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Edward Elgar

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11. Worksite emergency preparedness: lessons from the World Trade Center Evacuation Study

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INTRODUCTION

The events of September 11th, 2001, and other recent workplace fires, explosions, natural disasters, violent assaults with deadly weapons and other emergencies, have underscored not only the potential vulnerability of workites, but the importance of preplanning for disaster response. Since the World Trade Center Disaster (WTCDD), the role of emergency preparedness, in terms of mitigating the adverse impacts of disaster events in the workplace, has gained in importance and recognition, both nationally and internationally. In the United States (US), the leading workplace safety agency, the National Institute of Occupational Safety and Health (NIOSH), has identified emergency preparedness and response as an important cross-sector research program in recognition of this significance (NIOSH, 2007).

Worksite readiness for a wide range of emergencies is important, not only because it can help reduce disaster-related morbidity and mortality among workers and visitors, but it can also help to preserve organizational assets and maintain corporate functions and processes. Preplanning and response, therefore, is essential to business continuity and viability. While numerous recent events heightened both interest and efforts in preplanning, a number of challenges to preparedness have hampered these efforts. Perhaps the most important of these is the general lack of consensus of what constitutes 'preparedness'. There is also lack of agreement on how best to measure and achieve this, and this is true at a number of levels, including the community, business, public health, and public safety sectors. From a management perspective, a serious challenge to preparedness is the competition for limited resources; low probability/high consequence events

can, and often do, play a lesser role when there are other, more pressing, issues at hand. The question facing work organizations of all sizes and types after addressing: 'Are we prepared for emergencies?' and 'How do we know that we are prepared?' is 'How can I achieve this in the most efficient and cost-effective way possible?' This is the question that is also of concern to emergency planners, disaster researchers, worker representative groups, and workers.

This chapter provides an overview of the role of workplace emergency preparedness in protecting the health and safety of workers and work organizations. It also presents evidence from the World Trade Center Evacuation (WTCE) Study on the factors that influence employees' response to a workplace disaster, along with simple and relatively low-cost recommendations that address these factors.

Disasters

Life-threatening workplace disasters may be naturally occurring, human-made, or technologically related. Often, the term, 'emergency', is used interchangeably with the term, 'disaster', which has been defined as 'any destructive event that disrupts the normal functioning of a community' (Veenema, 2006). Some examples of naturally occurring disasters are wild fires, floods, hurricanes, tornadoes, earthquakes, and extreme weather or temperature conditions, and so on. Examples of human-made disasters (either intentional or unintentional) include fire, explosions, major hazardous materials release (for example, chemical, biological, and radiological), exposure to physical hazards (for example, electrical and so on), and acts of violence (including, in its most extreme form, terrorist attacks or threats of such attacks). Technological disasters include nuclear power plant releases, chemical plant explosions, oil spills, and equipment failures. Disasters are generally declared when the event reaches a certain magnitude that is beyond the capability and capacity of the local emergency response agencies. The statutory framework for the declaration of a major disaster is provided by the Robert T. Stafford Disaster Relief and Emergency Assistance Act (2005).

Human behaviors during disasters

From a worksite preparedness perspective, a particular aspect regarding disasters is of special importance, namely human behavioral responses during these types of events, as it can provide guidance to the planning process. Scientists have long been fascinated by human response to disaster or emergency, and some of their findings are informative here. Careful study of how individuals and groups respond under threatening conditions

has led to some surprising and counterintuitive conclusions. For example, although panic is believed to be common during disasters, this is, in fact, rather uncommon. The conditions for panic have been identified by Quarantelli (1997) and others and include the following:

- Ineffective crisis management (leaves people feeling completely on their own).
- Pre-existing beliefs in a group that certain kinds of situations will lead to panic (that is, during a fire people will stampede exits).
- Immediate threat of entrapment (panic does not develop when people know they are trapped, but rather when they sense that their chances for escaping danger are dwindling).
- There is a sense of complete social isolation – that is, that there is no one else in the setting upon whom they can depend.
- There is no possibility of survival, except through flight.

These findings support the important role that emergency preparedness can play in helping to manage the emergency, thereby lessening the chance of panic. In the WTC/D, panic behaviors were rare. This is most likely due to the fact that the conditions for panic were absent; people were familiar with one another and felt supported, there was some leadership provided, and escape was possible for those below the impact zones. Importantly, most people did not know how serious the impacts were to the structural integrity of the buildings and thus did not know that the buildings would collapse (Gershon et al., 2007). Other research has shown that people usually behave in active and adaptive ways during a disaster, with altruistic behavior not uncommon.

Another area of study that also has implications for workplaces is the resistance some people have to evacuation during disasters or the threat of disasters. Social scientists (Lindell and Perry, 1992) have identified four key questions that people ask themselves before they decide to evacuate:

- How believable is the threat?
- What is the feasibility of my escape (for example, stairway access)?
- Do I personally have the ability to escape?
- How effective will my attempts be to actually escape?

The responses to these questions have been found to be affected by various situational and social factors such as age, ethnicity, socioeconomic status, family status, personality characteristics, experience and so on. This model has been tested and found to explain significant variance in protective and proactive responses to disasters. The important message to

management from these findings is that accurate communication during an emergency, along with training and drilling, can result in appropriate action. These findings also highlight the role of senior leadership in setting an example by following evacuation orders.

Health and safety impacts

The adverse impact of disasters on the health and well-being of those affected, even indirectly, can be great, and these can have important implications for the affected workplace. Mental health problems, such as post-traumatic stress disorder (PTSD), depression, and anxiety, are especially common in the aftermath of disasters. Importantly, beyond the immediate negative physical and mental health effects related to disasters, long-term consequences can also result. In a review of more than 160 disaster reports, with roughly 10 percent classified as violence related, a number of co-morbidities of mental health disorders, including elevated substance use, non-specific distress, chronic difficulty coping with the activities of everyday life, and psycho-social resource losses, were identified (Norris et al., 2002). Consequences appear to be most severe when the disaster has the following characteristics: (i) widespread property damage, (ii) ensuing and ongoing financial crises, (iii) high rates of trauma or fatalities, and (iv) intentional human violence.

Terrorism in particular, including the threat of terrorism, has been shown to have the greatest adverse impact on survivors' well-being, in comparison to other types of disasters (Ursano, 2002; Stith Butler et al., 2003). These findings have been confirmed by Galea et al. (2005) in a review that focused on the determinants of PTSD after disasters. The prevalence of PTSD in the first year, after human-made/technological disasters, has been documented as high as 75 percent (Galea et al., 2005). In comparison, studies of adult survivors of disaster have estimated the prevalence of PTSD as high as 60 percent (Brooks and McKinlay, 1992; Green et al., 1992; Dooley and Gunn, 1995; Selley et al., 1997; North et al., 1999; Arata et al., 2000; Yule et al., 2000; Galea et al., 2005). In further comparison, the lifetime risk of PTSD within the general public is 10 percent (Kessler, 2000). Although there has been less study on other psychopathologies following disasters, data on post-disaster depression (for example, Kuo et al., 2003; Morgan et al., 2003; Salcioglu et al., 2003), anxiety (Ben-Ezra, 2004; Centers for Disease Control and Prevention, 2004; Verger et al., 2004), and panic disorders (Deering et al., 1996; Bystriksy et al., 2000) indicate that survivors of disasters are at risk. However, despite high levels of psychological distress, many disaster victims fail to seek mental healthcare (Tierney et al., 2001). Investigators have suggested that much of the work needed to discern the appropriate post-disaster mental health response

should involve survivors on a variety of levels, including those 'directly' and those 'indirectly' affected (Everly, 1999). Thus, disaster management plans should include services to primary (direct survivors), secondary (families of survivors), and even tertiary victims (the neighboring population) (Green and Lindy, 1994), since stress and maladaptive coping mechanisms are frequently underestimated in all groups (Burkle et al., 1994). The delivery of mental health services to appropriately screened populations is one of the most pressing, and promising, areas of post-disaster research. Since the workplace may be directly or indirectly affected by terrorism and other disasters, the workplace can make an effective target for reaching at-risk individuals for screening and treatment.

Terrorism

Terrorism is a type of disaster, even though, in some cases, it may affect only a small number of individuals. Terrorism has been defined as an act of violence or threat of violence against civilian populations to achieve political, religious, or ideological objectives (FBI, 2001). In the workplace, terrorist attacks can take many forms (Cameron et al., 2000); as any of the more typical life safety threats (for example, fires, workplace violence, hostage situation, bombs and bomb threats, hazardous material release and so on) may involve acts of terrorism. For example, terrorism can manifest overtly, such as a bomb attack (for example, such as the bombings of abortion clinics), or covertly (for example, the mailing of anthrax letters to news centers). Sometimes there is a fine line between terrorism and felonious assault; mass shooting by a disgruntled worker can be construed as a terrorist event or as an act of violence. From a management perspective, preparedness enables the worksite to effectively prepare and respond to a range of terrorist events, regardless of the form it takes.

Terrorism in the workplace can take on special meaning as it not only disrupts the work environment, but can also lead to a destabilization of trust in the work organization. Because work is a central organizing factor and key source of identity in adults (Schouten et al., 2004), workplace terrorism can disturb deeply held beliefs. Further, by targeting government and iconic structures, including high-rise buildings (for example, the Murrah Building in Oklahoma City, the World Trade Center (WTC), and embassies in Africa), terrorists can even affect the trust that the general public has in their government, with respect to their security and safety. The attack on the WTC was an example of the far-reaching effect of targeting an iconic (that is, symbolic) structure. Because the towers were a symbol of capitalism, the attack served to assault the US financial system, the culture, and the country itself (ibid.). Further, extensive damage can result when the worksite targeted is in a large urban area, resulting in the greatest possible

damage and disruption. Similarly, attacks on train stations and other mass-transit systems disrupt commuters (to and from work) and the general public, as well as the area in the immediate vicinity of the attack. Both mass-transit and large worksites are likely targets because they provide a convenient source of large numbers of people at predictable times and places.

Emergency Preparedness

Emergency preparedness, sometimes referred to as emergency management or disaster management, is the process of preparing for, and recovering from, disasters. Emergency preparedness is categorized into four components: mitigation, preparedness, response, and recovery (Veenema, 2006), and is considered the proactive planning for each of these categories. With respect to the workplace, the National Fire Protection Agency (NFPA) published a standard that establishes a common set of criteria for emergency preparedness, and management and business continuity that applies to both the private and public sectors (NFPA, 2007). While earlier editions of the standard focused on the continuity of operations and the property, facilities and infrastructure of businesses, and delivery of services, the newer editions stress the importance of emergency preparedness that protects the health and safety of persons in the affected area, as well as personnel responding to the incident. The 2007 version emphasizes preparedness in terms of worksites preplanning collaboratively at the local (for example, emergency services), state (for example, state agencies), and federal (for example, Department of Homeland Security, Federal Emergency Management Agency (FEMA), FBI and so on) levels.

Increasingly, the emergency preparedness and response community is moving toward a concept referred to as an 'all hazards' approach, which posits that preparedness in general will improve responsiveness to a wide range of emergencies. The elements of a basic 'all hazards' emergency response plan for worksites include the following: (i) the development of an incident management system, (ii) a written emergency plan, and (iii) a business continuity plan.

The incident management system is simply a way to identify who will be in charge (that is, the leader or 'incident commander') during an emergency. It also identifies who will assist this person and how all of these individuals can be contacted in case of emergency. The leader is the key decision maker during an emergency and also serves as the link to professional responders when they arrive at the scene.

A written emergency plan can range from a simple document to a highly complex and detailed one, depending on the size and type of the

work organization. In general, for most small to mid-size businesses, this can be relatively easy to develop, usually by a small committee. The committee can help identify the potential risks that could threaten the worksite (for example, fires, earthquakes, hurricanes, bombings and so on). Once these are identified, a plan is prepared for responding generally to disaster events and, more specifically, to certain types of events (for example, floods versus fires). The plan, in essence, serves as the blueprint for how the worksite will manage a disaster. Key elements in the plan generally include the following:

- How to report emergencies, both externally and internally to the leadership.
- How to evacuate the workplace.
- How to help individuals with special needs evacuate or move to a safe location.
- How to shut down critical workplace equipment or procedures – and who is authorized to do this.
- How to account for all employees after an evacuation.

Some workplaces have found it helpful to identify and train a cadre of workers to act as a response team (that is, 'the emergency response team'). The teams can be effective in terms of assisting the incident commander or leader, or by helping co-workers evacuate, or by providing immediate first aid prior to the arrival of professional responders.

The third key aspect of worksite emergency preparedness is the continuity of operations plan. This is a written document that can help the affected business survive the disaster. The quicker the business can become functional after a disaster, the better the outcome will be for the employees. The major elements of a continuity plan (FEMA, 1993; Chao and Henshaw, 2001) are listed below:

- Identify staff, materials, processes, and equipment that are essential to the business.
- Prepare a back-up plan for these essential elements.
- Prepare contact lists for all key support systems and keep back-up copies at several locations.
- Plan for continuation of operations in alternative locations.
- Determine how employee contact will be maintained if the work location is inaccessible.
- Determine how payroll will be maintained if normal services are no longer functioning.

RECENT ACTS OF TERRORISM IN THE US WORKPLACE

These case studies provide insights, with respect to the impact these events had on the involved worksites, as well as the surrounding communities. Most of these worksite terrorist events resulted in changes in practice at multiple levels, especially including worksites, seen as vulnerable or likely targets for terrorism. In addition, both the public safety and public health sector response plans were greatly affected by these events.

World Trade Center Bombing, 1993

On February 26, at 12:18 p.m., a terrorist bomb containing approximately 1200 pounds of urea nitrate exploded in an underground parking garage at the WTC in New York City (Fahy and Proulx, 1995). The explosion resulted in a five-storey crater that was 24–36 meters wide (Hinman and Hammond, 1996). The bomb incapacitated the fire alarm and power systems, and a back-up generator quickly overheated and shut down. The resulting fire, smoke, and structural damage caused more than 1000 injuries to building inhabitants (mostly employees) and the death of six workers. A mass evacuation of the seven fully occupied (approximately 100,000 occupants) high-rise building complex (including the two 110 storey towers) was immediately attempted, but took over six hours to fully complete. Hours after the bombing, occupants were found by rescue workers still sitting at their desks, unaware of the evacuation orders (Fahy, 1995).

Several studies reported on various aspects of this event, including the fire safety aspects (*ibid.*), morbidity risk factors (Quenemoen et al., 1996), the effect of group size and social cohesiveness on the evacuation behavior of WTC occupants (Wenger, 1987; Aguirre et al., 1998), and the human behavior factors associated with the evacuation (Proulx, 2001). From these studies, valuable information on high-rise fire safety and optimal group size and group characteristics for adaptive and pro-social behavior in workplace disasters were obtained. For example, social cohesion was shown to affect pro-social behaviors, thus reducing risk of group panic, and thereby supporting the evacuation process. These studies also provided important insights as to the role of worksite preparedness on evacuation behaviors of occupants, which, in turn, affected survivability.

These studies also noted some serious response flaws. For example, the most serious response problems involved the following: delays in notification that a mass evacuation was in effect, locked egress routes, inoperable elevators (some workers were physically incapable of exiting 100 or

more flights of stairs), poor lighting in the stairwells, and 'turning-back' behaviors of workers. Here, employees who were afraid of exiting through smoky stairwells turned back or sought refuge on the nearest floors. Incomplete or delayed evacuation of the buildings occurred, as many workers stayed where they were because they were waiting for instructions. Even though they were capable, some of these workers were not evacuated until hours later when fire personnel reached their locations. Many workers also reported that they were unaware of the nearest fire notification (that is, pull boxes) stations and many (90 percent) reported that they had *never* participated in an evacuation drill and, therefore, were unfamiliar with the location of the stairs. This was especially important since many of the people who reportedly did not know where the stairs were located also stated that they were assigned as fire wardens for their floor. While 80 percent of those surveyed stated that they had received prior safety information, most felt that it had simply prepared them to wait for instructions, which in some cases either never came or came many hours after the bombing had occurred. Importantly, many building occupants were unaware of the poor helicopter access to the rooftop, because of the communication towers that were placed there, and ascended for a rooftop rescue.

The Port Authority of New York and New Jersey, which managed the WTC at the time of the 1993 bombing, made numerous improvements to fire safety at the complex after this event. For instance, reflective egress signage was added and new overhead intercom systems were installed throughout the buildings. Many businesses that leased space in the towers similarly increased and improved their emergency readiness plans. Unfortunately, some important recommended changes were not implemented, such as widening stairwells and adding stairways.

Oklahoma City Bombing, 1995

On April 17 at 9:02 a.m., the detonation of 4000 pounds of explosives in front of the nine-storey Murrah federal building in Oklahoma City resulted in massive structural damage. The blast resulted in a 30-foot wide and 8-foot deep crater that blew away nearly half of the building (Himman and Hammond, 1996). The bombing caused 168 deaths and more than 800 injuries among building occupants, those in adjacent locations, and on the street (North et al., 1999). The fatality rate (46 percent or 168/361) of Murrah building occupants, mainly government employees, was extremely high (*ibid.*). The occupant-injury rate (47 percent) was also high and the combined fatal and non-fatal injury rate of Murrah occupants alone was 92 percent (331/361) (*ibid.*). The force of the explosion was sufficient to

damage or destroy approximately 800 buildings in the area, causing property damage in excess of \$625 million.

In the aftermath of the bombing, several assessments were conducted, including a study of injuries to rescue workers (Delinger et al., 1997). A study of psychiatric disorders among survivors approximately six months after the disaster by North et al. found that 45 percent of 182 adult survivors had a post-disaster psychiatric disorder and 34.3 percent had PTSD. Predictors of mental health sequelae included exposure factors, female gender, and history of pre-disaster psychiatric disorders. However, details on the preparedness planning for the occupants of the building were not provided. Other studies related to this disaster, including disaster-related substance use, focused on first responders and community members.

The Murrah building was targeted because it was a symbol representing the federal government. It was a relatively easy target since access was readily available (that is, the bomb-laden truck was able to park directly in front of the main entrance, even though this was a no-standing zone). Following the attack, the General Services Administration ordered the more than 1300 US federal buildings to increase security and surveillance. Inspection of packages and vehicles was instituted and, in some buildings, parking restrictions and the installation of barriers occurred. Barriers were also placed at critical points at many other non-federal buildings that were seen as potential targets.

Another aspect of the Murrah building bombing was that it affected a first-floor daycare center for young children of employees. When the bomb exploded, many children were injured and 19 were killed (Pfeifferbaum et al., 2003). After this event, many at-risk buildings housing similar daycare centers moved children to safer areas of their buildings. Some businesses now refuse to house daycare centers on their premises.

Pentagon Attack, 2001

At 9:38 a.m. on September 11, 2001, terrorists crashed a Boeing 757 carrying 20,000 gallons of fuel into the Pentagon. The Department of Defense reports that 125 people on the ground and 64 in the hijacked airliner died, while 76 people in the Pentagon were injured (Grieger et al., 2003). Studies on the mental health of survivors (*ibid.*) examined PTSD, alcohol use, and perceived safety in 77 survivors several months after the attack. They noted a probable PTSD rate of 14 percent, with 13 percent of respondents reporting increased use of alcohol. Women were more than five times more likely than men to have PTSD and almost seven times more likely to report increased use of alcohol. Women were also more likely to have a lower perceived sense of safety compared to men. Furthermore, those with lower

perceived safety several months after the attack were more likely to have PTSD and increased alcohol use. In another study of Pentagon employees ($n = 120$), more than one year after the attack, the prevalence of PTSD was even greater at 23 percent (Grieger et al., 2004). Anecdotal reports suggest that Pentagon survivors felt isolated from their community and the larger grieving US community, which was highly focused on the WTC attack. Since the attack, there are reports that emergency drills have increased, but no other information regarding preparedness efforts has been forthcoming.

Anthrax Attacks, 2001–2002

Letters contaminated with a microbial pathogen (anthrax) were mailed from Trenton, New Jersey one week after the September 11th terrorist attacks (CDC, 2001). Five separate letters were mailed on September 18, 2001 to different media organizations, although only two of these letters were obtained by the authorities. A short time later, on October 9, two additional contaminated letters were mailed to members of the US Senate. These later two letters differed from the first wave of mailings in that they contained highly refined 'weaponized' grade anthrax spores. Altogether, 22 people contracted anthrax through contact with the letters and, in at least two cases, the point of contact was never identified. Five out of the infected individuals subsequently died, all from inhalation anthrax, a deadly form of the disease.

This terrorist event had an enormous economic impact. It resulted in millions of dollars of clean-up costs and it effectively shut down the Brentwood postal facility in the District of Columbia for over two years. Total damages are believed to have exceeded one billion dollars. The impact on the workers who may have been exposed was great; more than 10,000 people were placed on prophylactic medication and, years after the attack, reports of chronic anxiety and other physical and mental health problems were reported (Quinn et al., 2005). This event also spurred interest in bioterrorism in general. Significant change occurred at the health sector level as healthcare employees needed training and education on bioterrorism signs, symptoms, and treatment, since patients with known or suspected bioterrorism-related infection rarely, if ever, had been previously encountered. Some workplaces developed specific training and education programs on bioterrorism for their staff, although, for the most part, this was not done.

At the government level, this event led to very significant changes. For example, the Strategic National Stockpile, a large supply of medicine and supplies the US government stores in case of a public health emergency, was greatly expanded. The US also increased the number of both trained personnel who can respond to a bioterrorism event, and the entire

bioterrorism response infrastructure. However, there is now a growing realization that, in addition to the need for a public health and Department of Homeland Security response, businesses will need to be involved in preparedness planning and response as well. Specifically, the government is considering approaching large companies to develop a response plan that would include being able to receive assets, whether in the form of prophylaxis or vaccine, develop the capability to set up a 'clinic' to vaccinate, and provide prophylaxis to workers. This would remove some of the burden on the local health departments during a large-scale emergency since there is still limited workforce at the federal, state and local levels. The role of management, in addition to receiving, staging, storing, and distributing assets to their workers, would include developing an emergency management plan with a policy addressing continuity of operations. Companies would also need to provide their employees with the technology to work at home, thereby limiting contact in public gathering places, such as schools and workplaces, during a contagious outbreak that might result from a bioterrorist event.

WTC Disaster, 2001

At 8:46 a.m. on September 11, 2001, WTC Tower 1 was attacked by terrorists who used an American Airlines Boeing 767 passenger plane as a weapon (Centers for Disease Control and Prevention, 2003). The impact occurred on the north elevation of the building between the 94th and 98th floors. At the time of impact, the airplane was traveling at 470 mph and carried an estimated 10,000 tons of fuel. Seventeen minutes later, at 9:03 a.m., terrorists crashed a United Airlines Boeing 767 into the south elevation of Tower 2 between the 78th and 84th floors. This plane was traveling at 590 mph and also carried an estimated 10,000 gallons of fuel. The collapse of Tower 2, 56 minutes after impact, was followed less than an hour later by the collapse of Tower 1 at 10:28 a.m., 102 minutes after impact.

An estimated 100,000 people visited or worked in the seven buildings that formed the WTC complex, on the morning of September 11, 2001, however, roughly half that number were present. For a variety of reasons (for example, it was the first day of public school, a primary mayoral election was being held), approximately 58,000 people were in the WTC buildings 1–7 and concourse (including the subway and train stations), with an estimated 17,400 people in WTC Towers 1 and 2. The Observation Deck, which was typically crowded with tourists, was empty at the time of impact since it normally opened at 9:30 a.m. With nearly 2800 deaths related to the WTC attacks (including 157 individuals on the two airplanes) (ibid.), this was the worst terrorist attack in US history (the Pearl Harbor death toll

stands at 2403) (Aguirre et al., 1998). Data collection on injuries and fatalities began within hours of the WTC attack and, in the CDC's review of victims' injuries (ibid.) it was found that of 810 individuals treated at five local hospitals after the attack, 16 percent required hospitalization and 0.4 percent died while receiving emergency care. Only 14 percent of the patients suffered non-injury conditions (for example, cardiac, respiratory, or psychiatric), with most victims suffering from exposure to smoke, dust, debris, and fumes. Other common injuries included burns, fractures, head injuries, and crush injuries. The percentage of WTC inhabitants treated was much lower than that in the Oklahoma City bombing because most WTC victims either escaped or died (no one in Tower 1 above the 92nd floor survived, and only 18 people above the 78th floor in Tower 2 survived). The evacuation effort in the WTC attacks was remarkable (especially in comparison to the 1993 bombing noted above) in that most of the people who were at their work stations that morning escaped in a mere 102 minutes between the first impact and the collapse of the second tower. The rapidity with which the buildings were evacuated has been credited to two factors: first, the low occupancy rate and, second, because of the numerous fire safety enhancements that were made following the 1993 bombings. A number of problems were identified in the studies that examined the evacuation (Proulx and Fahy, 2002; NIST, 2005; Gershon et al., 2007) and these are discussed in the final section of this chapter.

EMERGENCY STANDARDS AND GUIDELINES RELEVANT TO WORKPLACE EMERGENCY PREPAREDNESS

Codes and Standards

Management should be aware that there are numerous standards, codes, and guidelines that address workplace safety, some of which are particularly relevant to the discussion of emergency preparedness for the worksite. Standards differ from guidelines in that standards are enacted under the law, whereas guidelines are advisory recommendations usually applied through consensus or convention. Standards have the weight of the law and infractions can result in penalties.

With respect to worksite preparedness, codes and standards for fire safety and building design, construction, are most applicable here. In the US about half of the states have adopted the National Fire Protection Association life safety code (NFPA, 2000) which establishes the minimum requirements for providing a reasonable degree of protection from fire.

With respect to building codes, the National Institute of Standards and Technology (NIST) produces standards and technical reports that refer to buildings. In addition, in 1994 the US International Code Council (ICC) developed a comprehensive set of model standards and codes to standardize the myriad building design and construction codes that exist. These include the Building Officials and Code Administrators (BOCA) International, which publishes the National Building Code (NBC, 2003), the International Conference of Building Officials (ICBO), which publishes the Uniform Fire Code (UFC, 1994), and the Southern Building Code Congress International (SBCI), which publishes the Standard Building Code (SBC, 1993; ICC, 2003). There are also industry standards and codes, such as the American National Standards Institute (ANSI) codes, that serve an important role in the safety and integrity of building structures (Society of Fire Protection Engineers, 2003). Other countries have also developed similar standardized codes.

In terms of worker protection related to worksite emergencies, regulations that are applicable here have been promulgated by the federal Occupational Safety Health Administration (OSHA). The general industry standards for fire safety and emergency evacuation are found in two subparts of the OSHA regulations at 29CFR 1910, Subparts E and L. The OSHA regulations, 29CFR 1910.36, 37, and 38, detail the requirements for emergency egress, basic fire safety, emergency response, and fire prevention (FEMA, 2002). All employers covered by the general industry standard are *required* to comply with *all* aspects of 1910.36 and 37 (fire exits, alarm systems, visibility and signage for egress routes and so on). Section 38, which describes OSHA's requirement for emergency response and fire prevention, applies only if the workplace is required by another OSHA regulation to have an emergency action or fire prevention plan. For example, workplaces that comply with the OSHA Hazard Communication Standard would also be required to comply with section 38. In addition, most employers in office, retail, and manufacturing establishments are subject to section 38 in order to be in compliance with OSHA standards related to fire detection systems and equipment (Subpart L, 29 CFR 1910.156-65) (Eachempai et al., 2004). Under section 38, employers have an obligation to develop an 'emergency action plan', which is a written policy for evacuation of the worksite in case of an emergency. In addition, employers need a written fire prevention plan, which describes safe handling and procedures for controlling workplace fire hazards. To help employers meet the requirements of these standards, OSHA developed a number of fire protection training courses, including fire safety videos, and has extensive information available to both employers and employees on their website (FEMA, 2002). OSHA also conducts inspections to determine whether the

standards are being met; between October 1999 and September 2001, the federal OSHA issued in excess of 4000 citations for violations with elements of these two standards, with roughly \$1.4 million in penalties. Violations typically were related to lack of fire extinguishers, blocked egress, including blocked stairwells, and lack of fire prevention and protection programs (Department of Labor, 1987).

The key elements of OSHA Emergency Preparedness Standards are listed below.

1. A written emergency action plan.
2. A written fire prevention plan.
3. Employee training on the plan, including when employees are first hired.
4. Establishment of a chain of command and the designation of an emergency response team coordinator.
5. Emergency communications systems, including alarm systems.
6. Emergency escape procedures and emergency escape routes.
7. Procedures to account for all employees after emergency evacuation has been completed.
8. Assignment of rescue and medical duties and training for those employees who are to perform them (emergency response teams).
9. The means of reporting fires.
10. The capability for rapid provision of emergency medical assistance on- or off-site.
11. Security of the affected worksite, including maintenance of important records and documents (for example, listing employees' relatives to be notified in case of emergencies).
12. Unobstructed egress from all parts of the workplace at all times it is occupied.
13. Clearly marked exits and exit routes.
14. Where applicable (by size), fire alarms.
15. Exits which discharge directly to a street or other open space.

In addition to federal and state OSHA standards that are enforced for businesses with 11 or more employees, there are a number of state and local fire safety code regulations which apply to businesses, including egress regulations and fire supervision regulations. These state and local regulations generally apply to all businesses, regardless of their size. There are also guidelines that are published to help improve disaster readiness, such as the FEMA guidelines entitled 'Emergency management guide for business and industry', for emergency planning, response, and recovery for companies of all sizes (FEMA, 1993). As guidelines, they serve as recommendations, not

regulations, and therefore there are no reporting requirements. Similarly, the CDC Fire Safety Guidelines, published in the *CDC Health and Safety Manual, 1997*, are also recommendations (CDC, 2007).

In response to the WTC disaster, 2001, the first major New York City (NYC) fire safety code regulation in 30 years was legislated to improve emergency preparedness of high-rise structures. This new law (Local Law 26, 2004), entitled 'Building Safety', requires that the NYC Fire Commissioner promulgate rules establishing standards, procedures, and requirements for the orderly evacuation of occupants from any office building or building classified in occupancy group E (high-rise office space buildings) including, but not limited to, the evacuation of persons necessitated by fire, explosion, biological, chemical, or hazardous material incident, or release arising from natural disasters, or other emergencies, or threat of such events (Local Law 26, 2004).

As a result of Local Law 26, and the new requirements that resulted, the NYC Fire Department (FDNY) passed the following rule in 2006: 3 RCNY § 6-02, entitled 'Office Building Emergency Action Plans' (FDNY, 2005). This new rule requires that all high-rise buildings in NYC designated as office space must have an approved emergency action plan (EAP) that must be implemented in the building (*ibid.*). The EAP for each building must include provisions for the following: sheltering in place, in-building relocation, and partial and full evacuation of the building as a result of different emergency situations occurring either within the building or the building's vicinity (*ibid.*). This rule also stipulates that in addition to having an EAP for all class E high-rises in NYC, each of these buildings must also have a Fire Safety/Emergency Action Plan Director (FS/EAPD) who is responsible for implementing the EAP. Certification as a FS/EAPD requires training that is in addition to the training required for certification as a fire safety director. The training requirements for certification as a FS/EAPD are documented in the proposed rule 3 RCNY §9-08 entitled 'Training Courses for Fire Safety/Emergency Action Plan Directors' (2006).

Other cities have adopted, or are planning to adopt, similar high-rise emergency codes. Details of these may be obtained by contacting local fire departments.

Compliance Issues

Code violations at both the employee and employer level have been well documented. Researchers have examined the reasons for this and the research sheds important light that may be informative, with respect to compliance with emergency preparation codes and standards. For example, several studies have shown generally poor compliance with the OSHA

Blood and Body Fluid Standard (Department of Labor, 1998), which was developed to help minimize the risk of worker (primarily healthcare workers) exposure to infectious diseases transmitted through blood and other body fluids. One of the most, if not the most, important correlates of compliance at the employee level was found to be 'safety climate', which is defined as employees' perception of their organization's commitment to safety (Gershon et al., 1995, 2000).

In addition to safety climate, a number of psycho-social variables have also been significantly correlated to employee compliance, such as inaccurate perception of risk, maladaptive fear response, and negative influence of subjective norms (co-workers). In addition, certain individual factors, such as risk-taking personality profile, as well as socio-demographic factors (male gender), have also been associated with lower rates of compliance with workplace regulations (Becker and Maiman, 1983; Gershon et al., 1995, 1999; Michalsen et al., 1997). Organizational variables that affect employees' perceptions of safety climate (for example, weak safety culture, such as lack of safety supplies and resources, inadequate training and educational programs, lack of safety leadership and so on) have also been directly (as well as indirectly through safety climate), correlated with compliance (Gershon et al., 1995).

At the management level, generally, the employer's knowledge of the regulations and an understanding of the cost-effectiveness of risk reduction measures (that is, the ability of preventive measures to offset the cost of exposure) have been shown to correlate with regulatory compliance (Gershon et al., 2007).

HIGH-RISE EVACUATIONS

The WTC resulted in the full-scale evacuation of all the buildings in the WTC complex, including the towers. High-rise buildings, including the older ones, have robust construction designs and redundant fire safety systems, thus making mass evacuations generally unnecessary. When a high-rise emergency does occur (usually a fire event), the building occupants are simply relocated to safe areas only one or two floors away from the affected area. Yet certain events can result in danger to all occupants and, in these rare cases, full building evacuation may be necessary. This occurred, as noted earlier, in the 1993 WTC and Murrah building bombings. Other recent serious fires include the Chicago high-rises fires in 2003 and 2004 ('Fire in Chicago high-rise office building kills six', 2003; Ciokajlo et al., 2004). In each of these situations, the complexity and lengthy time required to fully evacuate increased the risk to the occupants.

To better understand the process of evacuating large numbers of occupants from high-rises in extreme conditions, a study was conducted in the aftermath of the WTC. The pertinent findings are described in the next subsection.

World Trade Center Evacuation Study Background

The World Trade Evacuation Study was designed as a three-year and five-phase examination of the factors that helped or hindered evacuation of the towers on September 11, 2001. The study examined a number of potential factors, using both qualitative and quantitative epidemiologic methodologies. There were three major constructs of interest that were targeted: individual, organizational (that is, workplace), and structural (building environment) factors.

Data were collected from over 1400 individuals, or roughly 10 percent of the individuals who evacuated from Towers 1 and 2. Individuals participating in the study completed an extensive questionnaire, available as a paper or web-based version. Almost all of the findings from this study have emergency preparedness implications and are not necessarily limited to high-rise structures. The findings underscore the important role that management plays with respect to preparing employees to respond quickly and effectively to emergencies, including those that result in mass evacuation. Factors from each of the three major categories are discussed in detail below, along with the management implications.

Individual Factors that Served as Barriers to Initiation of Evacuation

While most participants were motivated to initiate their evacuation process, delays in getting started were not uncommon. The primary reason for delaying the initiation process was the lack of information; many occupants did not know what had happened that caused the building to sway (which was the first indication for most occupants that an event had taken place). Consequently, occupants spent time in the immediate few minutes following the impact trying to obtain information, generally, by seeking out others, or by trying to make phone calls. Some individuals who were in Tower 2 when Tower 1 was attacked saw the plane as it hit Tower 1 and, in some cases, occupants felt the heat of the fireball that resulted. In these cases, the occupants understood immediately that something very serious had occurred and, even though they were in Tower 2, which had not yet been attacked, they immediately began their descent. This quick action saved the lives of those situated on high floors, as only 17 minutes later Tower 2 was attacked by the second plane and these individuals would have

been above the point of impact. In Tower 1, the first building to be attacked, occupants facing away from the point of impact did not know what had happened and many people did not find out until they reached the ground level and could see for themselves how heavily damaged the building was. Because of the loss of most infrastructure in Tower 1 (for example, power, elevators, PA system and so on), communication was completely disrupted and, therefore, the normal channels of notification of occupants could not be used. Individuals learned about what had happened, either from people who had seen the attack (that is, those on lower floors that were facing the impact), or from others who had learned about what had happened via battery operated radios or a landline phone call. Hand-held devices were not widely used at that time, but the few who had them also learned about what had happened in this manner. Without information, people spent time seeking out others; a well-known behavior pattern in other types of emergency situations, as people tend to seek out groups to share information and feel safety or support. From a management perspective, a back-up system that is not dependent on the building's electrical supply in order to operate, is important to consider so that information can be readily transmitted during emergencies. Many companies now routinely provide their employees with hand-held devices for just this purpose.

Another factor that led to delays in initiation was the performance of tasks. This included making outside phone calls, trying to find telephones that worked, trying to contact the security desks of the towers, collecting personal items, trying to save computer files and collecting hard files, completing last-minute work activities (for example, shutting down computers), seeking permission to leave, and trying to decide whether to take elevators or stairs. Delays were also reported by individuals who were concerned about their physical ability to walk down multiple flights of stairs. Others delayed because of their general lack of familiarity with the building layout, including uncertainty regarding where the stairwells were located and where they terminated (that is, whether or not they would end at street-level exits). From a management perspective, most of these delays could have been prevented through appropriate education of employees regarding the building design. This should include practice on the use of stairs (which would also help the occupants know where stairwells are located), provision of written policies that explicitly state that permission is unnecessary for evacuation, final appraisals of individuals' capability of evacuating, and planning for those requiring special assistance. From an employee perspective, compliance with recommended or required training regarding emergency preparedness will clearly be beneficial, regardless of the type of building structure of the worksite.

Individual Factors that Served as Barriers to Progression

Footwear played an important role in progression of evacuation, with many reports of uncomfortable shoes (for example, high heels, slip-ons) slowing people down. In some cases, the footwear had to be removed, which was a problem for some evacuees when they encountered broken glass and debris in the lobby area. Some individuals were injured in this way and had to be carried out of the building. This problem could be prevented by advising building occupants, and most especially high-rise occupants, to have adequate footwear readily available in case rapid egress is needed.

Occupants were also slowed down by physical limitations, health conditions, and disabilities. Again, physical capabilities should be appraised before full-scale evacuation (without use of elevators) is ever required of occupants. Preplanning, including practice drills using a buddy system or fire safety team, should take place. This is an ongoing challenge for many high-rise buildings. In the WTC, evacuation of an occupant, who used a wheelchair with an additional breathing support mechanism, took place. A rotating team of eight people took turns carrying the occupant and the extremely heavy chair down several flights of stairs. All of these individuals evacuated safely, although there are anecdotal reports of long-term musculoskeletal problems in the persons who assisted. Specialized equipment is available to assist the evacuation of persons with limited mobility and, in some cases, this equipment was used in the WTC evacuation. In other cases, individuals would have used the equipment, but they did not know that it was available. In addition, some individuals knew that equipment was available, but did not know its location. Many of these special evacuation devices had been purchased after 1993, but, over time, they had been placed in inaccessible storage areas. Management should have full knowledge of the persons they employ who may require assistance during an emergency, in order for every option to assist them to be explored and planned as needed. Frequent training is required so that all occupants are familiar with any special equipment that can be used to assist persons with disabilities.

Organizational Factors that Influenced Evacuation

By far the most important factor, at the organizational level, that affected both the initiation and progression of evacuation, was leadership. In an emergency, people turn toward leaders for guidance since most people are unfamiliar with emergency operations. During the WTC, lack of knowledgeable and trained leadership led to delays. In some cases, new leaders emerged; individuals with special knowledge or experience from their prior

military service or experience as an emergency responder stepped in to fill this role. By providing training to *all* employees on emergency operations, management can ensure a ready supply of trained and knowledgeable individuals. This is important during a large-scale event, as fire safety personnel may be occupied elsewhere and additional trained staff will be able to extend their usefulness.

Another important organizational aspect, which will help occupants of high-rise buildings or large complex structures, is providing them with training on the layout of the building, the location of the exits, including the terminal exits, and the policies regarding elevator use and roof-top egress. Management should institute practice drills to reinforce classroom, web-based, or written training materials. In the WTC, fire drills often consisted of gathering people in hallways and simply pointing out the fire exits. Many of the evacuees reported that they had never even entered a stairwell before the disaster occurred. The inconvenience and disruption created by full-scale drills is well recognized, but this can be ameliorated by having frequent, smaller, drills so that disruptions are kept at a minimum. Drills should include going down one or two flights of stairs and then descending again only one or two flights leading to the lobby level. This will shorten the drill and prevent untoward consequences for occupants located on high floors. Walk-through orientation of the entire building structure should take place frequently and be mandatory for all new employees. Senior management should support these educational efforts by participating and publicizing them.

Environmental Factors that Affected Evacuation

Environmental sensory cues, such as loud noises or fuel odors, served as strong motivators to initiate evacuation. Many individuals reported that the buildings' physical safety features, such as adequate lighting on the staircases and handrails, and steps marked with reflective tape, also facilitated the rapid and orderly evacuation. Staircases maintained their integrity, for the most part, and this also supported rapid egress.

Building conditions that impeded progress of the evacuation included: structural damage such as debris on the stairways and collapsed interior walls that blocked egress routes; heavy congestion on certain stairways due to the sheer number of people descending and counterflow of first responders moving upwards with equipment; slowly moving individuals (which caused a back-up of those behind them); debris and glass in the lobby; smoke and water conditions on the stairs, which intensified towards the end of the evacuation; and, in a few cases, locked staircase doors (that is, doors leading back onto floors). Slow-moving individuals, including people with

various types of conditions, general poor health or fitness, obesity, persons who use wheelchairs and guide dogs, and the elderly, slowed down the progress on the stairwells. From a management perspective, some of these structural factors may not be within their purview, especially with respect to businesses located in high-rise structures. In these types of buildings, there are generally many leaseholders and the fire safety program is managed by the building's owner and building's management firm. However, worker safety is the responsibility of employers and knowledge, awareness, and assessment of the building's capabilities should be well within the scope of management. Many high-rise buildings provide extensive training and information to major leaseholders. In some cases, major leaseholders have their own in-house fire safety director and fire safety team. Regardless of whether management relies on the building manager or their own fire safety staff, they should be aware of any structural impediments to the safe movement of occupants during a disaster response, while management should encourage the implementation of effective interventions that will address any gaps.

Recommendations

As part of the WTCE Study, a group of evacuees from the towers met extensively with the research team to develop a set of recommendations for improvement in terms of high-rise evacuations. This process, referred to as Participatory Action Research (PAR), was very productive, as it led to the development of an extensive list of action items. Many of these (provided in summary form in Appendix Tables 11A.1–3) may be helpful to managers as they develop their own emergency preparedness plans.

In addition to recommendations based on the WTCD Study, other recommendations have been developed to address the important area of disaster mental health. These are discussed in the next subsection.

Disaster Mental Health Strategies

There is growing recognition that the workplace provides a vital link to post-disaster mental healthcare. In the event of any type of disaster, there is an increased reliance on familiar social supports which embody safety and security. In the trauma literature, the availability of social support has been associated with more favorable outcomes (Kaniasty and Norris, 1993; Irving et al., 1997; Andrews et al., 2003). Isolation and the absence of social support, conversely, can serve to exacerbate unfavorable responses to trauma and disaster. Thus, in preparing for and following disasters, workplaces can play a critical role in providing workers with general social

support, as well as specific services (Schouten et al., 2004). Assistance with basic needs and efforts to provide social support are beneficial and mechanisms that provide social support to employees need to be built into the core of an organization's emergency plans (Tyler and Rogers, 2005). Such mechanisms can enhance the resilience of employees in the face of a terrorist attack at the worksite and reduce the ensuing psychological sequelae. As Schouten et al. (2004) note, it is the offer of organizational support and services in the workplace that is particularly important to workers, regardless of actual utilization. Employees view the offer of support services as a compassionate, timely, and much appreciated gesture by the employer. Informal support, in the way of peer support provided by co-workers, can also be useful in facilitating recovery and return to normal functioning.

While larger organizations often have detailed plans for crisis response and business continuity, smaller organizations are often not in a position to have well-developed preparedness plans or to provide resources for response to mitigate the impact of an event at the worksite. Yet, according to Pohlman (1999), in these smaller organizations, employee commitment is more likely to be influenced by intangible perceptions of preparedness and response efforts that can impact on an organizational performance. Thus, smaller organizations may face a greater risk in terms of impact if they are unprepared to react quickly and appropriately.

In many workplaces today there are efforts in place, in the form of employee assistance programs, to address a variety of work, family, and personal problems. The goal is to enhance employee well-being, to promote job performance, increase organizational efficiency, and help facilitate work-family balance (Masi et al., 2002; Akabas and Kurzman, 2005). In the past few decades, more and more workers have begun to seek help with work-related stress and other emotional problems and there is a growing need for a broad array of services to assist them. The knowledge and utilization of these services may be seen as part of a continuum of preparedness for a disaster response to mitigate the impact of psychological sequelae that is likely to follow.

Employee assistance program designs and services vary. Programs can be sponsored by employers and/or unions (Masi et al., 2002). Employee assistance services can be provided internally by staff members of the organization or externally where services are outsourced to an outside provider (Straussner, 1988). Services can also be provided through a mixed model of internal and external providers, as well as both on- and off-site service provision. EAPs in the workplace have evolved and expanded over the past 30 years to include both professional and paraprofessional service providers and a myriad of support services (Masi et al., 2002). It is interesting to note that employee assistance services are required to be provided by federal

agencies for their employees. However, considerable latitude in structuring federal agency employee assistance programs is left to the discretion of each agency to meet its own mission and organizational culture (US Office of Personnel Management, 2004).

Disaster mental health interventions in the workplace can be provided by employee assistance programs or other individuals or groups that offer social support and support services. Worksite interventions should foster community resilience; the ability of the workplace to return to normal and adaptive functioning after a disaster (Benedek et al., 2006). While the need to provide mental health interventions in the workplace has been established, the efficacy and appropriateness of the interventions has been the subject of debate. The empirical research on the critical incident and stress management model (CISM), an intervention designed for first responders, but also adapted in other workplace settings, is inconclusive. Benedek et al. suggest an approach of multidisciplinary teams using a program of health education and informational briefings which occur at the worksite and outside of traditional healthcare settings. With an emphasis on early intervention, the goal of disaster mental health services is to reduce the severity and/or duration of event-related distress and to promote the restoration of normal functioning. Early interventions include meeting basic needs, psychological first aid, assessing needs, monitoring the rescue and recovery environment, outreach and information dissemination, technical assistance, consultation and training, fostering resilience/recovery, triage, and treatment (National Institute of Mental Health, 2002). Interventions that are tailored to address individual, community (for example, the workplace), and organizational cultural needs and characteristics are most likely to be helpful. In addition, interventions should be matched to the phase of the event, to the setting, and to the survivor. Clearly, one size does not fit all. There is no ubiquitous mental health intervention that can address the needs of all parties.

Mental health personnel, including EAP staff, have key roles to play in workplace disaster preparedness (ibid.). They can assist in the coordination of service provision in order to ensure that mental health is an integrated element of a comprehensive workplace disaster preparedness and management plan. Furthermore, mental health expertise can guide and facilitate the implementation of interventions to achieve a positive mental health outcome for individuals in the workplace affected by a disaster (ibid.).

Workplace disaster preparedness requires the coordination and integration of various efforts, including mental health. More specifically, it requires the coordination and integration of efforts between the areas of security, human resources, employee assistance programs, and medical care (Benedek et al., 2006). While employers may be interested in introducing

disaster preparedness, there may also be reluctance for fear of raising undue anxiety among employees (Vineburgh, 2004). Vineburgh suggests that 'a workplace model that reframes disaster preparedness as resiliency training can educate employees about disaster behaviors in the pre-event phase, as well as promote awareness of the psychological consequences of terrorism, help-seeking, and employee assistance response in the post-event phase' (p. 143). This approach reframes negative attributes, and adverse consequences, associated with trauma and disaster and provides an opportunity for promoting empowerment.

In terms of disaster mental health preparedness in the workplace, it is essential that there is consistency within all levels of an organization (for example, individual employees, managers/supervisors, and organizational systems) in adhering to the commitment of preserving psychological health and well-being of all workers (Flynn et al., 2005). This idea needs to be integrated into overall organizational continuity planning.

CONCLUSION

Emergency preparedness in the workplace can help minimize the negative impact of disasters. Terrorism, or the threat of terrorism, can result in severe disruptions, in addition to loss of lives. Many workplaces have taken steps since the WTC, and subsequent anthrax attacks, to protect their employees and material assets, but the challenge in developing and implementing emergency preparedness plans is believed to have kept many other workplaces, especially smaller ones, with minimal plans. Few studies have actually assessed workplace preparedness planning, but anecdotal reports indicate that lack of preparedness is widespread in the business world. A number of agencies and organizations have prepared simple templates and guidelines that can be helpful in this regard. Special attention to these, as well as the guidelines on mental health services for those affected by work place emergencies, can help businesses meet their responsibilities.

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Table 11A.1 Summary of PAR team recommendations: to address delays in initiation of evacuation

Risk factor	Recommendations for improvement by category (I = individual level, O = organizational level, S = structural level)
1. Seeking out others to form a group for mutual support and information sharing during exit	<ul style="list-style-type: none"> ● Participate in group activities both within company and on the floor where office is located (I) ● In the absence of complete information or leadership guidance, individuals may have to act based upon instinct and 'gut feelings' (I) ● Have multiple sources of communication available (e.g., battery operated radio) (I) ● Share information about unusual circumstances with co-workers (I) ● Support pre-event group formation with programs such as workplace coffee hour, ongoing social activities across floors and among floors (O) ● Building management/employer must provide accurate information early in the event (O) ● Provide clear and consistent, accurate messages (O) ● Provide wireless cell phones for the safety team (O) ● Link company computers to television stations, emergency broadcast announcements (e.g., Office of Emergency Management) (O) ● Limit non-emergency public address (PA) announcements to only those that are necessary (O) ● Utilize multiple environmental cues, i.e., flickering lights to alert participants of an unusual occurrence (S) ● Install back-up communication systems (S) ● Equip buildings to allow for emergency radio broadcast announcements (S) ● Equip elevators and staircases with systems for public address announcements (S) ● All communication sources should link to one main broadcast site (S) ● Individual should conduct self-assessment of their capability and time needed to fully exit (I) ● Individuals should inform the building's safety personnel regarding special evacuation needs they may have (I) ● System to rapidly identify those who will require special assistance for evacuation (O) ● Pre-planning for persons with disabilities (O)
2. Personal concerns about own health and ability to evacuate	<ul style="list-style-type: none"> ● Evacuation drills for persons with special needs for evacuation, including situations where elevator is not functioning (O) ● Maintain an emergency 'go bag' at desk (I) ● Delay calls until fully exited (I) ● Ownership of own safety actions (i.e., act independently) (I) ● Wear sensible footwear that will facilitate rapid evacuation (I) ● Maintain evacuation supplies by the exits that are not locked and are easily accessible (O) ● Implement policies that support employee initiative for evacuation (O) ● Install emergency supply storage receptacles near exits (S)
3. Individual behaviors that delayed initiation of exit (e.g., gathering items, making phone calls, work-related tasks, waiting for directions or permission to leave, changing shoes)	<ul style="list-style-type: none"> ● Compliance with training and drills (I) ● Facilitate a workplace climate for emergency preparedness (O) ● Enforce training and education of all employees for evacuation (O) ● Enforce mandatory drills that involve entry into the staircase and various routes for terminal egress (O) ● Color code the exit doors (S) ● Signage that indicates where staircases terminate (S)
4. Uncertainty about route to take including: exit locations, staircase endpoints, locked access, locked re-entry points, when to use elevators	

Table 11A.2 Summary of PAR team recommendations: to address delays that served to increase length of time of evacuation

Risk factors	Recommendations for improvement by category	(I = individual level, O = organizational level, S = structural level)
1. Lack of knowledge and poor emergency preparedness of workers	<ul style="list-style-type: none"> ● Active participation in training and drills (I) ● Conduct training and drills (O) ● Incorporate entry into stairwells in fire drills (O) ● Promote an organizational emergency preparedness safety culture/climate from top down (O) ● Conduct specialized safety training for senior management (O) ● Foster employer ownership of safety training and climate, accountability enforced by building owner (O) ● Garner political and regulatory support for training and drills (O) ● Clarify use of elevator vs. stairs during emergencies (O) ● Encourage wearing sturdy, closed-toe, flat-soled, footwear in the workplace (I) 	
2. Footwear that did not facilitate rapid exit downstairs and through lobby debris field	<ul style="list-style-type: none"> ● Widen staircases where feasible (S) ● Consider drainage for water on stairs (S) ● Assign widest staircases for evacuation and accommodations of persons using wheelchairs (S) ● Ensure that doors to floors off stairwells unlock during emergency (S) ● Design high-rise buildings that are intuitive and easy to navigate (S) 	
4. Complex building design was confusing	<ul style="list-style-type: none"> ● Improve signage (S) 	
6. Suboptimal workplace emergency safety climate	<ul style="list-style-type: none"> ● Ensure an organizational safety culture including emergency preparedness from top down (O) ● Conduct specialized emergency preparedness safety training for senior management (O) 	
7. Inadequate communication system infrastructure	<ul style="list-style-type: none"> ● Ensure a working emergency generator and PA system (S) ● Link buildings to TV station and PCs for better communication (S) 	
8. Transportation of responder supplies	<ul style="list-style-type: none"> ● Place emergency supplies throughout the building (S) 	
9. Flow of traffic in certain areas led to congestion on stairs	<ul style="list-style-type: none"> ● Assess building capabilities to support evacuation (S) ● Stagger evacuation of occupants to reduce numbers on stairs (S) ● Designate specific staircases for slow movers or those that need special assistance (S) ● Co-workers or response team should practice use of evacuation chairs (O) ● Preparedness planning for PWHC/D (O) ● Code identification badges to permit rapid identification of PWHC/D (O) ● Instruct PWHC/D to use elevators as directed by safety personnel (O) ● Assign buddies for evacuation of PWHC/D (O) ● Training for those assisting PWHC/D so that they can offer assistance in cases where carrying is necessary (O) ● Pass new regulations to protect PWHC/D (O) ● Ensure confidentiality of information about PWHC/D (O) ● Special evacuation training/drills for PWHC/D (O) ● Keep extra wheelchairs at lobby level for PWHC/D (O) ● Designate widest stairwell for PWHC/D (S) 	
10. Procedures for evacuation of persons with health conditions or disabilities (PWHC/D)		

Table 11A.3 Summary of PAR team recommendations: risk factors associated with sustaining an injury

Risk factor	Recommendations for improvement by category (I = individual level, O = organizational level, S = structural level)
1. Weak emergency preparedness	<ul style="list-style-type: none"> ● Support, encourage individuals to have a positive safety attitude (I) ● Participate in training drills (I) ● Promote a strong organizational safety culture/climate (O)
2. Stair/building environment	<ul style="list-style-type: none"> ● Designate use of the widest stair for a person with a disability or injured (O) ● Develop innovative methods for evacuation (D) ● Issue flashlights to occupants (O) ● Widen existing stairs (S) ● Maintain evacuation supplies throughout the buildings (S) ● Reduce possibility of broken glass (S)
3. Health condition or disability of evacuees	<ul style="list-style-type: none"> ● Awareness of PWHC/D in the individual's work area (I) ● Conduct self-assessment of capabilities (I) ● Awareness of all occupants regarding location and use of safety equipment (I) ● Promote organizational commitment for a disability emergency preparedness climate (O) ● Seek out and provide specialized training for volunteer assistants (O)
4. Footwear	<ul style="list-style-type: none"> ● Educate building occupants regarding use of sensible shoes that will support rapid evacuation (I)

12. Airline industry responses to September 11th*

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INTRODUCTION

The US airline industry faced devastating losses in the wake of the September 11th, 2001 terrorist attacks. According to Kevin Murphy (2001), airline industry analyst for Morgan Stanley, 'if there was ever a stress test for a good business, this is it'. The day after the attacks, the major airlines appeared in front of Congress seeking relief in the form of federal assistance. Fifteen billion dollars were allocated to the industry, some in the form of outright grants to cover the loss of operating revenue in the days after the attacks when the industry was shut down by federal order. The rest of the \$15 billion allocation was made available in the form of loan guarantees to be allocated according to rules established by the Air Transport Stabilization Board. Even with this federal assistance, however, the industry continued to lose millions of dollars on a daily basis due to the slow rate of passenger return. In response to these losses, the major airlines cut their flights by an average of 20 percent and laid off an average of 16 percent of their workforces in the weeks following the attacks. Even though all of the major airlines were devastated about equally in terms of the initial decline in passenger traffic, however, they did not respond in the same way. Some airlines emerged from this crisis resilient and strong, whereas others languished and even confronted bankruptcy.

This chapter investigates the factors explaining the success of some airline companies after the 9/11 attacks and the struggles of others. It focuses on the roles played by relational reserves, financial reserves and the viability of the underlying business models in 10 major airline companies. Specifically, the study explains why managers must maintain and enhance

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