

## **Safety**

From Wikipedia, the free encyclopedia - <http://en.wikipedia.org/wiki/Safety>

**Safety** is the state of being "safe" (from French *sauv*), the condition of being protected against physical, social, spiritual, financial, political, emotional, occupational, psychological, educational or other types or consequences of failure, damage, error, accidents, harm or any other event which could be considered non-desirable. This can take the form of being protected from the event or from exposure to something that causes health or economical losses. It can include protection of people or of possessions.

### **Meanings**

There also are two slightly different meanings of *safety*. For example, *home safety* may indicate a building's ability to protect against external harm events (such as weather, home invasion, etc), or may indicate that its internal installations (such as appliances, stairs, etc) are safe (not dangerous or harmful) for its habitants.

### **Limitations**

Safety can be limited in relation to some guarantee or a standard of insurance to the quality and unharmed function of an object or organization. It is used in order to ensure that the object or organization will do only what it is meant to do.

It's important to realize that safety is relative. Eliminating all risk, if even possible, would be extremely difficult and very expensive. A safe situation is one where risks of injury or property damage are low and manageable.

### **Types of safety**

It is important to distinguish between products that meet standards, that are safe, and those that merely feel safe. The highway safety community uses these terms:

#### **Normative safety**

*Normative safety* is a term used to describe products or designs that meet applicable design standards.

#### **Substantive safety**

*Substantive*, or objective safety means that the real-world safety history is favorable, whether or not standards are met.

#### **Perceived safety**

*Perceived*, or subjective safety refers to the level of comfort of users. For example, traffic signals are perceived as safe, yet under some circumstances, they can increase traffic crashes at an intersection. Traffic roundabouts have a generally favorable safety record, yet often make drivers nervous.

## Risks and responses

Safety is generally interpreted as implying a real and significant impact on risk of death, injury or damage to property. In response to perceived risks many interventions may be proposed with engineering responses and regulation being two of the most common.

Probably the most common individual response to perceived safety issues is insurance, which compensates for or provides restitution in the case of damage or loss.

## System safety and reliability engineering

System safety and reliability engineering is an engineering discipline. Continuous changes in technology, environmental regulation and public safety concerns make the analysis of complex safety-critical systems more and more demanding.

A common fallacy, for example among electrical engineers regarding structure power systems, is that safety issues can be readily deduced. In fact, safety issues have been discovered one by one, over more than a century in the case mentioned, in the work of many thousands of practitioners, and cannot be deduced by a single individual over a few decades. A knowledge of the literature, the standards and custom in a field is a critical part of safety engineering. A combination of theory and track record of practices is involved, and track record indicates some of the areas of theory that are relevant. (In the USA, persons with a state license in Professional Engineering in Electrical Engineering are expected to be competent in this regard, the foregoing notwithstanding, but most electrical engineers have no need of the license for their work.)

Safety is often seen as one of a group of related disciplines: quality, reliability, availability, maintainability and safety. (Availability is sometimes not mentioned, on the principle that it is a simple function of reliability and maintainability.) These issues tend to determine the value of any work, and deficits in any of these areas are considered to result in a cost, beyond the cost of addressing the area in the first place; good management is then expected to minimize total cost.

## Safety measures

*Safety measures* are activities and precautions taken to improve safety, i.e. reduce risk related to human health. Common safety measures include:

- **Root cause analysis** to identify causes of a system failure and correct deficiencies.
- **Visual examination for dangerous situations** such as emergency exits blocked because they are being used as storage areas.
- **Visual examination for flaws** such as cracks, peeling, loose connections.
- **Chemical analysis**
- **X-ray analysis** to see inside a sealed object such as a weld, a cement wall or an airplane outer skin.
- **Destructive testing** of samples
- **Stress testing** subjects a person or product to stresses in excess of those the person or product is designed to handle, to determining the "breaking point".

- **Safety margins/Safety factors.** For instance, a product rated to never be required to handle more than 200 pounds might be designed to fail under at least 400 pounds, a safety factor of two. Higher numbers are used in more sensitive applications such as medical or transit safety.
- Implementation of **standard protocols and procedures** so that activities are conducted in a known way.
- **Training** of employees, vendors, product users
- **Instruction manuals** explaining how to use a product or perform an activity
- **Instructional videos** demonstrating proper use of products
- **Examination of activities by specialists** to minimize physical stress or increase productivity
- **Government regulation** so suppliers know what standards their product is expected to meet.
- **Industry regulation** so suppliers know what level of quality is expected. Industry regulation is often imposed to avoid potential government regulation.
- **Self-imposed regulation** of various types.
- **Statements of Ethics** by industry organizations or an individual company so its employees know what is expected of them.
- **Drug testing** of employees, etc.
- **Physical examinations** to determine whether a person has a physical condition that would create a problem.
- **Periodic evaluations** of employees, departments, etc.
- **Geological surveys** to determine whether land or water sources are polluted, how firm the ground is at a potential building site, etc.

## Standards organizations

A number of **standards organizations** exist that promulgate safety standards. These may be voluntary organizations or government agencies.

### American National Standards Institute

A major American standards organization is the American National Standards Institute (ANSI). Usually, members of a particular industry will voluntarily form a committee to study safety issues and propose standards. Those standards are then recommended to ANSI, which reviews and adopts them. Many government regulations require that products sold or used must comply with a particular ANSI standard.

### Testing laboratories

Product safety testing, for the United States, is largely controlled by the Consumer Product Safety Commission. In addition, workplace related products come under the jurisdiction of the Occupational Safety & Health Administration (OSHA), which certifies independent testing companies as Nationally Recognized Testing Laboratories (NRTL).

For other countries, there are many other organizations that have accreditation to test and/or submit test reports for safety certification. These are typically referred to as a Notified or Competent Body. The most common is the IECCE Certification Body Scheme.

## **Government agencies**

Many government agencies set safety standards for matters under their jurisdiction, such as:

- the Food and Drug Administration
- the Consumer Product Safety Commission
- the United States Environmental Protection Agency

## **Non-US bodies**

- British Standards Institution
- Canadian Standards Association
- Deutsches Institut für Normung
- International Organization for Standardization