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**SAFETY AND OCCUPATIONAL HEALTH MANAGEMENT: A CASE STUDY OF
A BRAZILIAN PRODUCER OF AUTOMOTIVE BATTERIES**

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Abstract

Organizations are looking more and more for new management tools to help them focus, organize and systematize their processes, making it possible to transform market forces into competitive advantages. In this context, the Safety and Occupational Health Management Systems take on great significance for organizational competitiveness. Using the case study method, the object of this study is to present which practices related to safety and occupational health are being developed in an automotive battery producer in the central-west region of São Paulo state in Brazil, and to identify the benefits and the disadvantages of using the available tools for management of safety and occupational health as well as the main obstacles to their implementation. The data were collected by *in loco* observation, analysis of documents and interviews with production managers and workers on the factory floor.

Key Words: Management system; Safety and occupational health; Automotive batteries; OHSAS 18001.

1. Introduction

Increasing global competition is forcing organizations to continuously search for new management tools that can help improve their processes and transform market pressures into competitive advantages.

In order to reduce costs and adjust product characteristics and production processes to market needs, companies are forced to change their internal management systems so they can provide better quality products and services, sustainable development and consequently increase profitability.

In the global market's current dynamic climate, the need for organizational change is increasingly greater and demands organizations to develop integrated management systems (BAMBER; SHARP; HIDES, 2000).

Along these lines, the Safety and Occupational Health Management Systems (SOHMS), together with the Quality and Environmental Management Systems, take on increasingly more important meaning in the organizations' performance.

Studies carried out by the Occupational Health and Safety Management Standards Policy Committee indicates that global costs with diseases and accidents, with and without lesions, for companies in the United Kingdom are estimated at about 5% to 10% of gross profits (LOPES; QUELHAS, 2006).

Besides the human cost, work-related accidents and illnesses impose financial expenses on individuals, employers and society as a whole. It thus becomes indispensable to have conditions and resources that generate safety and health for workers.

The objective of this paper is to present the results from a study that verified which safety and occupational health practices are being developed at an automotive battery manufacturer in the mid-west region of the state of São Paulo, Brazil, identifying the benefits and difficulties in using available safety and occupational health management tools at work, as well as the main obstacles to their implementation.

This paper was elaborated using qualitative research based on the case study methodology. According to Yin (2005), in order to confirm, contest or extend the theory, there must be a single case that satisfies all conditions to test the theory. This single case can then be used to determine whether the propositions for a theory are correct or if another alternative set of explanations can be more relevant.

According to Santos, Rossi and Jardimino (2000), qualitative research is fundamentally concerned with the understanding and interpretation of studied phenomena where the main objective is to understand it, explore it and specify it. It is a method that requires creativity and intuition.

Yin (2005) defines case study as an empirical investigation that studies a contemporary phenomenon within its real context, especially when the limits between the phenomenon and the context are not clearly defined.

The instruments used for data collection were: (a) semi-structured interviews using open questions and answered by production managers and some shop floor employees; (b) *in loco* observation; and (c) analysis of documents (document gathering).

Santos, Rossi and Jardimino (2000) underscore that the interview is used in situations where sources are not available or safe for obtaining data or when you want to complement information already raised or else to help in the diagnosis or treatment of a problem.

Rea and Parker (2000) say that observation has the important characteristic of involving the direct study of behavior by simple observation, without any direct interference and permitting the recording of reactions.

According to Yin (2005), the analysis of documents has the following strong points: it is stable (can be revised countless times), discrete (was not created as a result of the case study), exact (contains names, references and exact details of an event) and has broad coverage (long period of time, many events and many different environments).

The script for the semi-structured interviews includes *general* questions, such as the company's name, main products produced, total number of employees, certificates, about the *professional being interviewed*, addressing the position held, how long he/she has held it, the major attributions, about *safety and occupational health related activities*, such as

SOHMS management, the main accidents and near-accidents that have occurred and the measures taken to mitigate them, the types of environmental risk, unsafe conditions and unsafe acts, how the risk map was planned and about *SOH Legislation in Brazil*, identifying how the Regulatory Norms influence the studied company and how the activities contained therein were implemented and executed.

2. Theoretical Foundation

According to Quelhas, Alves and Filardo (2003), the improvement in workplace environment conditions is aimed at reducing the social cost from work accidents, valorizing self-esteem and providing continuous improvement to the workers' quality of life. It is up to each of us – potential agents for transformation, the government, employers and workers to contribute towards improved safety, quality of life and the formation of a healthier and more productive society.

Below we will present and discuss the basic concepts and main definitions used in the Safety and Occupational Health (SOH) area. A full understanding of them is of fundamental importance for organizations and an essential condition for elaborating and interpreting this paper.

2.1 Safety and Occupational Health

Safety and occupational health differ from many areas because the success measured by managers is the result of the absence of a situation (injuries or jeopardized health), rather than their presence. However, few injuries or high health levels, even over several years, is not a guarantee that the risks are under control and that there may not be injuries or health problems in the future (MEARNS; HÅVOLD, 2003).

According to Barbosa Filho (2001), the activities needed for our survival, performed voluntarily or involuntarily by our body, are translated into work.

According to the World Health Organization (WHO), health represents a complete state of physical, mental and social well-being, and does not consist of the mere absence of illness (WHO, 2007).

Cardella (1999) defines safety as a set of actions carried out with the intent of reducing damage and losses caused by aggressive agents of a human, property or environmental nature.

According to the International Labor Organization (ILO), the main objective of Safety and Occupational Health is to promote and maintain a high degree of worker physical, mental and social well-being in all their activities, impeding any damage caused by work conditions and protecting them against the risks of agents that are harmful to their health (ILO *apud* BENITE, 2004).

SOH can thus be defined as the state of non-existence of considerable risks of damage or loss to workers in their work environment, guaranteeing their physical, mental and social well-being.

2.2 Safety and Occupational Health Management System

Arantes (*apud* SILVA *et al.*, 2004) defines a management system as a set of instruments the administration uses to facilitate its tasks. It helps the administration in its efforts to define procedures and methods to carry out activities, to share the roles and responsibilities among the team and to promote relations and common understanding. The success of a good management system consists of achieving both efficiency and effectiveness in using organizational resources.

According to OHSAS 18001 (2007), an SOHMS is applicable to a company that wants or needs to eliminate or minimize risks to workers and other interested parties that can be exposed to accident and occupational health risks associated with their activities.

According to Quinam and Quelhas (*apud* RODRIGUES; BARBIERI, 2006), efforts in SOH management reduce the frequency and severity of accidents that injure workers, avoiding stoppages in processes.

Lin and Mills (2001) affirm that the main factors that influence safety are the organization's performance, company size, management and employee commitment to safety and occupational health.

SOHMS's success depends on the nature of the intervention, workplace characteristics and external environment characteristics (ROBSON *et al.*, 2007).

In that sense, SOHMSs are management tools that contribute to the efficient improvement in company performance with regard to safety and health issues, aimed at full compliance with legislation, increased productivity, fewer accidents, credibility before public opinion and growing awareness in relation to the safety and health of the organization's workers and partners.

2.3 Accidents and Near-Accidents

Saurin (*apud* CAMBRAIA; SAURIN; FORMOSO, 2005) defines an accident as an unplanned occurrence, instantaneous or not, resulting from the human's interaction with its physical and social work environment that causes injuries and/or material damage.

According to BS 8800 (1996) and OHSAS 18001 (2007), the term "near-accident" can be defined as an unforeseen event that has the potential to cause accidents. In other words it includes all occurrences that do not result in death, health problems, injury, damage and other losses.

According to Cambraia, Saurin and Formoso (2005), the concept of near-accidents, as well as of accidents, varies according to your objectives for prevention purposes, to the context under analysis and the interests of those involved. The main divergences verified in

literature about the definition of near-accidents concern the consequences of the event, since in some contexts they can generate damage to people, material or a combination of both and in others they cannot.

Knowledge of such information thus permits organizations to identify deficiencies and establish the appropriate methods of control and the consequent elimination or reduction of the probability for near-accidents and that they become real accidents in the future.

2.4 Environmental Risks

According to Ruiz and Lima (2006), in the current world, many factors contribute to the emergence and worsening of environmental problems, such as: the growth in population, industrialization, accelerated urbanization, pollution and depletion of natural resources. The way how these phenomena interact, reproduce themselves and perpetuate themselves has been causing the growing degradation of human quality of life, with unpredictable effects for all life on the planet.

Barbosa Filho (2001) says the possibilities for damage to a person's integrity or health in a work environment are called environmental risks. According to the Regulatory Norm that deals with the Prevention Program for Environmental Risks (NR 9), environmental risks are physical, chemical and biological agents that exist at the workplace and that due to their nature, concentration or intensity and time of exposure, are capable of harming the worker's health (SEGURANÇA E MEDICINA DO TRABALHO, 1998).

Battery contains substances that offer physical-chemical danger and toxicological effects at several levels and in several forms. For example, lead is extremely toxic even in small quantities and one of its main effects is renal dysfunction and anemia when absorbed by the skin or lungs (FURTADO, 2004).

Companies in the battery manufacturing segment dealt with in this study have lead and sulfuric acid as their main examples of environmental risk since they can contaminate human beings and the soil when the appropriate safety and occupational health techniques are not used.

2.5 Unsafe Conditions and Unsafe Acts

According to Saurin (*apud* CAMBRAIA; SAURIN; FORMOSO, 2005), unsafe acts are events where the danger situation results from the continuous action of one or more workers over some time, whereas near-accidents, also normally involving human action, is instantaneous, without continuity.

According to Zocchio (*apud* BENITE, 2004), unsafe acts are personal factors that depend on human action, which are the causes of accidents. Examples are: operate machines without being trained or authorized, not wear personal protection equipment, enter unauthorized areas and remove protections from machines among others.

Unsafe conditions are linked to work environment conditions, which are potential causes of accidents. Some examples of this are: inappropriate illumination and ventilation, machines without adequate protection, tools in poor states of conservation, slippery floors, etc.

According to Benite (2004), there is great difficulty in using such classifications, because if on one hand the characterization of an accident cause as an unsafe act is interesting for organizations, because it positions the human as the element that causes the accident, exempting them from any blame, on the other hand, characterization as an unsafe condition interests workers, because it classifies companies as the most responsible for not establishing minimal conditions in the workplace.

2.6 Risk Map

The Risk map is a graphic representation of health risks identified at each of the company's diverse workplaces.

According to ANNEX IV of Regulatory Norm # 5 – Ruling # 25, of 12/29/1994, the objectives of the Risk Map are:

- gather the information needed to diagnose the company's safety and occupational health situation; and
- during its elaboration, permit the exchange and disclosure of information between workers, as well as encourage their participation in prevention activities.

The need to know how to classify the main occupational risks, as in CHART 1, at the time the risk map is developed can also be underscored.






Group	Risks	Identification Color	Description
1	Physical	 Green	Noise, heat, cold, abnormal pressures, humidity, ionizing and non-ionizing radiations and vibrations.
2	Chemical	 Red	Dust, smoke, gases, vapors, mists, fogs and compound substances or chemical products in general.
3	Biological	 Brown	Fungi, viruses, parasites, bacteria, protozoa and bacilli.
4	Ergonomic	 Yellow	Intense physical effort, lifting and manually transporting weight, demands for improper posture, rigid control of productivity, excessive rhythms, working dayshifts and nightshifts, prolonged work shifts, monotony and repetitiveness and other situations that cause physical and/or psychological stress.
5	Accidents	 Blue	Inappropriate physical layout, inappropriate illumination, probability for fire and explosion, electricity, machines and equipment without protection, inappropriate storage, falls and poisonous animals.

CHART 1: Classification of the main occupational risks

Source: Adapted from ANNEX IV (Table I) – REGULATORY NORM # 5 (2007).

With regard to safety inspection, this should be carried out by the Internal Commission on Accident Prevention (ICAP) to raise the necessary data. Along these lines, a search of the location, identification and evaluation of risk seriousness should undergo

consultation and dialogue with people who work with *the* chemical products, machines, tools, systems and organizations. During this contact, an attempt will be made to diagnose how workers live in their surrounding environment.

Thus, after the complete or sector Risk Map has been discussed and approved by ICAP, it should be hung in each analyzed location in a clearly visible place with easy access for the workers.

2.7 International Norms Related to SOH

The British BS 8800 (*Guide to Occupational Health and Safety Systems*) norm, created in 1996, was the first successful attempt at establishing a norm reference for implementing a safety and health management system. The principles of this norm are in line with the concepts and guidelines for ISO 9000 (Quality Management System) and ISO 14000 (Environmental Management System) norms.

BS 8800 was broadly disclosed throughout the world and adopted in the most diverse industrial sectors, namely because it presented three basic objectives:

- minimize risks to workers;
- improve company performance; and
- help companies establish a responsible image in the market in which they operate.

In 1999, a group was formed coordinated by the *British Standards Institution* (BSI), with the participation of diverse international certification bodies (BVQI, DNV, LRQA, SGS, NQA, etc.) and standardization entities from Ireland, South Africa, Spain, Malaysia and Australia to elaborate the OHSAS 18001 (*Occupational Health and Safety Management Systems – Specification*) norm. This norm was created with the intent to

replace all the norms and guides previously elaborated on the subject by the participating entities (BENITE, 2004).

OHSAS 18001 is a specification that defines the requirements for a SOH and it was drawn up to be applied to all types and sizes of companies, adjusting to the different geographic, cultural and social conditions.

Similar to the norms related to quality management and environmental management, OHSAS 18001 does not define performance standards or indicate how its elements can be developed. They merely present basic requirements to be followed. This condition can result in companies with SOH management systems based on the same norm and with completely different performance results.

The basic principle for an SOH based on norm aspects involves the need to determine evaluation parameters that not only incorporate operational aspects, but also top management's policy, management and commitment to the process, change and continuous improvement of safety and occupational health conditions (QUELHAS; ALVES; FILARDO, 2003).

3. Legislation on SOH in Brazil

According to Hodkinson (*apud* BAMBER; SHARP; CASTKA, 2004), large companies seek a commitment to guarantee good environmental practices and operations which do not expose their employees to unsafe or illegal situations. Besides that, pressure from interested agents (partners, owners, commercial partners, government agencies, etc.) request that the companies comply with legislation and regulations and at the same time reduce costs and negative impacts on the environment.

The Federal Constitution of the Federal Republic of Brazil is the maximum law that governs all legislation in the country. In Article 7, Chapter II – Of Social Rights, the rights

of urban and rural workers are listed, as well as others that aim at improving their social condition. These rights include:

- the reduction of inherent risks to the job by means of health, hygiene and safety norms.

The State's intervention in regulating labor relations is thus confirmed. Consequently, work is somehow standardized at the federal level.

3.1 Regulatory Norms

Ruling 3.214 of 6/8/78, published by the Ministry of Labor and Employment, approved the 28 Regulatory Norms (NR) in Chapter V – Title II of the Consolidation of Labor Laws (CLL) related to Safety and Occupational Medicine. Other complementary norms were approved later, thus comprising the 33 Regulatory Norms that can be seen in CHART 2.

It is obligatory for private and public companies, direct and indirect public administration entities and legislative and judicial power bodies that have employees governed by the CLL to comply with these Regulatory Norms

The provisions contained in the NRs apply to freelancers, entities and companies that contract work from them and the representative unions for the respective professional categories.

Among the 33 Regulatory Norms, NR 9 seeks to guide the implementation of Environmental Risk Prevention Programs (PPRA) and NR 7 to guide the implementation of Medical Control and Occupational Health Programs (PCMSO) at companies. The implementation of these programs is fundamental for promoting worker health and

protection in the work environment because it permits control of employee exposure to environmental risks and to accompany continuous improvement measures in the workplace.

NR 1 – General Provisions
NR 2 – Prior Inspection
NR 3 – Embargo or Interdiction
NR 4 – Specialized Services in Safety Engineering and Occupational Health
NR 5 – Internal Commission on Accident Prevention
NR 6 – Individual Protection Equipment
NR 7 – Occupational Health and Medical Control Programs
NR 8 – Buildings
NR 9 – Environmental Risk Prevention Programs
NR 10 – Safety in Facilities and Electricity Services
NR 11 – Transportation, Movement, Storage and Handling of Materials
NR 12 – Machines and Equipment
NR 13 – Boilers and Pressure Vessels
NR 14 – Furnaces
NR 15 – Unhealthy Activities and Operations
NR 16 – Dangerous Activities and Operations
NR 17 – Ergonomics
NR 18 – Workplace Conditions and Environment in the Construction Industry
NR 19 – Explosives
NR 20 – Liquid and Flammable Fuels
NR 21 – Open-Air Jobs
NR 22 – Safety and Occupational Health in Mining
NR 23 – Fire Protection
NR 24 – Sanitary Conditions and Comfort in the Workplace
NR 25 – Industrial Waste
NR 26 – Safety Signing
NR 27 – Professional Registration of the Occupational Safety Technician at the Ministry of Labor
NR 28 – Inspection and Penalties
NR 29 – Regulatory Norm for Safety and Occupational Health at Ports
NR 30 – Regulatory Norm for Safety and Occupational Health at Waterways
NR 31 – Regulatory Norm for Safety and Occupational Health in Agriculture, Fishing, Fruit-Growing, Forest Exploration and Aquiculture
NR 32 – Safety and Occupational Health at Health Establishments
NR 33 – Safety and Occupational Health in Confined Areas

CHART 2: SOH Regulatory Norms in Brazil

Source: LEGISLATION (2007).

4. Case Study

A case study with an exploratory function was carried out in this study at a manufacturer of automotive batteries in the Midwest Region of the state of São Paulo, Brazil. The following types of batteries are produced: stationary and tractionary.

Interviews were conducted with a production manager and with safety and occupational health technicians. *In loco* observation and the analysis of some documents were also performed.

Based on these sources, the important role of the Internal Commission on Accident Prevention (ICAP) must be underscored in the elaboration of risk maps, inspection and instruction of employees with regard to compliance with safety measures, request for measures of risk elimination or existing inappropriate workplace conditions and other measures aimed at the prevention of accidents and occupational illness.

Some existing programs at the company deserve highlighting, such as the Medical Control of Occupational Health Program (MCOHP) and the Environmental Risk Prevention Program (ERPP), which aim at preserving the health and physical integrity of workers and to accompany continuous improvement measures in the workplace, and the Weekly Safety Dialogue (WSD) where workers are informed of the accidents that occurred during the week and the corrective and preventive measures taken by the company to avoid their recurrence. The WSD encourages worker participation to suggest improvements for processes and products in order to prevent accidents.

The company also has a new employee integration program, which includes safety and occupational health instructions. The employees are accompanied more closely during the first six months of activity, when there is an intense evaluation of their behavior with regard to safety norms and procedures, and whenever necessary, the occupational safety technicians intervene in a punctual manner.

The company's Specialized Services in Safety Engineering and Occupational Health (SSSEOH) has the following members: 1 occupational safety engineer, 1 occupational health doctor and 3 safety technicians. Their main activities include: accident prevention

training and implementation and follow-up of accident and occupational illness prevention programs.

The company has 417 collaborators and a degree of risk of 4 due to its classification as a manufacturer of batteries and accumulators for vehicles. According to Regulatory Norm # 4 (see Chart II), its SSSEOH is correctly dimensioned for its structure and activities.

The organization has ISO 9001 (Quality Management System) and ISO 14001 (Environmental Management System) certification and it is currently implementing TS 16949 (Automotive Specification) and OHSAS 18001 (Safety and Occupational Health Management System). Its current safety-related activities are based on the Regulatory Norms instituted by the Brazilian Ministry of Labor and the other requirements applied to the automotive battery manufacturing sector.

The company has a variety of collective protection equipment (CPEs) in its facilities and it obliges its collaborators to use individual protection equipment (IEP), when warranted, such as hearing protection, safety goggles, half-face masks, gloves, PVC boots and steel-toed safety boots.

The existence of 30 accidents involving work loss was observed in the company recently. These include dropping a lead ingot on an employee's foot. Although he was wearing IEP (steel-toed safety boots), he still suffered serious physical injury. The company is replacing the steel-toed safety boots with boots that also protect the inner metatarsus, thus demonstrating it has been continuously investing in the improvement of its occupational safety instruments.

The main risks managed at the company are: *chemical*, from the release of dust and lead smoke, sulfuric acid, caustic soda and acid vapors; *physical*, such as noise, extreme

temperatures and high pressure; *ergonomic*, such as lifting and manually transporting excessive weight (movement of batteries and lead ingots), inappropriate posture and repetitive tasks.

Environmental evaluations are carried out periodically, as per the safety system work plan, to detect the concentrations and/or intensities of aggressive agents. At the workplaces where exposure is above the permitted tolerance, the worker receives an additional for unhealthy conditions, as per Regulatory Norm # 5.

In order to elaborate the risk map, production sectors, managed risks, agents and each risk's intensity were taken into account. Some examples can be seen in Chart 3.

Sector	Risk	Agent	Intensity
Mill	Chemical	Lead	Small
	Physical	Noise	Small
	Risk for accident	Thermal burn	Small
Filling	Chemical	Lead	Small
	Physical	Noise	Small

CHART 3: Example of risks managed by the sector

It is worth noting that a study carried out at the company in 2006 detected that approximately 44% of all accidents were caused by collaborators who were at the company less than one year.

The safety and occupational health department is comprised of three safety technicians and is directly subordinate to the organization's General Directorate. This department ascertained that a great part of the resistance to following safety rules adopted by the company is found in middle management. This resistance creates conflict with the other collaborators who also feel they are not obliged to follow them.

Human resources sector is initiating a leadership development program, training operational collaborators as well as middle management in relation to safety and occupational health management.

The results of the safety and occupational health management system are not linked to any type of remuneration system or any other incentive; however, there are some studies for this to be implemented in the future.

In general, the efforts and investments in safety and occupational health improvements are evident and considerable at the company, which has strongly supported its safety technicians responsible for developing and inspecting most of the measures.

The safety programs have the direct participation of human resources and collaborators, who are the most jeopardized by an unhealthy environment with many risks.

5. Conclusion

This paper is restricted to the study of safety and occupational health management systems specifically at an automotive battery manufacturer whose industrial plant is located in Bauru, Brazil. It thus sought to delimit its scope of analysis in relation to the system to be studied (safety and occupational health), to the production segment (automotive batteries) and also to its geographic scope (Bauru, SP).

The theoretical basis used in this study, which was condensed due to space limitations, was fundamental for the contextualization and interpretation of the study in question and to better understand safety with regard to the automotive battery production area.

The methodological instruments used (qualitative research based on single case study methodology) proved to be very appropriate and effective to structure the study and made it possible to ratify what the theory asserted since the case study in question converged with most of the questions dealt with in the theory.

Based on the theoretical revision, confirmed by the case study, we can affirm that involvement by Top Management, Human Resources sector and the participation of all

collaborators are determining factors for the success or failure of the referred to management system. The implementation and development of safety and occupational health management systems must be seen as the main strategy to combat the serious social and economic problem of work-related accidents and illnesses and are also an important factor to increase competitiveness.

A certain deficiency was observed in compliance with safety and health measures at the company, especially by older employees, since they are the most resistant to change.

Participation and motivation of all employees are of vital importance to facilitate the development of a management system and thus avoid the existence of greater occupational risks for accidents and illnesses.

In conclusion, it is worth informing that the difficulties found in carrying this study were mainly institutional, since there were difficulties in accessing data. However, the initially established objective in this paper was met.

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