Assessing Definitions and Concepts Within the Safety Profession

Miguel Angel Mariscal Saldaña[1], Susana García Herrero[1], Miguel Angel Manzanedo del Campo[1], Dale O. Ritzel, Ph.D.[2]

[1] Area de Organización de Empresas, Escuela Politécnica Superior, Avda. Cantabria S/N, 09006 Burgos Spain

[2] Professor/Director, Safety Center, Southern Illinois University, Carbondale, IL 62901-6731 USA

Corresponding author: Dale O. Ritzel, PhD, Professor/Director, Safety Center, Southern Illinois University, Carbondale, IL USA 62901-6731; Phone: 618.453.2080; FAX: 618.453.2879; Email: DRITZEL@SIU.EDU

Submitted July 5, 2002; Revised and Accepted November 25, 2002.

Abstract

English:

This article tries to provide an understanding of the terms that have been used relating to prevention of work risks around the world. The basic terminology used by diverse authors and safety technicians are defined and discussed. Since there exists many difference shades of the same terms, an exploration of the various revisions and new safety concepts is done. These differences are not owed only to the extension of safety for all over the world, but rather to problems in terminology that exist inside the same countries, or inside the same sectors of activity. Finally, this article tries to integrate the current diverse thoughts about occupational safety.

Spanish:

Este artículo intenta proveer un mayor entendimiento de los términos que han sido usados alrededor del mundo en relación con la prevención de los riesgos asociados con el trabajo. La terminología básica usada por los múltiples autores y tecnólogos de seguridad es definida y discutida en este artículo. Debido a que existen muchas diferencias y variaciones en los mismos términos, una exploración de las múltiples revisiones y nuevos conceptos relacionados con la seguridad es discutida en este artículo. Estas diferencias no solo se deben a la extensión de la seguridad alrededor del mundo, sino también se debe a los problemas en la terminología que existe dentro de los países o dentro de los mismos sectores de actividad. Finalmente, este artículo trata de integrar los pensamientos actuales acerca de la seguridad ocupacional.

Key Concepts: Injury prevention; safety; international issues

Introduction

Safety and injury concerns in the workplace exist throughout the world. Besides the difficulty of different terminology and concepts throughout the world, differences in terminology exist within countries. This paper examines the similarities and differences in terms and concepts commonly used by safety professionals throughout the world. In addition, discussion into issues specifically related to occupational safety occurs.

Risk and Danger

All worksites contain risk physical to the likelihood to injury (Baselga, 1984). Risk is associated with the presence of a situation or, the eventuality that we produce an unwanted or negative outcome. For safety professionals, personal injury is a negative event.

The challenge to safety professionals when dealing with risk is factoring in the concept of probability and a mechanism to quantify risk. According to Cortes (1997) risk is the probability that in the presence of a certain danger, damage takes place. The danger would be, then, everything that could produce damage or deterioration from the quality of life of an individual or groups of people. From these two definitions, the concept of damage arises, defined as a negative consequence of an individual or collective life of people as the result of risk.

Many countries have regulations or laws that have varying definitions related to risk and its prevention or reduction. For example, UNE 81900 (Spanish Norm, based on American Industrial Hygiene Association's OHSMS), in its chapter on definitions, identify risk as damage to people or things resulting from the consequence or circumstances of the work. Danger is identified as a situation of imminent risk.

In UNE 81902, a document expanding UNE 81900, risk is defined as the combination of frequency or probability and consequences that could be derived from danger. In this standard, danger is a source or situation with capacity of damage in terms of injuries, property damage, environmental damage, or a combination of all. These definitions are similar to the Spanish Occupational Safety and Health Law (LPRL) where it states that risk is the possibility that a worker will suffer a certain damage derived from work.

Baselga (1984) defines danger as "the situation that exceeds and surpasses the limit of the acceptable risks." When danger exists, acceptable risk is exceeded, often resulting in worker injury.

Acceptable risk would be, then, the marginal risk, not imminent, not very serious, and of scarce frequency. But, the level of acceptance of a certain risk

is often falsified by intrinsic technical difficulties (Baselga, 1984).

Although these various definitions are similar, small differences in the definition can have a substantial impact on interpretation. To avoid potential problems, a unified effort to define risk and danger is imperative. It appears that there are two major concepts: a danger-like situation and a method to quantify risk.

In accordance with the previous definitions, the following groups will classify worker risk:

1. Safety: factors or conditions of safety, where conditions that influence the probability of injuries are included.
2. Health: factors of environment conditions, whether it be physical, chemical, or biologic in origin.
3. Ergonomics: factors derived from the characteristics of work, including the demands that the task imposes to the individual that carries them out.
4. Psychosocial: factors derived from the organization of work, considering the characteristics of the organization and those depending on the work task.

In the section "Evaluation of Risks" in the Spanish Occupational Safety and Health Law (LPRL), the beginning to preventive actions is risk evaluation. The information obtained from any evaluation is used to make necessary decisions.

According to the "Guidelines for the Evaluation of Risks in the Workplace", elaborated by the European Commission and published by the Official Office of Publications of the European Communities (European Network for Workplace Health Promotion, 1997), the evaluation of risk is the process of appraisal of the risk so that danger in the job situation will be reduced. For UNE 81902 (Spanish Norm), the evaluation of risks is the process by means of which the necessary information is obtained, so appropriate decisions can be made.

When the evaluation of risk is set as the standard, company management can provide adequate measurements to comply with their obligation of guaranteeing safety and health protection for their workers. The following must be measured:

1. Worker risks.
2. Ways of providing information to workers.
3. Approaches to Organizing workers into various workstations.
4. Organizational strategy to put in practice when measurement is necessary.

The process for evaluating risks includes:

1. The analysis of the risk, understanding the dangers, identification phases, and estimation of the risks.
2. The appraisal of the risk, which will permit one to say if the risks detected turns out to be tolerable.

Evaluating risks have a number of levels, from the simplest (based on subjective considerations of the workers), to quantitative procedures that utilize statistical methods to determine damages. Finally, there are those levels that are of general application in evaluating risks. The classification of the procedures of evaluation is a function of:

1. Its degree of difficulty.
2. The type of risk to analyze. Examples include a) evaluation of risks required. These might be job specific or fall under federal rules and regulations; b) evaluation of risks that need specialized methods of analysis; c) evaluation of risks for ones that do not have existing rules, but specific, and are submitted to national, European, international norms or official guids of various prestigious agencies. Among some exampes are TLVs (Threshold Limit Values) of the ACGIH (American Conference of Governmental Industrial Hygienists) for evaluation of the risk by contaminants (pollutant) chemical and, some, physical hazards (radiation UV, IR, etc.), or the UNE for evaluation of Estres thermal, vibrations, comfort thermal, etc.; d) general evaluation of risks, for those not covered in the previous groups.

The Work Accident

The strictest definition of work accident is one usually described in legal terms. (Note: The authors prefer to use the word "injury" instead of the word "accident", but for purposes of this paper will use in its general discussion of terminology the word "accident" that is used in most of the literature. However, the reader will find that we end this paper with the word "injury" instead of the word "accident"). The basis of such a legal definition indicates that a work accident is a social risk to a worker who has an exposure because of his/her work and of the consequence of that work.

Outside legal environments, the limitation that is imposed upon legal definitions makes it necessary to expand those concepts. For this, an analysis of a work accident from the legal point of view, as well as the safety point of view needs to be completed.

Legal Concepts of Work Accidents

In article 115 of the General Law of Social Safety in Spain (Real Decreto Legislative 1, 1994, of 20th June) depicts a work accident as an injury that the worker suffers from and the consequence of the work. There are three requirements needed to qualify as a work accident:

1. One must work for another person;
2. Verification of an injury;
3. There must be something in the worksite that caused an injury.

The UNE 81902 (Spain) defines the work accident as any event not desired or wanted that give rise to loss of health to the worker. To be considered as a work accident, there has to exist an injury. For an event to

not be considered as a work related accident, there is no worker injury.

Work Accident from the Safety Point of View

Accidents are a palpable sign of a potential dangerous situation. Thus, events without injuries are important issues to deal with. One must consider events that do not cause injuries. Replacing legal definitions of accidents with a wider concept that focuses on events with potential damages (losses) will be more valid to preventive effects and economic analysis.

There are two differing views on what constitutes an accident. There are those that integrate all events, including accidents and accidents with injuries. For others, accidents are those with injuries and those incidents without injuries. The former concept has been examined by a variety of safety experts, including Heinrich (1931), Compes (1964), del Castillo (1976), Baselga (1984), and Labar (1990).

Heinrich's (1931) definition of accident is unplanned and without control in which the action or reaction of an object, substance, person or radiation results in a personal injury. Many authors use the term "incident," more than for "accident." This includes not only an accident that results in injury but also those accidents that have no injuries involved. Compes (1964) proposes that a work accident is one in which a worker is injured in such a way that care has to be provided by first aid personnel or by a physician. In 1966, Compes expanded the previous definition of an accident to "a sudden event, not projected, inside the company, for which the normal process of doing work is interrupted and people and/or equipment has suffered damage." Under this definition all possible consequences of the accident--personal damages and/or damage to materials-- are included. Furthermore, delCastillo (1976) does not differentiate between the different consequences, and defines accident as a sudden event, that appears in the course of the productive process.

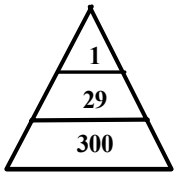
Baselga (1984) defines work accident as "an abnormal event that takes place in a work activity, or could result in injury to a worker. This paper defines a work accident as an injury to a worker that happens in the course of the work. Recognition is given to the point recognized that the consequences of an accident includes personal injuries and material and equipment damages.

On the other hand, Labar (1990) introduces the existence of energy or substances in the cause of an accident, where he indicates an accident as being "a contact not wanted with energy or a substance, above the limit threshold of the body or structure that result in some adverse effects." Certainly, this definition does not consider the consequences or affects, it does consider the idea of presence of energy or substance. On the other hand, Del Castillo (1979) centers his definition of an accident more on the possible origin of the accident rather than their consequences.

Krause and Russell (1994), the National Safety Council (NSC) (1995) and Rodriguez de Prada (1996) have worked on distinguishing between the terms accidents and incidents. These authors propose a more precise definition of an accident and incident.

For those in favor of the "behavioral based safety", the definition of an accident would change because we forget the fact that the results of an accident "are not planned." In this way, an accident is an event, not planned, from a behavior, that produces injury. An incident is an event not planned from a behavior that produces no injury or damage (Krause and Russell, 1994). With all of these, it is recognized that there is a difference between accidents and incidents at the end (after each occur), even though they are equal before the occurrence.

In the Accident Investigation Manual of the National Safety Council (2001), an accident is "an act not planned, nor wanted that resulted in a personal injury or property damage." The NSC would integrate all the consequences under the concept of "accident", however, NSC has made a distinction between those possible consequences.



For 1 serious accident or death

occurs 29 accidents with lost days and

300 accidents without injuries

Figure 1. Pyramid of Heinrich. Source: Heinrich (1931)

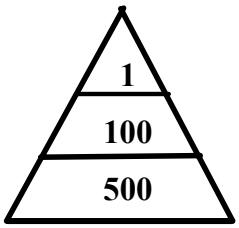
Rodriguez de Prada (1996) defines accident as "an abnormal event, not wanted, that comes in an unexpected form, although it normally is avoidable, that interrupts the normal continuity of the work and could cause injuries to workers."

By analyzing the group of listed definitions, one could observe that they do not embrace the wide range of possible situations of the workers' life. All definitions of accident should be expanded and include the concept of incident.

The Incident

Heinrich (1931), in his book *Industrial Accident Prevention* introduced the idea of the existence of accidents where injuries did not occur, and where damages to the property did occur. This "incident" is an act, not wanted, that could degrade the efficiency of an operation. Based on Heinrich's work, he established proportions of accidents associated with injuries or damage. Figure 1 presents the established proportions by Heinrich as for the different types of accidents.

After these initial studies, a stagnation of safety programs investigations took place until the practical work of Bird (1975). Bird carried out his studies at Lukens Steel Co, embracing a period of seven years and nearly 90,000 cases in which an accident had taken place (with or without injuries) without material damages. The obtained results make one modify the established proportion by Heinrich (see Figure 2).



For every 1 serious accident or death occurs 100 accidents with injuries and 500 accidents with damages to the property

Figure 2. Pyramid of Bird. Sources: Geller (1998).

In 1969, Byrd revised those proportions after his study for the International Safety Academy, on 1,753,498 accidents in 297 companies, revised the proportion. These companies had 1,750,000 people, with more than 3 billion hours worked during the period of time analyzed. Byrd's revisions appear in Figure 3.

The concept is similar to the figure of an iceberg, in which the visible part (accidents) is very small compared submerged part (incidents).

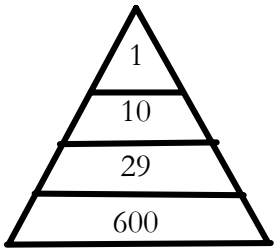
Baselga (1984) defines incident as "an abnormal event, not wanted, that resulted from an abrupt, unexpected and accidental form that interrupts the normal continuity of the work." According to this concept, we can differentiate between:

1. An accident-like incident having the potential to cause worker injuries.
2. A mishap in the sense of an incident without injuring workers.

In this way, the negative consequences (abnormal, accidental, and not wanted) of accidents could be of material type (damages) or of personal injuries, thereby arriving at a classification of an accident according to the type of consequences they generate. In this sense, we could identify:

Critical incidents or quasi-accidents. They do not represent losses, neither damages, neither injuries, and sometimes are unreal work accidents. However, it is almost impossible to think of an incident that does not occasionally occur.

White accidents. White accidents only result in damages and they are very frequent. Although they are not the main objective of safety, for logical and/or strategic reasons, they should be of concern to safety professionals since they have the potential to result in injury. White accidents used as indicators for the analysis and identification of risks. As for the economics of safety and with injury prevention, injuries do occur from these types of accidents. The lack of aggressive energy, the lack of aggressive energy



Serious injury (with disability)

Light injury (without disability)

Accident with losses (property/equipment)

Incidents

Figure 3. Pyramid of Bird. Source: Geller (1998).

contact, or the lack of violence in the aggressive contact can explain the absence of injuries.

Typical accidents. Those that cause damages and injuries and represent the prototype of work accidents.

Rare accidents. Rare accidents are those that generate injuries only. They are similar to incidents, in that they are difficult to conceive, since most injuries do not generate a temporary and energy loss at the same time.

The classification of incidents by Baselga (1984) and explained by Cortes (1997) is shown in Figure 4. Swartz (1993) has a broader concept of an incident. He relates an incident with

1. fires of any size,
2. near miss losses.
3. observation of unsafe behaviors.
4. discovery of unsafe conditions.
5. identification of damages in properties, teams, or products

An incident could result in damage to property or to equipment and it could result in an employee needing first aid. Incidents would not involve medical covered treatment for compensation to the worker.

Top managers should be able to deduce that through observation of work habits, of work conditions, and of first aid treatments, those employees who have more accident risk exposure.

There are also great differences between investigators in explaining the different consequences of an incident. There are those who affirm that luck is a decisive factor that helps some people avoid an injury (Swartz, 1993; Krause, 1992; Lake, 998; Krzywicki & Vast, 2000.

Groover, Krause, and Hidley (1992) found that the difference between an incident and an accident is: 1) needing only first aid verses a major medical intervention, and 2) owed in a certain way, to the factor of luck. Likewise, Lake (1998) uses the expression "near miss" whereby an incident is like an accident that has not produced injuries or material damages. Lake's pyramid indicates where for each serious injury there is 10 minor injuries and 300 or 400 incidents.

Senecal and Burke (1994) state in some circumstances an incident could have resulted in a serious accident or injury. However, they do not attribute the possible consequences to luck, but to those invaluable and different circumstances that are studied. The concept is similar to one proposed by Smith (1994), in which the only difference between a fatal accident and an incident is the result. In this same sense, Cantarella (1997) insists that any incident could result in an injury or property damage loss.

National Safety Council (2001) defines an incident as an event not planned or wanted that adversely affects the completion of a task. The NSC goes on to future define an incident as an "unintentional even that may cause personal harm or other damage." In consequence, all accidents are incidents, as shown in Figure 5. As was stated earlier, Baselga (1984) proposed and Labelle (2000) confirmed this concept.

An incident includes all cases that any or all of the following exists: first aid or minor care; lost days; permanent disabilities; damages to the property; situations without material damages (Labelle, 2000).

According to the method of study of incidents, well known as MORT (Management Oversight Risk Tree), an incident is "the flow or transfer of energy not wanted that produces damages instead of work benefits (Adams 1995). Labar (1990) stated that the origin of the incident or accident and flow of energy is related.

The concept of an incident had a significant variation in definition by Jacobs and Nieburg (1989, 1992). They indicated that non-serious incidents are those resulting in no lost workdays, but the worst that could have happened, has already happened. One or more lost workdays are probably the difference with those serious incidents.

On the other hand, Geller (1998) sees property damage as the physical result of an incident and thus the forerunner of an injury. One should concentrate on

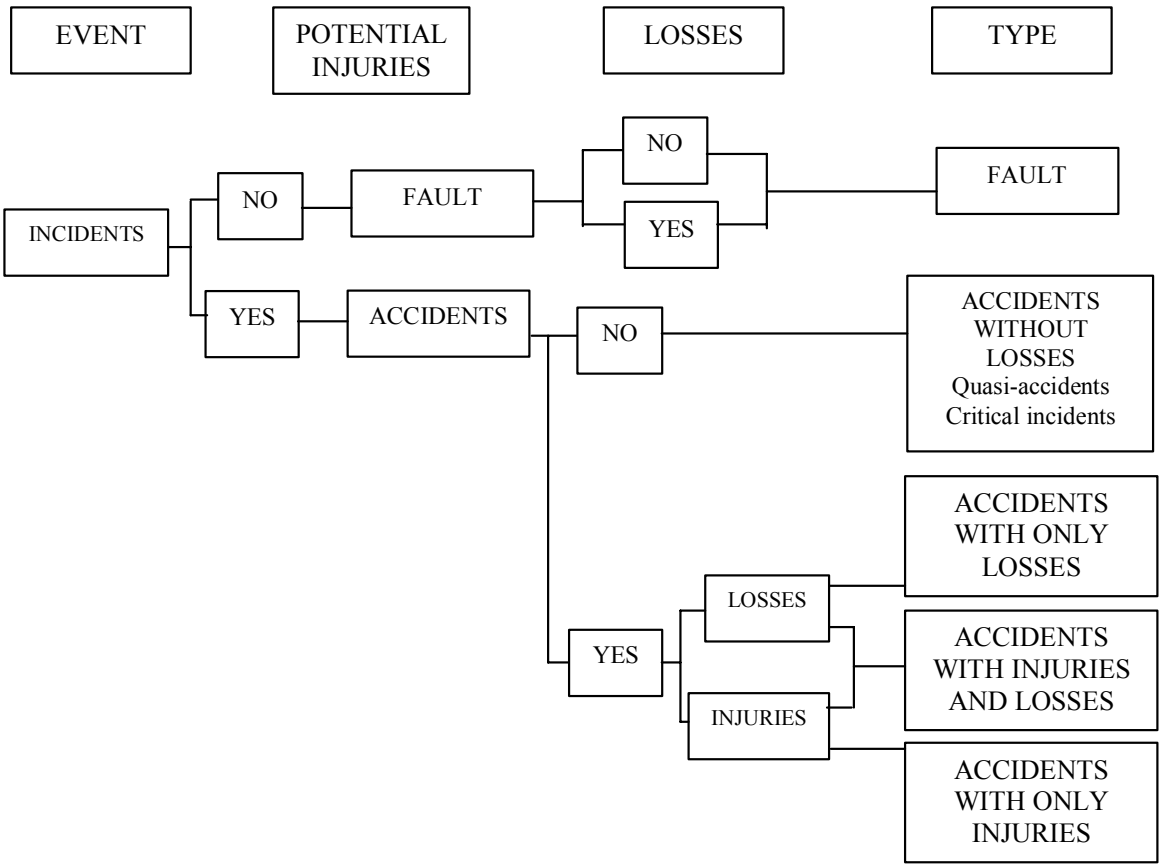


Figure 4: Classification of the incidents. Source: Cortes (1997).

the improving safety and the reducing damage to property rather the reduction injuries and illnesses.

Having a standard for the meaning of an incident is critical. The following are some current standards:

1. The standard UNE 81900 in Spain, defines an incident as an event of which damages do not occur or are not significant, that show the existence of risks derived from work.
2. The standard UNE 81902 explains an incident as undesired or unwanted that given rise to losses in the health of injuries of the worker, could result in occasional damages to property, teams, products, or to the environment. In addition, it causes losses in the production or increase in legal responsibilities. Rodriguez (1996) uses the same definition.

Niven (1999) includes the loss of between 5 to 15 minutes time of a worker during an incident. Much disparity on this timeframe exists between different safety professionals. After picking up many of the most important contributions to the definition and the concept of incident, this paper would like to come up with definitions for the terms of danger, risk, incident, and injury.

Definitions of Danger, Risk, Incident, and Injury

Based upon the definition proposed by Cortes (1997) and standard UNE 81902, *danger* is going to be a situation of imminent risk that could produce damage, or deterioration from the quality of individual or collective life of the worker, which results in the generation of injuries, damages to the property or to the environment.

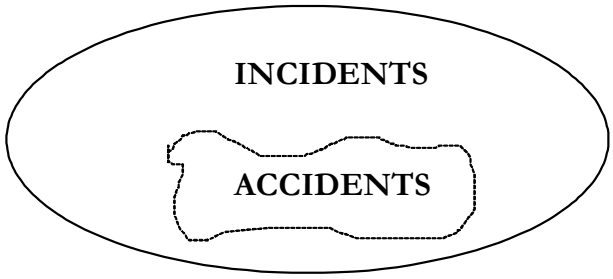


Figure 5. Relationship between incident and accident.

Source: National Safety Council (2001).

Risk would be the possibility that, for a combination of probability, exhibition and consequences in the face of a certain danger, damage occurs and becomes quantifiable. Danger passes on to risk when their importance is quantifiable. Risk is a possibility and does not materialize in a fact or event, which is the case with an incident.

Incident is a fact or event not planned nor wanted that will occasionally result in an unintentional injury or health related problems, will occasionally result in damages to property, products, or to the environment, loss of production and/or an increase in legal responsibilities. This definition considers the existence of any loss type, either materials or even of productivity. The absence of this characteristic would imply that one was involved in a mere risk. We have discarded Baselga's (1984) existence of critical incidents and rare injuries.

Lastly, in order to define an *injury*, the definition in article 115 of the Spanish Adapted Text of the General Law of the Social Safety (Real Ordiance Legislative 1/ 1994, of 20 of June) has been adapted. An injury situation includes "all corporal injuries that the worker suffers with occasion or a consequence of the work that one executes." Several assumptions are included, like any injury the worker suffers going to or upon returning from the place of work, incidents that are the act of character elective, or they happened in acts of rescue.

However, it is necessary to distinguish the "injuries with lost days" to "injuries without lost days" Niven (1999). The approach used will be the loss of a day or more of work. An injury will be counted as a lost day, even when worker does not come to work the following day of the injury.

Figure 6 highlights the definitions in visual form. With this vision of the injury environment, arises the idea of eliminating the injury through the elimination of the incidents, risks or even dangers.

Concluding Statement

Workplace safety dangers, risks, incidents, and injuries are predictable and preventable. If one understands the interrelatedness of these situations, then any view, approach, or initiative should focus on prevention. In the long run it is cheaper to pay for prevention and control of injuries verses having to pay for first aid, medical treatment, administrative costs, and workers' compensation.

Leadership (and that is spelled with a capital L) and joint action by all interested parties (employers, workers, industry and labor organizations, government, and the public) is necessary to provide a safe workplace. Improvement and excellence of workplace safety can be enhanced by continuous efforts by the aforementioned groups.

The leaders in the workplace environment must a strategy plan developed by all of the key stakeholders. Both short-term and long-term goals and targets must be a part of the strategy plan. Long term-wise, workplace safety investments yield positive returns for employers, employees and society. Having a clear understanding of safety definitions and potential injury related problems will assist with making the workplace a safety environment for all.

References

Adams, E.E. (1995). *Total Quality Safety Management. An introduction*. Des Plaines, IL: American Society of Safety Engineers.

Baselga, A. (1984). *Seguridad en el Trabajo*. Madrid, Spain: Instituto Nacional de Seguridad e Higiene en el Trabajo.

Bird, F.E. (1975). Control total de Perdidas. *Consejo Interamericano de Seguridad*, New Jersey.

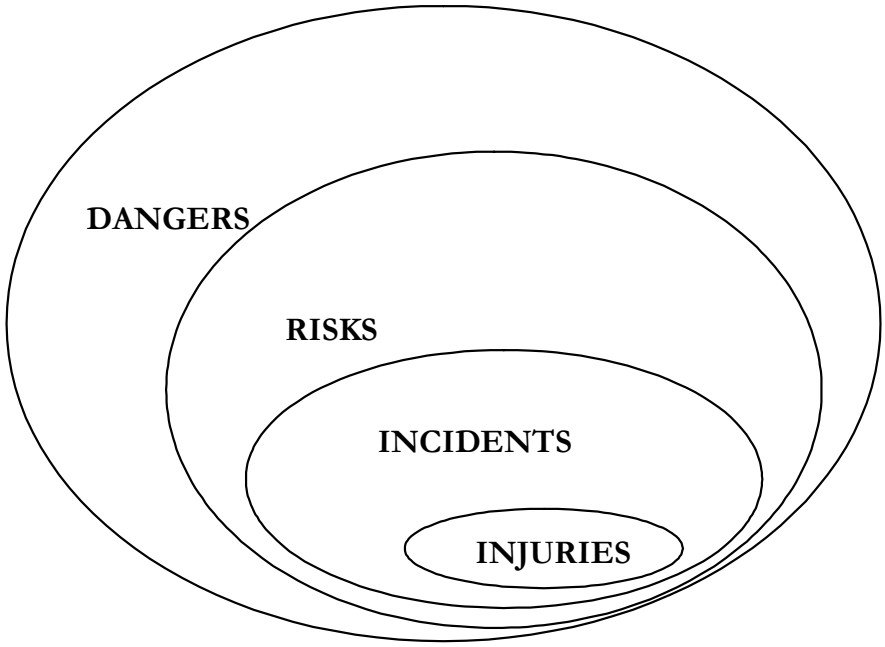


Figure 6. The process of the accident. Source: Own elaboration.

Bird, F.E., & Geman, G.L. (1985). *Liderazgo Práctico en el Control de Pérdidas*. Georgia: International Loss Control Institute.

Cantanrella, A. (1997). Incident investigations: Critical to the safety effort. *Professional Safety, 42*, 10.

Compes, P.C. (1966). Betriebliche Fehszeiten durch Unfalle. Arbeitswissenschaft, 5(4), 101-105.

Compes, P.C. (1964). Betriebsunfalle okonomisch betrachtet. *Arbeitswissenschaft, 3*(4),114-118.

Cortes, J.M. (1997). *Técnicas de Prevención de Riesgos Laborales*. Madrid, Spain: Tébar Flores.

Del Castillo, J.J. (1976). Impacto Economico de la Accidentalidad. *Boletín de la Asociación de Licenciados en Ciencias Economicas de la Universidad Comercial de Deusto (Bilbao), 31*(98), 407-423.

European Network for Workplace Health Promotion. (1997). *The Luxembourg declaration on workplace health promotion in the European Union*. http://www.terravista.pt/meco/5531/textos32.html

Geller, E. S. (1998). Do you investigate property damage? If not, injuries will eventually follow. *Industrial Safety & Hygiene News, 32*(1), 12-13.

Groover, D.R, Krause, T.R., & Nidley, J.H. (1992). Using the behavior-based safety process to increase injury reporting. *Professional Safety, 37*(1), 42-46.

Heinrich, H. W. (1931). *Industrial Accident Prevention*. New York: McGraw Hill.

Jacobs, H. C., & Nieburg, J. T. (1992). An incident investigation program can prevent future accidents. *The Safe Foreman, 63*(8), 6-7.

Jacobs, H. C., & Nieburg, J. T. (1989). Thorough investigation of incidents reaps rewards in improved safety. *Occupational Health & Safety, 57*(2), 66-71.

Krause, T. R., & Russell, L. R. (1994). The behavior-based approach to proactive accident investigation. *Proffesional Safety, 39*(3), 23-28.

Krzywicki, B., & Vasta, R. (2000). Building safer operations. *Occupational Health & Safety, 69*(4), 94-97.

Labar, G. (1990). How to improve your accident investigations. *Occupational Hazards, 52*(3), 33-36.

Labelle, J.E. (2000). What do accidents truly cost?" *Professional Safety, 45*(4), 38-42.

Lake, B. (1998). Accidentally on purpose. *Risk & Insurance, 9*(3), 43-44.

National Safety Council. (2001). *Accident Prevention Manual*. Itasca, IL: National Safety Council.

Niven, K. (1999). Accident costs in the NHS. *The Safety & Health Practicioner, 17*(9), 34-38.

Rodriguez de Prada, A. (1996). *Investigación de accidentes*. Madrid, Spain: Colección de Casos. Apuntes.

Senecal, P., & Burke, E. (1994). Root cause analysis: What took us so long?" *Occupational Hazards, 56*(3), 63-65.

Smith, S. L. (1994). Near misses: Safety in the shadows. *Occupational Hazards, 56*, 33-36.

Swartz, G. (1993). Incident reporting: A vital part of quality safety programs. *Professional Safety, 38*(12), 32-34.