

# Introduction to Safety: Philosophy and Terminology

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## ***Abstract***

This chapter deals with the basics of safety and its necessity in an organization. The philosophy of safety, which deals with common causes and their remedial measures, was also discussed. Lastly, some common terminologies associated with safety, i.e., accident, danger, hazards, disaster, emergency, error, and risk, were also stated along with their causes and effects.

**Keywords:** Safety, philosophy of safety, safety terminology, accident, danger, hazard, disaster, risk

## **1.1 Background**

We live in an unsafe environment. Natural dangers include fire, flood, storm, hunger, and illness. Technological and economic development has made us less vulnerable to these threats. However, technology also introduces new risks, such as workplace mishaps, vehicle accidents, toxic substances, and radiation. Future technologies, such as genetic modification or artificial intelligence, may pose dire dangers to the human species. These dangers are the most compelling case against a naïve or careless approach to development. To completely comprehend development, we must first comprehend danger and safety.

## **1.2 Introduction**

A safe scenario is one in which hazards and conditions are controlled to safeguard people's and society's health and well-being. Individuals, communities, governments, and others must create and maintain the following conditions to achieve an optimal level of safety: a climate of social cohesion

and peace; equity in protecting human rights and freedoms; prevention and control of injuries and other consequences or harm caused by accidents; respect for values; and the physical, material, and social environment. Environmental initiatives (physical, technical, social, economic, political, and organizational) as well as behavioral initiatives can serve to ensure these circumstances.

Safety is a value, and improvements in safety are seen as progress. We have made progress itself safer by requiring higher levels of testing and analysis before new technologies are put on the market. For example, a century ago, little to no testing was performed on new drugs, but, today, they go through extensive, multi-stage trials. In both nature and technology, we must actively pursue and build for safety. It necessitates procedures, norms, and protocols, as well as education and training, feedback loops, leadership, and statistical thinking protocols. Pressure valves, seat belts, and smoke alarms can all assist, but, ultimately, safety needs human answers.

Safety has typically been reactive, but, as we move forward, we must foresee risks in advance. This is because, as the baseline level of risk diminishes, it makes reason to reduce our tolerance for risks of all types, and the more advanced our technology becomes, the more possible harm we can cause. Being vigilant about safety entails recognizing risks through theory rather than experience, and this has intrinsic epistemic constraints. Even when risks are anticipated, individuals do not always take them seriously.

Broad skills help protect against broad categories of risk, including those we cannot predict. Science helps us comprehend risk and what we can do to reduce it; technology provides us with instruments; and riches and infrastructure provide a buffer against disruptions. The route to safety does not involve prohibiting wide areas of R&D or slowing development in general. The route to safety varies greatly depending on the topic. It requires the most accurate threat models that we can create, as well as particular tools, methods, procedures, and standards to counter them.

### **1.3 Philosophy of Safety**

The philosophy of safety is the search for and coordinate common causes and remedial measures for general as well as specific safety problems. It starts with the essential need or prerequisite of safety, its foundations, causation analysis and consequences, methods of detecting unsafe circumstances and unsafe actions, and the reason and order of mishap occurrence. It then investigates physical, physiological, psychological, and other

factors affecting and strengthening safety; the costs and types of accidents; the types of safety management; and methods and means of providing and maintaining safe working conditions, as well as human actions affecting people's health and safety and environmental safety. It also discusses the genesis, growth, and amendment of safety legislation, as well as its innovation, as well as all corporate and environmental safety requirements. The field of safety philosophy is limitless, its scope is broad, and it encompasses the entire subject of safety, from its origins to the most recent advances in causality and behavioral analysis to modern concepts of design, testing, reliability, hazard control technology, risk analysis, assessment, and audit, emergency planning, public awareness and involvement programs, and all future developments [1, 2].

The goals of philosophy of safety theory are to consider what is secure, why it is needed, where it is needed, what kinds and applications exist, and so on. The philosophy of safety also consists of protect and service humanity by researching, proposing, and implementing secure behaviors, working circumstances, and environments for everyone's safety, health, and well-being. This demonstrates the utmost significance of the topic of safety, as it has begun to form the age-old need for it eternally. This is the ultimate importance of safety guideline.

## 1.4 Safety Terminology

Many phrases and terminology in safety science, like in other areas of science, are now well defined. From a legal standpoint, some terms are specified by laws. The following is a list of some frequently used safety terms. It is critical to comprehend these terms because they clarify many ideas in safety theory, science, and law [3, 4].

### 1.4.1 Accident

An accident is an unplanned and uncontrollable occurrence in which the action or response of a substance, object, radiation, or person causes or increases the likelihood of physical harm. In the public health field, unintentional injury is the favored word for accidental injury. It is defined as any occurrence that disrupts or conflicts with the orderly progression of the activity and causes or is likely to cause harm, with or without property or environmental damage. An accident is defined as an undesired transfer of energy beyond the threshold boundaries that has the potential to cause human harm, property destruction, or both. A fatal accident, also known

as a fatality from accident, is defined as an accident that results in one or more fatalities within 1 year of the date of the accident.

Accidents happen either due to any unsafe working condition or to any unsafe act by any person (Figure 1.1). Unsafe conditions include any faults related to mechanical, physical, chemical, etc., whereas unsafe acts include error, ignorance, or overconfidence on the part of a person. Accidents cost an organization directly or indirectly (Figure 1.2). Direct costs include property damage, medical compensation to the affected person, and legal expenses, whereas indirect costs include time loss, production loss, and loss of image for the organization.

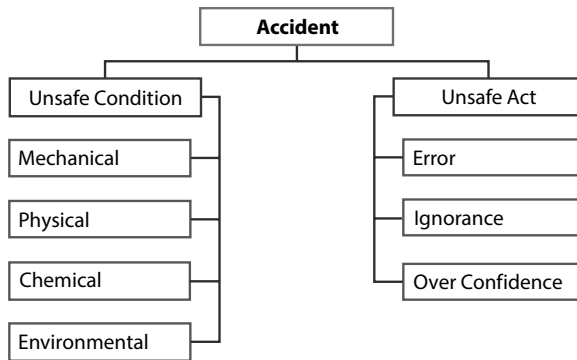


Figure 1.1 Different reasons of accident causation.

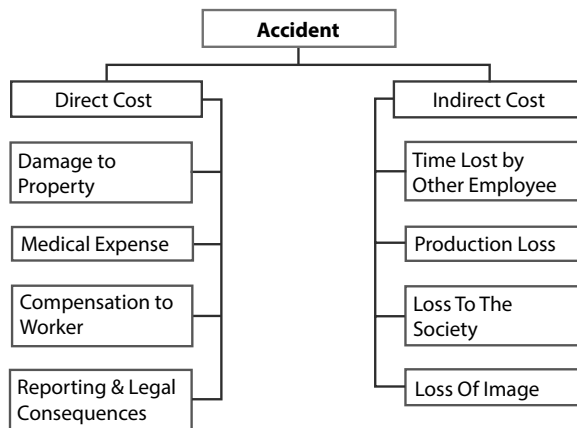


Figure 1.2 Different types of cost due to accident.

#### 1.4.1.1 *Accident-Consequence Analysis*

Accident consequence analysis is an examination of the anticipated consequences of a mishap, regardless of its frequency or likelihood. Typically, this is done after the risk assessment to forecast the outcomes, i.e., the severity of the effects, due to the worst or most plausible accident situations. The risk study of the impacted people, property, and surroundings can be done using accident consequence analysis. Computer software is helpful for performing consequence and risk analyses. In this form of analysis, the determination of the following factors is important:

- The type of material being discharged, for example, gas, liquid with vapor, and liquid.
- The type of discharge, such as instantaneous, sporadic, or constant.
- In the instance of a liquid reservoir, the leak rate, evaporation rate, and discharge amount.
- Calculation of the discharged mass' dispersion: Atmospheric factors are taken into account.
- Damage distances, i.e., the destructive concentration or impact of fire or detonation at various distances in the direction of the breeze or other depicting these distances and effects.
- The severity of the impact, i.e., vulnerability in terms of potential deaths, injuries, structure destruction, or environmental harm. Application of the probit equation.
- Plotting risk markers on a map of the discharge site and surrounding region: Counters should show regions of low, medium, and high risk.

#### 1.4.1.2 *Accident Prevention*

Accident avoidance is both a science and an art. Above all, it symbolizes control, i.e., control over human performance, machine or apparatus performance, and the real surroundings. The term "control" implies both avoidance and rectification of dangerous situations and actions. The first move toward management is prevention. Knowledge of psychology, logic, and management is required to regulate unsafe human actions. Controlling hazardous circumstances necessitates understanding of engineering, health effects, workplace hygiene, ergonomics, and so on. Accident avoidance entails five steps: organization, fact-finding analysis if the facts are

discovered, remedy selection, remedy implementation, and review. The sixth monitoring measure should be examined. It includes outcome measurement, appraisal (comparison with legal criteria or standards), feedback, and, if required, further development.

### 1.4.2 Danger

Danger denotes the degree of exposure to a potentially lethal situation, which can lead to death or serious injury if not avoided. The word “DANGER” should only be used in the most extreme situations (Figure 1.3) and not be used for property damage hazards unless there is also a personal injury risk at these levels. The danger can be reduced by taking appropriate precautions.

Dangerous occurrences can take several forms, including the pressure-induced burst of a steam plant; failure or collapse of lifting equipment, overturning of a crane fire, explosions, and the escape of molten metal, hot spirits, gas, and other substances; and explosion of a pressure vessel, collapse, or subsidence of a structure.

### 1.4.3 Hazard

A hazard is any item, circumstance, or behavior that can cause injury, sickness, environmental harm, or property damage. Some are readily recognized and rectified, whereas others are unescapable aspects of the work that must be minimized and managed via various control measures.



**Figure 1.3** A commonly used “DANGER” sign.

The term “hazards” refers to a wide group. Some hazards are severe and offer an instant threat to one’s health and safety. Others, such as many chemicals, vapors, and radioactivity, have effects that take longer to manifest or have accumulated effects.

Physical, chemical, mechanical, ergonomic, biological, and psychosocial are some of the categories of hazards found in a workplace. While each hazard will necessitate a unique set of controls to mitigate the risks associated with it, there is a commonly accepted hierarchy of control measures that applies to all hazards. Hazards at work are not always visible to the naked eye; we must sometimes look closely. There are three types of hazards:

- Visible hazards are those that can be seen, heard, smelled, felt, or otherwise detected by the inspector (open edges, moving machine parts, and vehicles).
- Hidden hazards: Those that cannot be detected without a more thorough investigation (radiation, dust, and ergonomic stressors).
- Developing hazards: Those that worsen over time may go undetected unless measured (erosion and corrosion).

#### **1.4.4 Disaster**

Disaster is a catastrophic scenario in which daily routines of humans are abruptly interrupted, leaving them helpless and suffering. As a result, they require security, housing, clothing, medical and other needs of life. Disaster can be natural such as earthquakes, cyclones, floods, and forest fires or man-made such as factory fires, river pollution, industrial accidents, aircraft crashes, explosions, and collisions of vehicles carrying flammable liquids.

#### **1.4.5 Emergency**

An emergency is defined as a sudden event that compromises the safety of one or more individuals. To guarantee a fast and effective response, health and safety practitioners must identify possible dangers, minimize risks, and have emergency planning in place. Employees should have a defined framework for dealing with crises while minimizing the danger to human life and health.

The first stage in developing emergency plans is to evaluate risks and vulnerabilities. Practical methods for mitigating risks should be implemented

to prevent crises, but staff must be prepared to respond if efforts to avoid an emergency fail. The strategy should include strategies for avoiding harm and death. Structures, machinery, and materials should be protected as much as possible, and the ecosystem and society at large should not be jeopardized. An effective emergency plan will also handle the actions that must be done following the disaster in order for operations to resume. Specific emergency protocols are developed, and employees are taught in their use.

#### **1.4.6 Error**

Human error, planning, design error, manufacturing, maintenance, and administration errors are all examples of errors. Human error is described as any action taken by a human that varies from or contradicts prescribed or set behaviors or processes. Human mistake occurs as a result of absence (failure to perform a required function) or commission (performance of a non-required function), failure to recognize dangers, poor reaction, poor timing, the incorrect choice, an abrupt disruption, and so on. It can be either expected or unpredictable.

- Predictable errors arise in comparable circumstances and can be predicted because they have happened several times.
- Random error is unpredictable and one of a kind. For example, a fly or bug may suddenly enter the eye, causing a worker to cast away a tool or lose his equilibrium, resulting in a mistake. However, if flies become a frequent, predictable occurrence, then the error becomes predictable, and corrective steps are needed.

#### **1.4.7 Risk**

Risk is the possibility or likelihood that a person will be harmed or suffered an adverse health impact if subjected to a hazard. It is the combination of the likelihood of damage occurring and the degree of harm. The most frequently used meaning of risk in the context of workplace safety and health is that it is the chance or probability of contracting an illness or being injured, while hazard alludes to the agent accountable (i.e., smoking).

The following factors affect the degree or probability of risk:

- The type of exposure or how frequently a person is exposed to a dangerous object or situation
- How the person is exposed
- The intensity of the impact

The possible harm or detrimental health effect of the danger, the number of times people are exposed, and the number of people exposed are used to classify risk categories. For example, exposure to airborne asbestos fibers can cause potentially deadly lung disease, whereas short-term exposure to a display screen may be deemed minimal due to the potential damage or detrimental health effects.

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