CHAPTER 1

WHY DO DISASTERS HAPPEN?

It seems like every time we turn on the news, a disaster has occurred. A tornado has touched down creating a swath of destruction, a chemical explosion is spewing toxic fumes into the air, an earthquake has crippled a populated area, wildfires are burning out of control, terrorists have attacked a major public transportation system, a hurricane is ravaging the coastline, buildings are collapsing, ships are sinking. And the list goes on.

Why do these disasters happen? With all of our knowledge, skill, and technology, why can't we do something to prevent them or at least keep them from causing such devastation? The more that we ask this question without a good explanation, the more frustrated and fearful we become of the world we live in. This situation has generated so much uncertainty and anxiety in today's society that our concern for these events seriously affects the way we think and act. It is truly unfortunate . . . and unnecessary.

Disasters come in many different forms, which can be conveniently organized into three groups. *Man-made accidents* are the result of human action or inaction that starts a chain of events leading to a catastrophic outcome. These errors in judgment are not considered intentional or malicious. However, *terrorist acts* are conscious actions made by people with purposeful and destructive intent. These acts are typically well planned, with a specific target in mind, directed at causing

heavy casualties and creating mass hysteria. *Natural disasters*, which make up the third category, are considered acts of God, the cause of which is beyond human control. Most natural disasters ultimately can be attributed to weather patterns or movements of the earth's crust. Although humans are not responsible for the occurrence of natural disasters, we can have a profound impact on the severity of the consequences.

While these disaster groups may seem quite different, when one takes a closer look at how these events evolve, there is remarkable similarity. That is to say, there emerges a pattern or "recipe" for disaster. The question that then arises is: What are the ingredients to this recipe, and how do they mix together to form such a lethal outcome?

Each ingredient can be thought of as an underlying *risk factor* that, when present, alone or in combination with other risk factors, erodes into a margin of safety that we normally try to build into our lives. Once that margin of safety is compromised, however, the situation is free to unravel to epic proportions.

I consider there to be 10 basic risk factors:

1. **Design and construction flaws.** Major facilities, such as power plants, skyscrapers, refineries, and ships, are built according to detailed blueprints, otherwise known as design specifications. These specifications are based on engineering analyses that focus on designing the structure to withstand the forces that will be imposed on it, such as load, wind, vibration, puncture, or blast. If there is a flaw in the design process and it is not discovered in time, when those forces are applied to the structure, it will be prone to failure. This failure can lead to a partial or complete collapse of the facility.

   Even when the design specification is valid, problems still can arise if the materials used to fabricate the building components are faulty or the components are not assembled properly. In either case, the integrity of the structure is compromised, making it susceptible to failure, with outcomes similar to those that occur

when a design flaw is present. Because of the close relationship between design and construction, it is not uncommon in a structural failure for opposing sides to argue whether the fault rests with a flaw in the design or in the construction.

2. **Deferred maintenance.** In the helter-skelter of trying to keep an operation up and running, discovery of a mechanical problem spurs a debate on whether to shut down the operation and fix the problem immediately, or to keep going and make the repair at a more convenient time. This is a judgment call, where the risk of deferring maintenance is weighed against the benefit of maintaining continuous operations. In these instances, it is human nature to choose to deal with problems at a later time, especially if the system is not actually malfunctioning. Unfortunately, decisions to defer maintenance often lead to the failure of a key system component before the repair can be made, causing a serious accident to occur. Moreover, within a culture where maintenance problems are customarily deferred, the situation is ripe for multiple component failures, allowing the consequences of the ensuing accident to propagate and intensify.
3. **Economic pressures.** As might be expected, one of the more common risk factors involves money. Whether exploring space, building a major facility, moving large quantities of cargo, or protecting a community from natural disasters, one is always dealing with a limited amount of available funding. Therefore, resources must be invested wisely. When a budget is too tight or spending is not controlled adequately, pressure intensifies to implement strict cost-cutting measures. This can translate into shoddy workmanship, purchasing lower-quality materials, eliminating the use of backup operating and safety equipment, or ignoring problems that arise. While economic pressures alone are rarely considered a root cause, they often serve as a catalyst for causing human errors that initiate a disastrous event.
4. **Schedule constraints.** Economic pressures and schedule constraints often go hand in hand as risk factors, as evidenced by the

phrase "Time is money." When a deadline has been imposed, and the project or operation has fallen behind, pressure to make up ground can cause the responsible party to cast a blind eye toward important details. Often this situation leads to the elimination of critical tasks, trying to accomplish tasks in parallel that should be done in sequence, or not pursuing certain considerations in sufficient depth to fully understand their impact on safety. As in the case of economic pressure, schedule constraints are considered a catalyst for committing errors in judgment that can lead to a destructive outcome.

5. **Inadequate training.** Most tasks in today's world have been made more complicated by the complexity of the technology being used and the highly integrated nature of various systems. Consequently, the performance of many important functions requires an individual to be highly trained. At the same time, some organizations view training as a burden because it can be costly to perform and because employees are not being productive while participating in a training program. This shortsighted perspective can place in positions of responsibility individuals whose lack of training causes them to make a mistake that either initiates an accident or allows a crisis situation to intensify.

   Problems with inadequate training go beyond the time when an individual first joins an organization. When there are personnel shortages, individuals may be thrown into an important decision-making role while covering for others, performing a function for which they were not properly trained. Because individuals tend to forget what they were originally taught and because processes change over time and require new learning, lack of retraining can also be a problem.

6. **Not following procedures.** Most organizations have well-defined procedures for how employees should perform a task or function. These procedures are often documented and made available during training and for reference purposes when individuals are on

the job. Moreover, job supervisors have as one of their duties to ensure that each employee is following standard procedures. Surprisingly, procedural errors are a frequent root cause of failure. When engaged in a repetitive activity, complacency can set in, and individuals tend to drift away from following a strict protocol. Consequently, they either neglect to perform certain steps or invent other ways to accomplish the same task, often not considering the ramifications of their actions on safety. Failing to follow procedure can create a hazardous situation, one that is exacerbated by coworkers whose actions are based on assuming that those procedures are being followed.

7. **Lack of planning and preparedness.** Planning and preparedness make up a proactive effort focused on applying resources in advance of an undesirable event to improve understanding and response to the threats with the greatest potential to cause serious harm. Depending on the nature of the threat, attention can be directed at preventing an undesirable event from occurring, mitigating the consequences of an event once it has occurred, or both. Planning and preparedness activities include the gathering of knowledge (intelligence), assessment of the likelihood and consequence of various disaster scenarios, evaluation of alternative risk reduction strategies, and conduct of exercises and drills to determine the effectiveness of ongoing efforts and maintain a state of readiness.

   Unfortunately, lack of planning and preparedness is evident in virtually every catastrophe recorded in history. Because of the luxury of time and the fact that a disastrous event may not have been experienced in recent memory, people tend to place a low priority on making the effort and spending the resources to be adequately prepared for a crisis situation. All too often, little forethought is given to the variety of disaster scenarios that could occur, the magnitude and impact of these events are underestimated if the scenario is considered, or the ability of the response community to handle mass casualty situations is overestimated.

Even in circumstances where significant effort has been devoted to planning and preparedness, the product of this effort can be a written plan that is not practiced or updated, rendering it of little value when a calamity arises.

8. **Communication failure.** This risk factor also is present in nearly every historical disaster, contributing to either the cause or the consequence of the event. Communication failures can occur at various stages, altering an outcome in different ways. One common form of communication failure occurs between members of the same organization. In this instance, critical information is not shared, such as when one group decides to shut down a critical protection system for maintenance while another group is carrying out a dangerous experiment. Poor communication between organizations is also problematic. A typical scenario is two agencies engaged in a response effort, each of which is unaware of what the other is doing. Finally, lack of communication with the public or the provision of inaccurate information can place people at risk either because they do not know the hazards they are facing or because they are not properly advised on how to protect themselves.
9. **Arrogance.** This risk factor is a human trait that can complicate what might otherwise be a safe operation. Arrogance can rear its head in many forms but usually appears as either the person in charge being driven to succeed for individual gain without sufficient regard for the safety of others or an experienced individual who has become overconfident with his or her ability to deal with any problem that might present itself. The former case creates an environment in which concerns expressed fall on deaf ears or, worse yet, a culture of fear of reprisal if an employee complains about personal safety. In the latter circumstance, the individual can underestimate the risk at hand, believing that "I've seen everything before and was able to handle it" or "This is not going to get the better of me." Arrogance displayed in either form can have serious repercussions.

While often associated with a key individual, arrogance can also appear at the institutional level. Such instances occur when the organizational culture has become dominated by an attitude of disregard for the well-being of others, overconfidence in the organization's ability to solve problems, or disdain for individuals whose beliefs threaten the ability to achieve desired goals and objectives.

10. **Stifling political agendas.** Government policies can have a powerful effect on the propensity for disasters. If these political agendas are hard-nosed, with little room for dialogue and compromise, then affected parties can feel that they have little recourse other than to resort to extreme and often hostile measures. Historically, political agendas have been closely associated with the vast majority of terrorist acts, an intentional reaction to what the aggressor perceives to be oppressive governmental policy. This risk factor is not limited to terrorist acts, however. It is also evident in developing countries where governments attempting to become more economically competitive are willing to relax safety standards to attract business, or among nations whose desire for an elevated status in global politics can put its citizens at greater risk.

An interesting observation when reviewing these ten basic risk factors is that we, as humans, are involved in each and every one of them. While this implies that we contribute to the cause or impact of every disaster, it also means that we have an opportunity to control these factors more effectively to achieve a better outcome: a safer tomorrow.

So, where do we begin? A good place to start is to go back in time and carefully review disasters that have occurred in the recent past, selecting a potpourri of those that were accidental in nature, terrorist acts, or due to natural causes. If we can follow the sequence of events that caused each disaster and analyze what went wrong, then we can extract important lessons learned about how to better control these risk factors. Moreover, if we also review actions taken in the aftermath of each

disaster so as to reduce the risk of it happening again, we can evaluate our susceptibility to a recurring event in the future. Doing this will allow us to understand how we can become more savvy in making the world a safer place.

The intent of this book is to encourage adoption of such an approach. The parts that follow document and evaluate several case studies of major disasters that have occurred in the past 30 years. Each case study contains a narrative describing what happened, an analysis of what went wrong, a review of what actions have been taken in the aftermath of the event, and a perspective on whether a similar event could happen again. The case studies are separated according to whether they were man-made accidents, terrorist acts, or natural disasters. Also included are cases where disaster was averted because of the exemplary risk management practices of affected individuals and organizations. These success stories become important learning experiences by allowing us to observe what went right. The book closes by summarizing what the case studies have taught us about the ten basic risk factors, followed by a glimpse into what the future could look like if we take these lessons to heart.