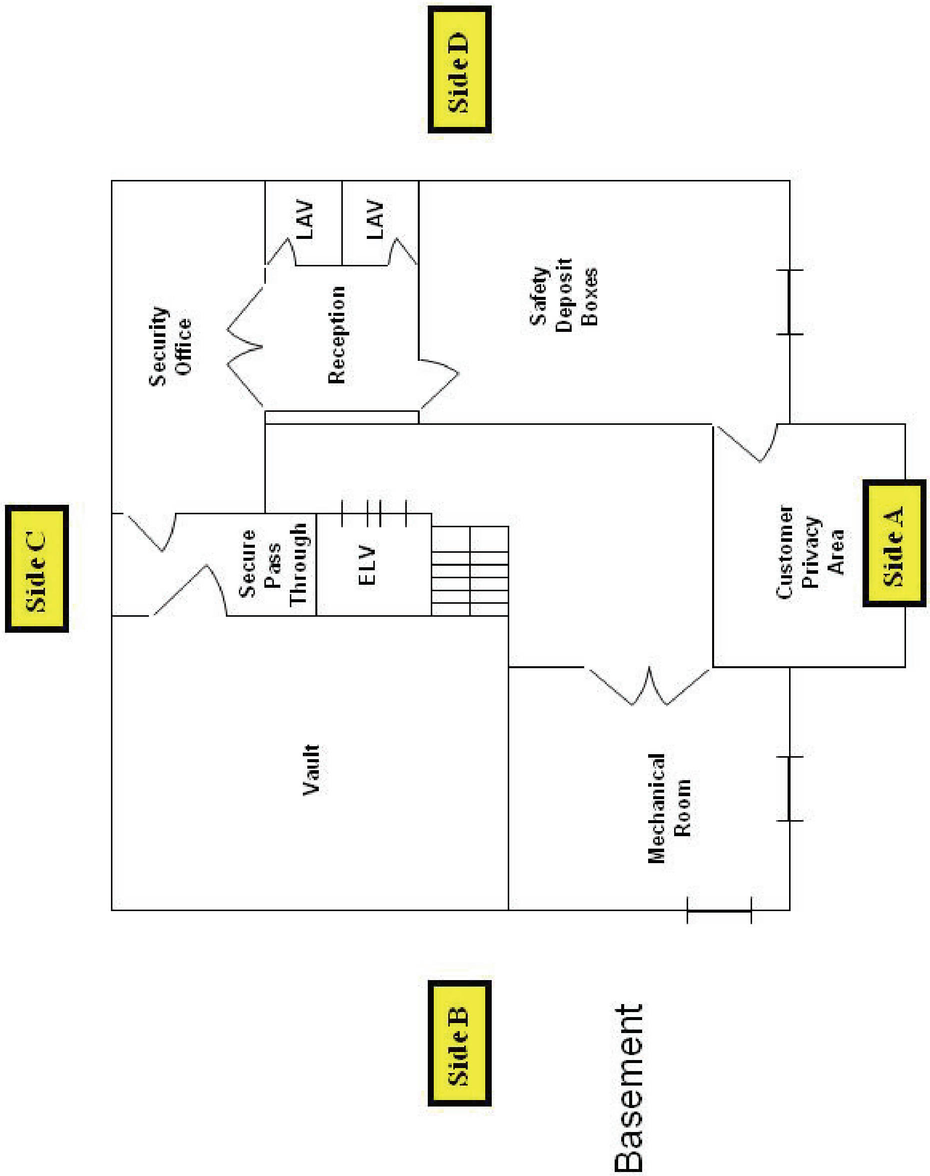
Iteration 4--Message 8




Side D
Side C
Side B
Side A
Message #8
CEO Office
Reception
Loan Department
LAV
LAV
ELV
Mortgage Department
Information Technology Department
Copy/Print Document Room
Conference Room
Second Floor Corporate Offices
Burn Time
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18



Third Floor Accounting


Side D
Side C
Side B
Side A
LAV
LAV
Security Office
Reception
Safety Deposit Boxes
Secure Pass Through
ELV
Customer Privacy Area
Vault
Mechanical Room
Basement

Activity 7.1 (cont'd)

Large Group Exercise #7: Noncombustible

Purpose

To allow you to demonstrate your knowledge, skills, and abilities (KSAs) you have gained as a result of attending this course. Conduct a walk-around of exposures A-B-C-D of the structures that will be seen in the exercise.

There can be up to seven structures used in the activity.

Directions

1. You will be working in small groups.

2. Each group will do each construction type. Exercise is designed to place the **ICO** as the Incident Commander (IC) until relieved by the next level of authority arriving at the incident. (This will be your instructor.)

3. For this simulation the **ICO** will have additional students assigned to Command and General Staff positions, which under normal field conditions would be the sole responsibility of the ICO.

4. Student group assignments for each group:

    a. ICO.

    b. ICOA--scribe.

    c. IISO.

    d. Initial Planning Section--Situation Unit.

    e. Initial Logistics Section--service and support.

5. Your group will record your predictions on an easel pad or paper.

6. Your group will select a spokesperson to explain to the class how fire would travel in this building.

7. Throughout the activity you will receive messages from the instructor.

8. In this portion of exercise your group is to concentrate on Column 1 Primary Factors Chart. You will have 10 minutes to complete this portion of the activity.

9. The ICOA-scribe shall develop a Primary Factors Exercise Chart on an easel pad for his/her assigned exercise scenario.

   a. Identify the most pertinent primary factors for each exercise scenario.

   b. Place findings on Column 1 of the Primary Factors Exercise Chart.

   c. Identify the most pertinent subfactors for each identified primary factor for exercise scenario. Place findings on Column 2 of the Primary Factors Exercise Chart.

   d. Identify pertinent precautions that will be taken to address each identified sub-factor for exercise scenario. Place findings on Column 3 of the Primary Factors Exercise Chart.

Activity 7.1 (cont'd)

Primary Factors Chart

Column #1 — Primary Factor - Situation Awareness- Chart

Primary Factors	(Check appropriate boxes) Pertinent Sub-Factors (P)	P
Life Hazard	Occupants	
	Firefighters	
Location/Fire	Fire Building on Arrival– Burn Time	
	Exposures On Arrival - Burn Time	
	Fire Spread Considerations Radiation/Conduction/Convection	
Construction	Fire Building – Type 1-2-3-4-5 (Lightweight Awareness)	
	Exposures – Type 1-2-3-4-5 (Lightweight Awareness)	
Occupancy (Contents)	Fire Building – (Fuel Load)	
	Exposures (Fuel Load)	
Height	Fire Building (Front-Rear)	
	Exposures (Front-Rear)	
Area	Fire Building/Configuration	
	Proximity of Exposures /Configuration	
Structural Collapse	Fire Building – Burn Clock After Arrival	
	Exposures – Burn Clock After Arrival	
	Collapse Zone – Safe Corridors	
	Apparatus Placement	
Weather	Visibility	
	Temperature/Humidity	
	Wind – Direction/Velocity	
Resource Requirement	Apparatus/Personnel/Equipment - RIT	
	Water Supply/Suppression Agent	
Auxiliary Appliances	Fire Building Supplied	
	Exposures Supplied	
Topography	Front-Rear	
Explosions/ Back Draft	Proper Ventilation Flash-Over Time Awareness	
Time	Time of Day Time of Year Duration of Incident	

Column #2 — Incident Objectives Attainable/ Measurable/ Flexible

Examples of Incident Objectives:

- Safe Removal of All Occupants within 10 minutes.
- Contain and Control Fire to Room/Building of Origin within 10 minutes
- Contain, Control and Limit Fire in Exposures within 10 minutes
- Other.

List Incident Objectives:

1. ______________________
____
2. ______________________
____
3. ______________________
____
4. ______________________
____
5. ______________________
____

Column #3 — Activities (Strategies) / **Column #4 — Evaluate Effect of Activities (Strategies) Every 10 Minutes**

Column #3 Activities (Strategies)	Effective	Ineffective
[R] Rescue • Interior/Exterior/Both		
[E] Exposure Protection • Exposure Examination		
[C/E] Confinement/Extinguishment • Hose Line Placement		
[O] Overhaul • Expose Hidden Fire		
[V] Ventilation • Removal of Occupants • Fire Control		
[S] Salvage • Water – Run-Off • Apply Covers		
Forcible Entry • Location • Method		
Special Equipment • Imaging Cameras		

List Incident Strategies	Assign Tactics:
For Objective # 1:	
For Objective # 2:	:
For Objective # 3:	
For Objective # 4:	
For Objective # 5:	
______________	

Identify alternative strategies for firefighter safety when occupant safety has been determined not to be a Primary Factor.

- ______________
- ______________
- ______________
- ______________
- ______________
- ______________
- ______________

Activity 7.1 (cont'd)

Primary Factors Exercise Chart

Pertinent Primary Factor	Pertinent Subfactor	Pertinent Precautions To Be Taken
1.	1. 2.	1. 2.
2.	1. 2. 3.	1. 2. 3.
3.	1. 2.	1. 2.
4.	1. 2.	1. 2.
5.	1. 2.	1. 2.
6.	1. 2.	1. 2.
7.	1. 2. 3. 4.	1. 2. 3. 4.
8.	1. 2. 3.	1. 2. 3.
9.	1. 2.	1. 2.
10.	1. 2.	1. 2.
11.	1.	1.
12.	1. 2.	1. 2.
13.	1. 2.	1. 2.

LARGE EXERCISE #7
Vital Building Information
Situation Report

COMMERCIAL--TYPE II--NONCOMBUSTIBLE

Structure:	One-story--metal fabricating and finishing
Building Construction:	Type II--noncombustible
Roof Construction:	Structural steel with asphalt covering over metal decking
Floors:	Concrete slab
Alarm System:	Smoke detectors installed
Sprinkler:	Paint spraying refinishing room only
Special Concerns:	Metal fabricating and spray paint Finishing compressed air bottles oxygen and acetylene Solvents and paint containers

Situation Report:

Fire Building:

It is August 14, 1530 hours, temperature is 92 °F (33 °C), wind from north at 3 mph.

Upon arrival, several employees are outside the building on Side A. Plant foreman reports a small explosion occurred near the paint finishing room and fire broke out after the explosion. Two employees are suffering from arm and neck burns and need further treatment. Three employees are unaccounted for. They worked in the manufacturing finishing area. Four office employees are complaining of smoke inhalation. All office employees are accounted for.

Exposures:

No immediate exposures.

Activity 7.1 (cont'd)

Objectives-Strategy-Tactics Chart

1. Use the enlarged Objectives-Strategy-Tactics Chart or easel pad.

2. Refer back the Primary Factors Exercise materials in Unit 4: The Analytical Sizeup Process if necessary.

3. Place Slide Iteration #2 for Sides A-B-C-D for each scenario chosen.

4. Receive and act on Exercise Message #2 and Plot Plan #2.

5. Concentrate on Columns 2 and 3 and develop the Objectives-Strategy-Tactics for the scenario.

6. ICOA scribe shall develop an easel pad for Objectives-Strategy-Tactics for assigned exercise scenario. (You have 20 minutes to complete.)

   a. Column 1: Identify the first operational period objectives for the scenario.

   b. Column 2: Identify the first operational period strategies for each objective.

   c. Column 3: Identify the first operational period tactics for each strategy.

   d. Column 4: Assign companies to perform tactics.

Each scenario has first alarm structural resources available at start of exercise:

- Engine 1
- Engine 2
- Engine 3
- Ladder 1
- Basic Life Support (BLS) 1

Each scenario will have working incident structural resources arrive 10 minutes into incident.

- **Engine 5**
- Engine 6
- **Squad 1**
- Engine 6 (Rapid Intervention Crew (RIC))
- Air Cascade-1 FF
- Safety Officer

Central City Fire EMS Dispatch Criteria

Assignment	Alarm Type	Engine	Ladder	Squad	Battalion Chief	EMS Unit	RIC	Safety Officer	Air Cascade
First Alarm	Structural	3	1			1 BLS			
Working Incident	Structural	2		1	1		1	1	1
First Alarm	Target Hazard	3	2	1	1	1 BLS			
Working Incident	Target Hazard	2				1 ALS	1	1	1
Second Alarm	Structural/ Target Hazard	2	1		1	1EMS		1	1
Third Alarm	Structural/ Target Hazard	2	1			1 MS			
Fourth Alarm	Structural/ Target Hazard	2	1		1				

Central City Fire/EMS Staffing:

- **Engine-Ladder-Squad Company--1 Officer--3 Firefighters**
- **Rapid Intervention Crew (RIC)--One Engine Company**
- **EMS BLS Unit--2 EMT Basic**
- **EMS ALS Unit--2 EMT Paramedic**
- **Air Cascade - 1 Firefighter**

A second alarm may be requested but will not arrive on scene before end of exercise.

Activity 7.1 (cont'd)

Objectives-Strategy-Tactics Chart

Objectives	Strategy (s)	Tactics	Assigned to:
Objective #1	**1.**	**1.** **2.** **3.**	**1.** **2.** **3.**
	2.	**1.** **2.** **3.**	**1.** **2.** **3.**
	3.	**1.** **2.** **3.**	**1.** **2.** **3.**
Objective #2	**1.**	**1.** **2.** **3.**	**1.** **2.** **3.**
	2.	**1.** **2.** **3.**	**1.** **2.** **3.**
	3.	**1.** **2.** **3.**	**1.** **2.** **3.**
Objective #3	**1.**	**1.** **2.** **3.**	**1.** **2.** **3.**
	2.	**1.** **2.** **3.**	**1.** **2.** **3.**
	3.	**1.** **2.** **3.**	**1.** **2.** **3.**

Activity 7.1 (cont'd)

ICS Form 201, *Incident Debriefing* and ICS Form 214, *Unit Log*

1. Use the enlarged ICS Form 214, *Unit Log* or easel pad.

2. The ICOA will maintain ICS Form 214 for all tactical decisions made by the ICO along with other pertinent messages and decisions made by the ICO during the exercise. Entries should be recorded under Time and Major Events columns.

3. Distribute ICS Form 214.

    a. IISO.

    b. Initial Planning Section (Situation Unit).

    c. Initial Logistics Section (Service and Support).

4. Distribute ICS Form 201, *Incident Debriefing* (enlarged to 11 by 17).

    a. Initial Planning Section (Situation Unit).

    b. Initial Logistics Section (Service and Support).

5. Begin exercise scenario message distribution.

6. Follow message distribution time frames until all messages have been distributed. (You have 30 minutes.)

Activity 7.1 (cont'd)

Preparing for Exercise Debriefing

You have 15 minutes for each group to prepare their debriefing materials for presentation.

1. ICO.
    a. Primary Factors Chart.
    b. Objectives-Strategy-Tactics Chart.
2. Initial Company Officer Assistant--ICS Form 214.
3. Initial Safety Officer--ICS Form 214.
4. Initial Planning Section.
5. Initial Logistics Section--ICS Form 201.

Activity 7.1 (cont'd)

ICS Form 214, *Unit Log*

UNIT LOG	1. Incident Name	2. Date Prepared	3. Time Prepared
4. Unit Name/Designators	5. Unit Leader (Name and Position)		6. Operational Period

7. Personnel Roster Assigned		
Name	ICS Position	Home Base

8. Activity Log	
Time	Major Events
9. Prepared by (Name and Position)	

Instructions for completing the Unit Log (ICS Form 214)

ITEM NUMBER	ITEM TITLE	INSTRUCTIONS
1.	Incident Name	Print the name assigned to the incident.
2.	Date Prepared	Enter date prepared (month, day, year).
3.	Time Prepared	Enter time prepared (24-hour clock).
4.	Unit Name	Enter the title of the organizational unit or resource designator (Engine 1 - Safety Officer, Situation Unit – Logistics Section).
5.	Unit Leader	Enter the name of the individual in charge of the Unit.
6.	Operational Period	Enter the time span covered by the log (e.g., 1800 Oct. 12 to 0600 Oct. 13).
7.	Personnel Roster	List the name, position, and home base of each member assigned to the unit during the operational period.
8.	Activity Log	Enter the time and briefly describe each significant occurrence or event (e.g., task assignments, task completions, injuries, difficulties encountered, etc.).
9.	Prepared By	Enter the name and title of the person approving the log. Provide log to immediate supervisor at the end of each operational period.

Activity 7.1 (cont'd)

ICS Form 201, *Incident Debriefing*

INCIDENT DEBRIEFING	1. INCIDENT NAME	2. DATE PREPARED	3. TIME PREPARED
4. MAP SKETCH			
ICS 201 (12/93) **NFES1325**	PAGE 1	5. PREPARED BY (NAME AND POSITION)	

6. SUMMARY OF CURRENT ACTIONS		
ICS 201	PAGE 2	

7. CURRENT ORGANIZATION		
ICS 201 (12/93) **NFES1325**	PAGE 3	

8. RESOURCES SUMMARY				
RESOURCES ORDERED	**RESOURCE IDENTIFICATION**	**ETA**	**ON SCENE √**	**LOCATION/ASSIGNMENT**
ICS 201 (12/93) **NFES 1325**	PAGE 4			

Instructions for completing the Incident Briefing (ICS Form 201)

ITEM NUMBER	ITEM TITLE	INSTRUCTIONS
1.	Incident Name	Print the name assigned to the incident.
2.	Date Prepared	Enter date prepared (month, day, year).
3.	Time Prepared	Enter time prepared (24-hour clock).
4.	Map Sketch	Show perimeter and control lines, resources assignments, incident facilities, and other special information on a sketch map or attached to the topographic or orthophoto map.
5.	Resources Summary	Enter the following information about the resources allocated to the incident. Enter the number and type of resource ordered.
	Resources Ordered	Enter the number and type of resource ordered.
	Resource Identification	Enter the agency three-letter designator, S/T, Kind/ Type and resource designator.
	ETA/On Scene	Enter the estimated arrival time and place the arrival time or a checkmark in the "on scene" column upon arrival.
	Location/ Assignment	Enter the assigned location of the resource and/or the actual assignment.
6.	Current Organization	Enter on the organization chart the names of the individuals assigned to each position. Modify the chart as necessary.
7.	Summary of Current Actions	Enter the strategy and tactics used on the incident and note any specific problem areas.
8.	Prepared By	Enter the name and position of the person completing the form.
*Note		Additional pages may be added to ICS Form 201 if needed.

Activity 7.1 (cont'd)

Debriefing Procedures

1. The instructor will debrief exercise scenarios with each group.

2. The instructor will display the slides for your group's scenario when debriefing.

3. Assigned ICO for each group shall present the following:

   a. Primary Factors Chart.

   b. Objectives-Strategy-Tactics Chart.

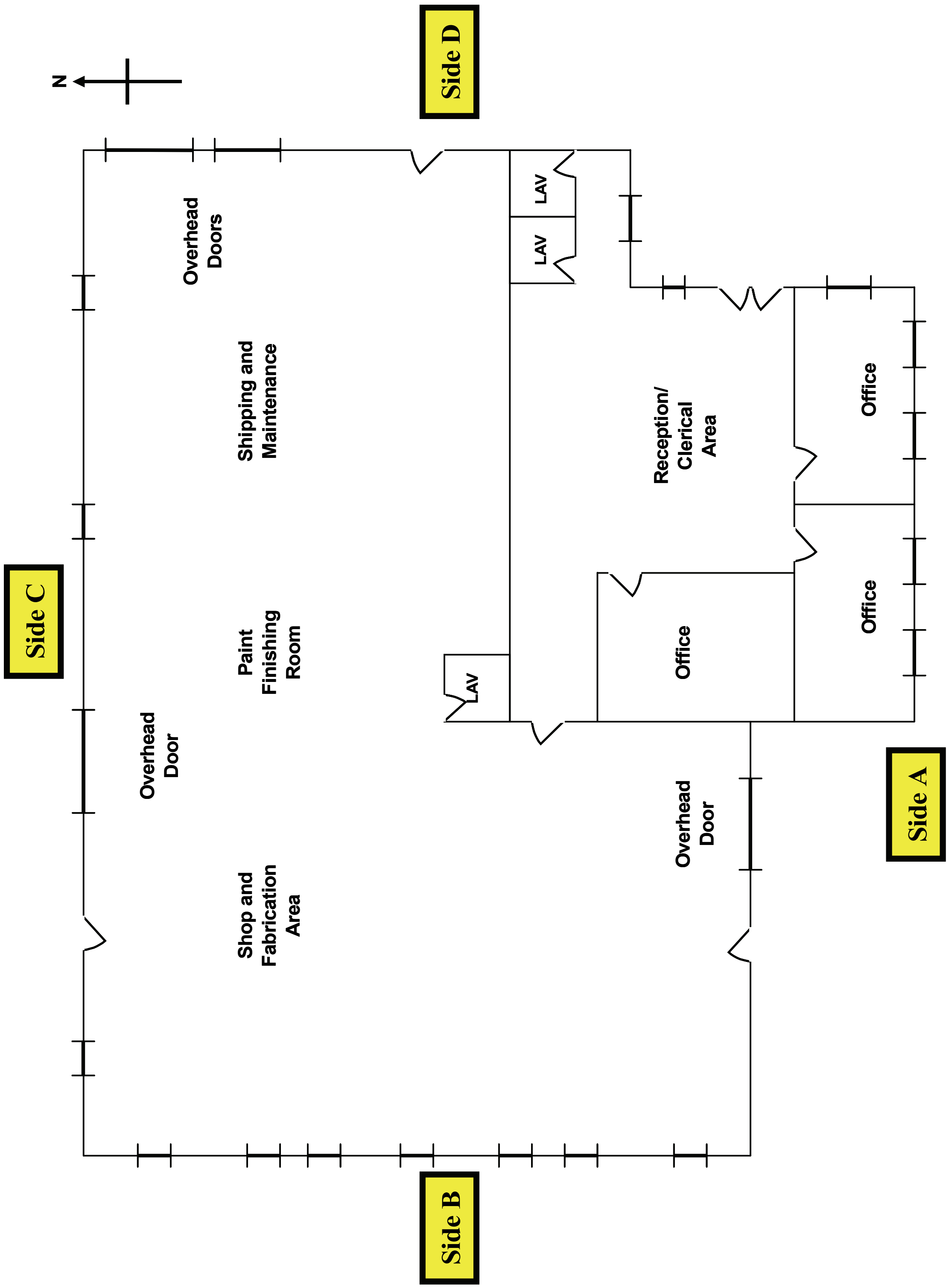
   c. ICS Form 214.

4. Each group will have 15 minutes to debrief.

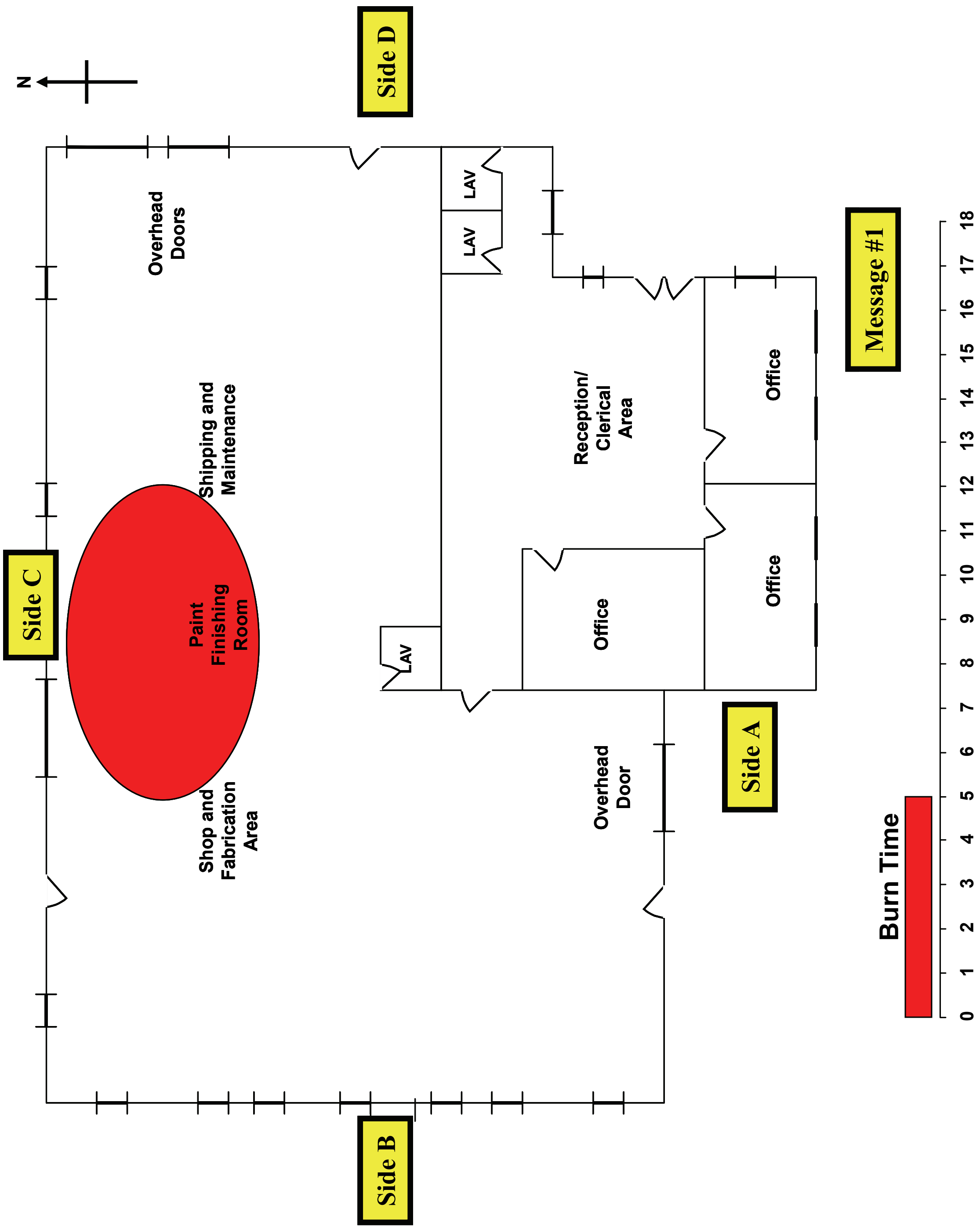
5. The instructor will address any specific issues that were omitted from charts and identify issues where improvement is required.

Activity 7.1 (cont'd)
Plot Plans
Exercise #7

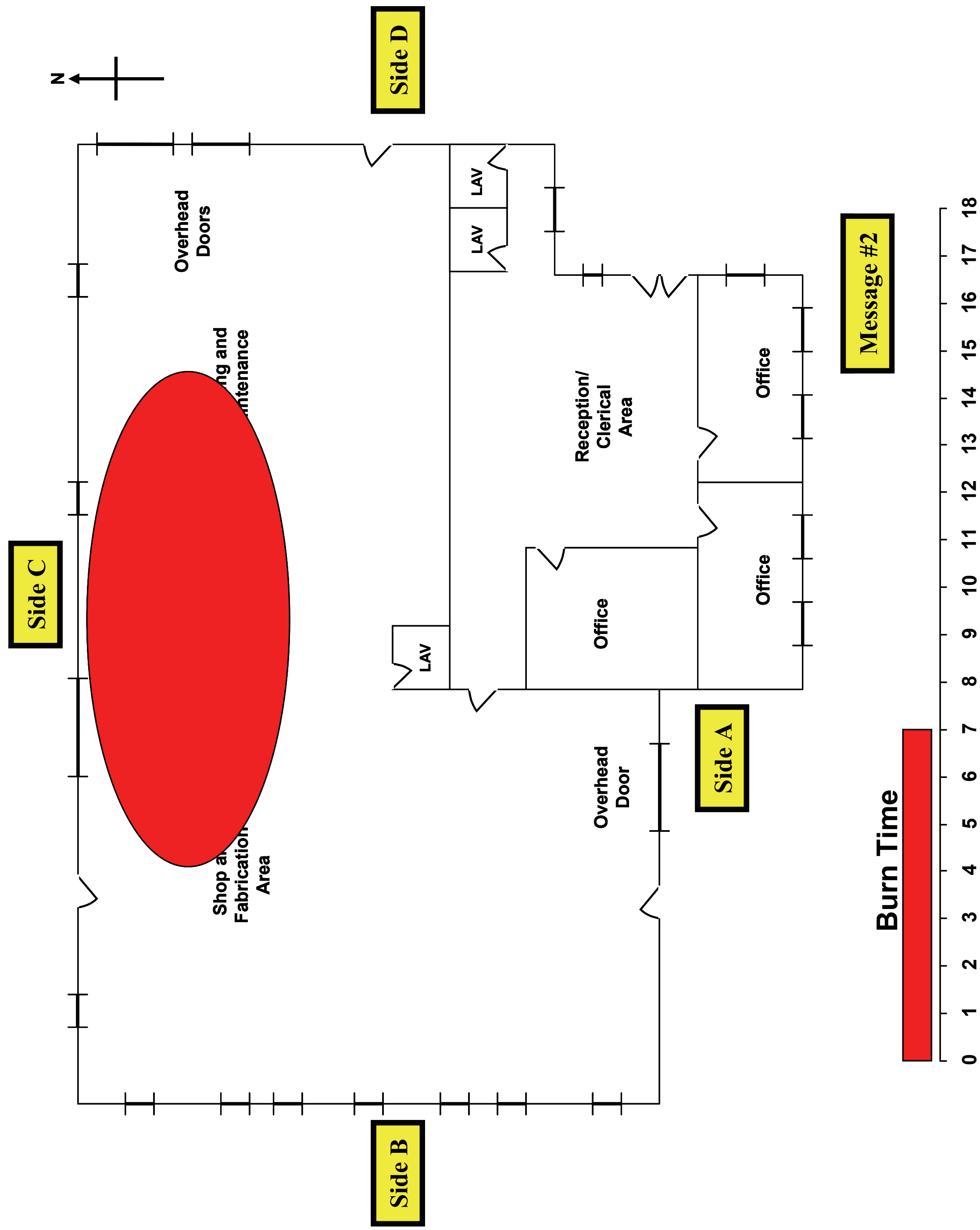
Noncombustible--Walkaround



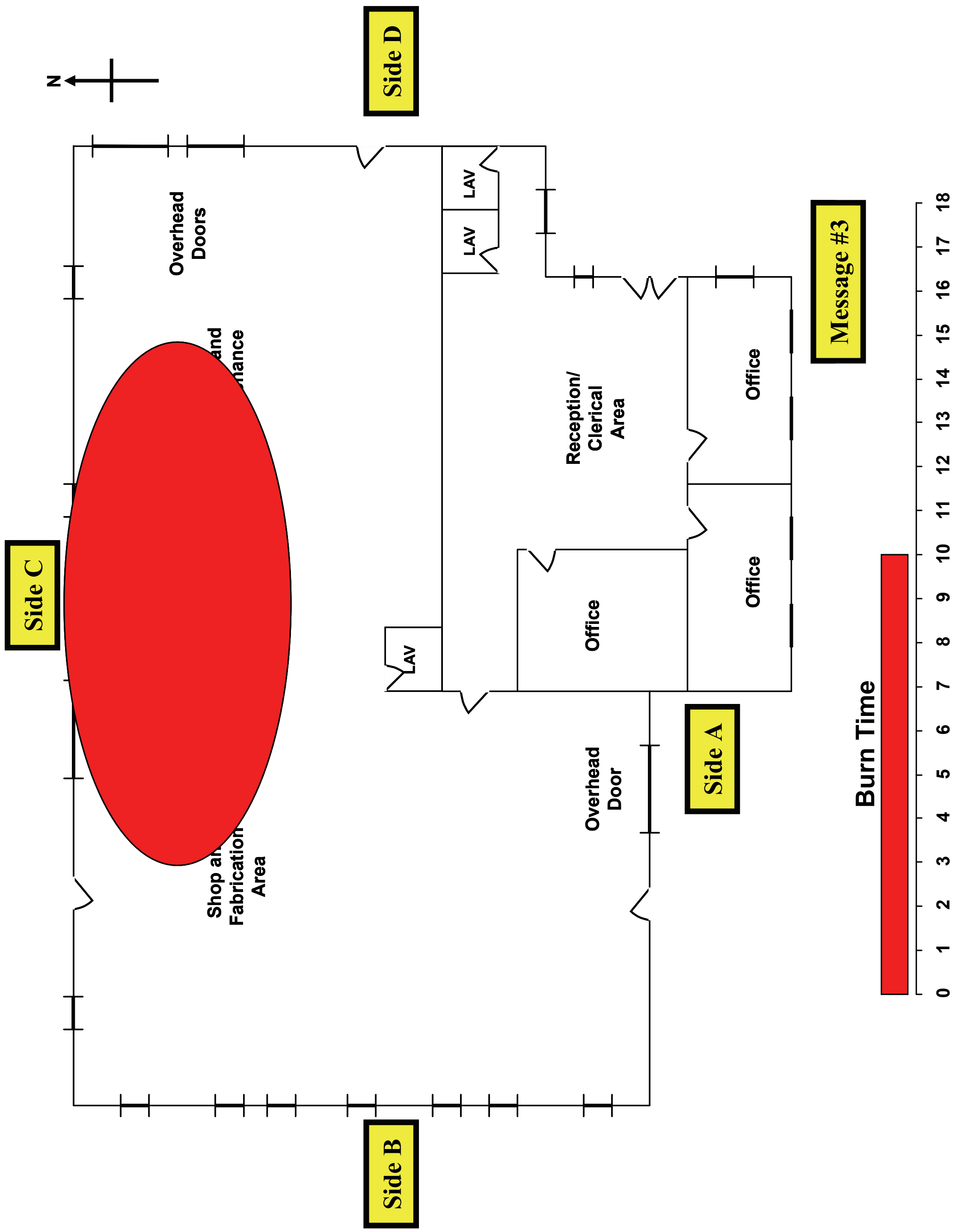
Iteration 1--Message 1



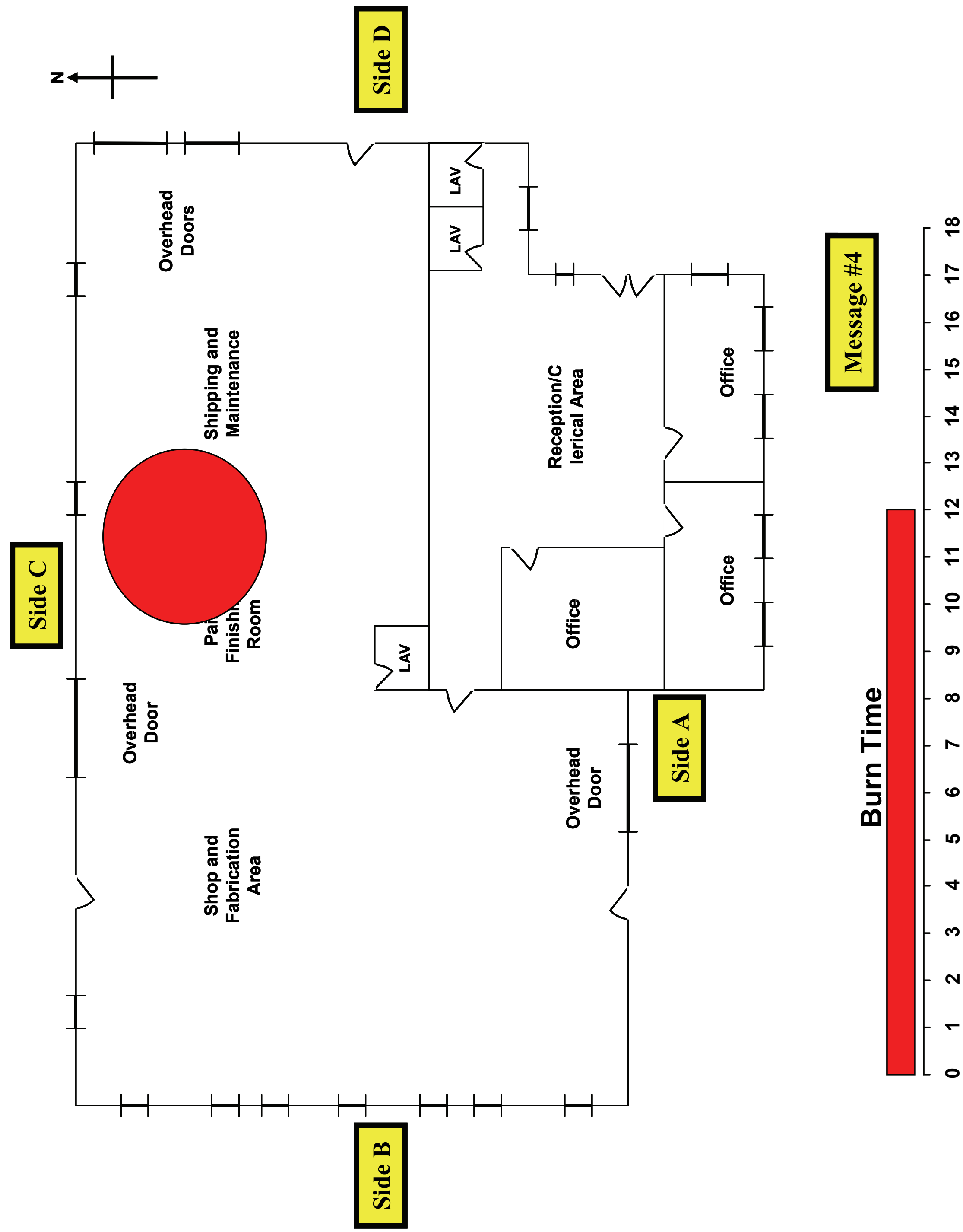
Iteration 2--Message 2



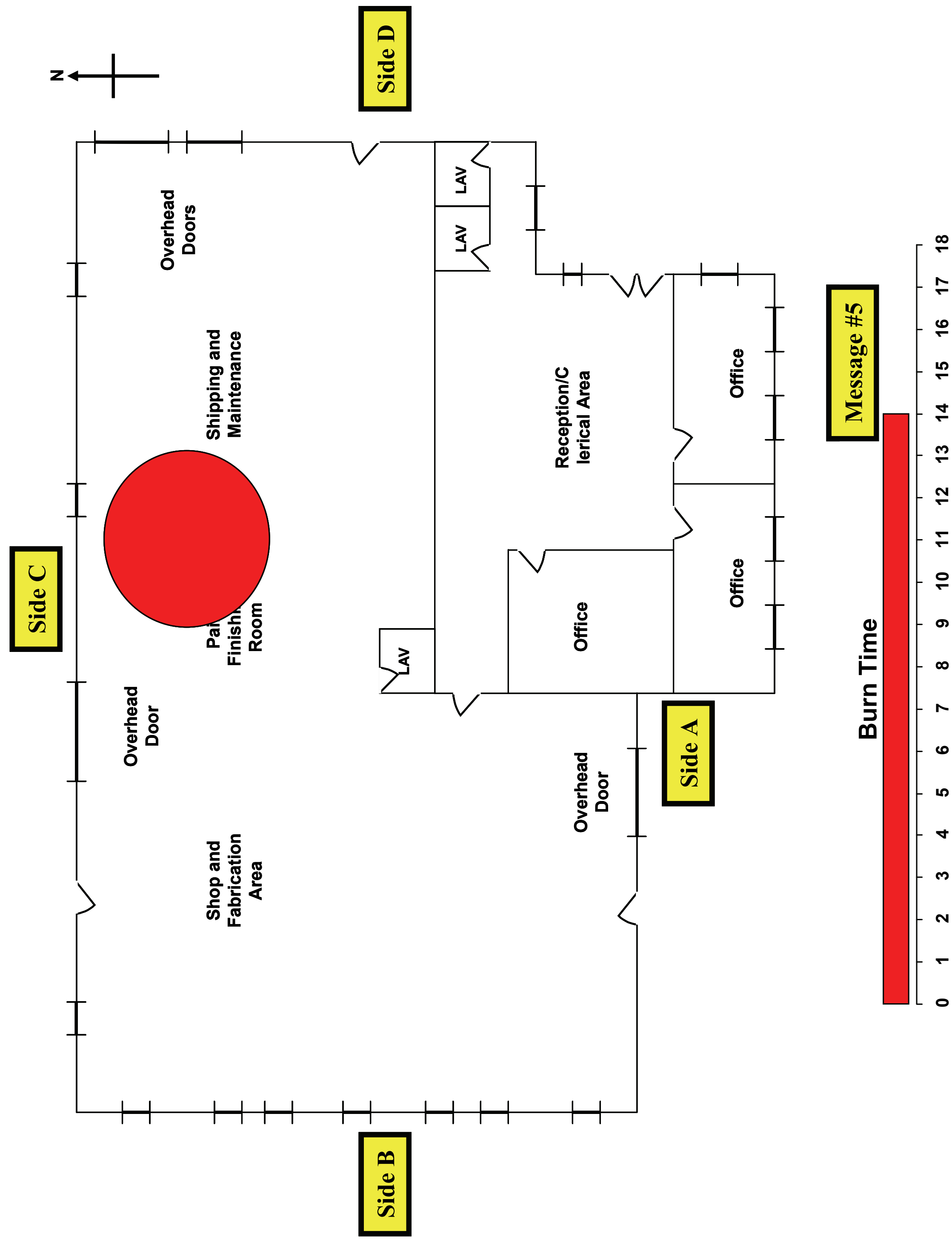
Iteration 2--Message 3



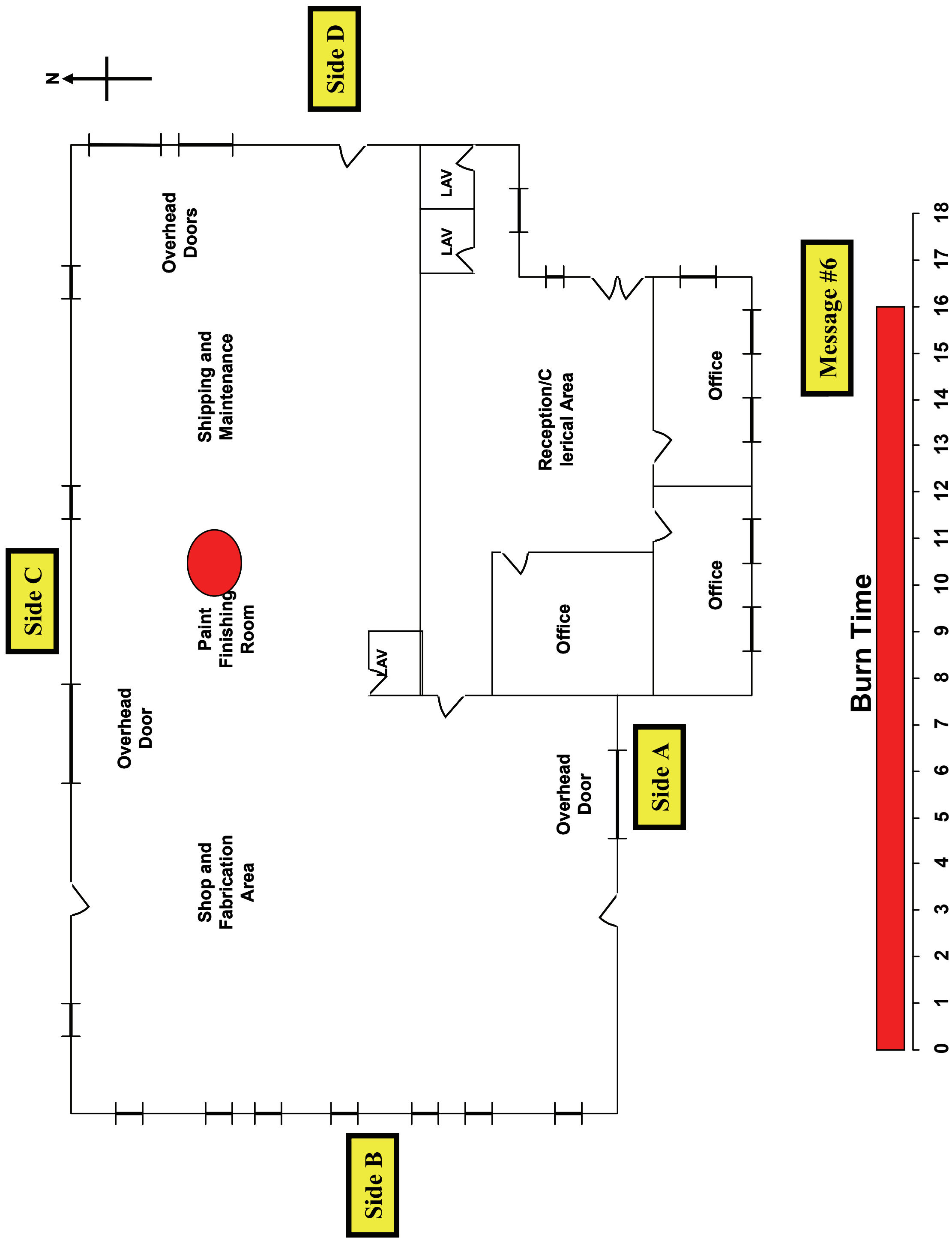
Iteration 3--Message 4



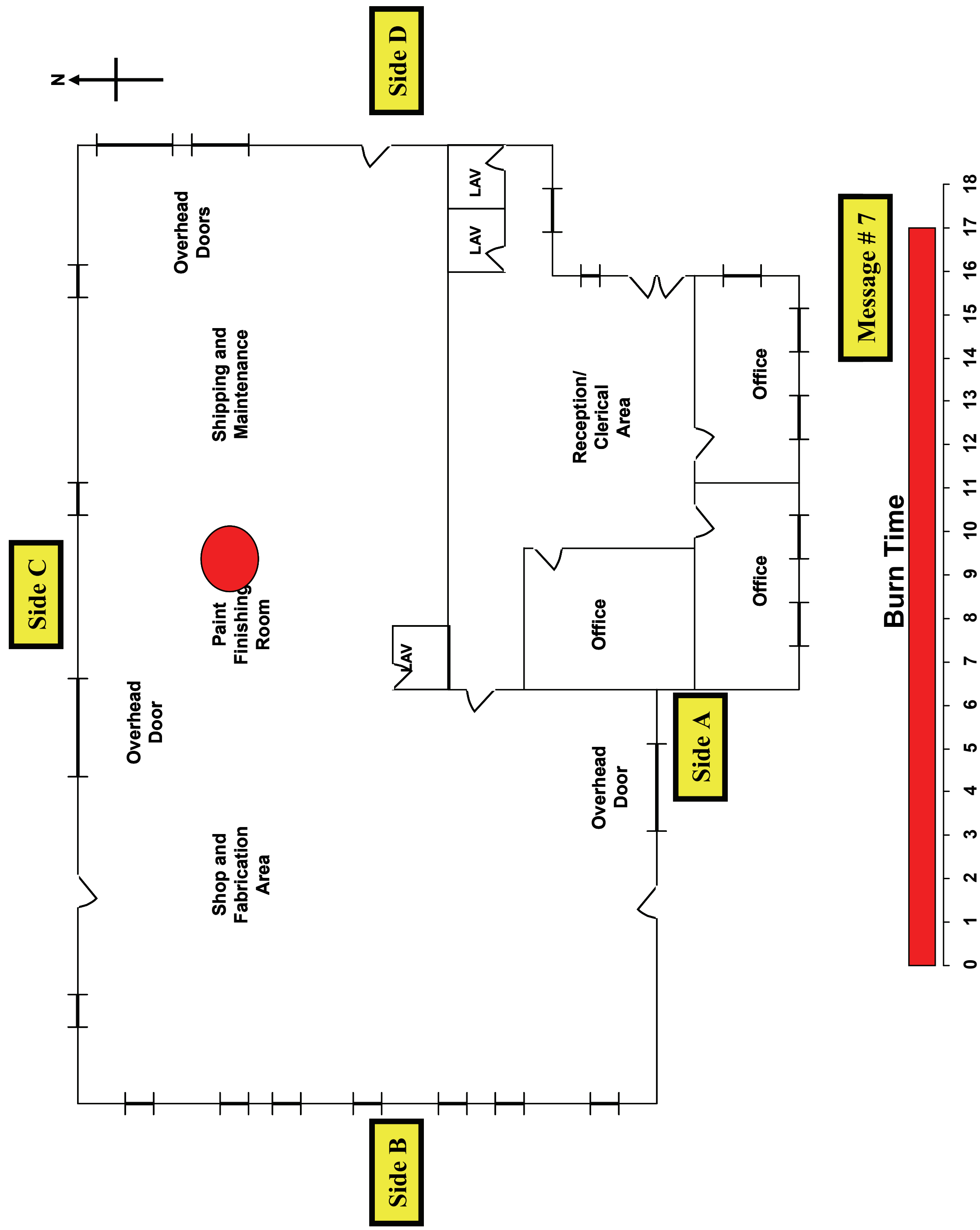
Iteration 3--Message 5



Iteration 4--Message 6



Iteration 4--Message 7



Iteration 4--Message 8