

GESTÃO DE RISCO NA REABILITAÇÃO DE UMA MINA DE ÁGUA

RISK MANAGEMENT IN THE REHABILITATION OF A WATER SPRING SITE

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Abstract

The main purpose of this research work was the application, “on site“, of general prevention principles. For this it was necessary to take into account Law n° 102/2009, of september the 10th, amended by Law no. 3/2014 of january 28th, Series I of 2014-01-28, of the Portuguese Official Gazette, which continues to transpose the principles of the framework directive. This framework directive was, meanwhile, amended by Directive no. 2007/30 / CE, of the European Council of june 20th, modified in 2014, introducing eleven general principles of prevention instead of the previous nine. For the methodology application it was chosen the work at the Mateus Mine, in the city of Vila Real, Portugal as it presented many, and different, risks for the contruction workers evolved. It was necessary to study and characterize this risks for subsequent application of the general prevention principles, “on site“. It was found that the application of these principles contributed to a reduction in risks and, in turn, fewer accidents on site.

Keywords: Risks, Work, Safety, Legislation, Health.

Introduction

In this research work it was essential to make a legal framework in terms of safety in construction. It should be noted that the current legislative and conceptual frame of reference, in the field of safety and hygiene in the workplace, results from the inclusion of Portugal as a member of the EEC - European Economic Community in 1986, and from joining the European Monetary System in 1992. Regarding safety legislation in construction, there are two basic laws. On the one hand, it is necessary to take into account the framework directive, which concerns any type of work or industrie, that inevitably encompasses the construction industry. On the other hand, the building site directive, which is more specific to the work and activities carried out on construction sites, and should be considered the fundamental document in this field.

At the end of the 1980s, Directive 89/391 / EEC of june 12th [1], called the framework directive, was published by the European Commission. The purpose of this directive was the implementation of measures aiming the improvement of safety and hygiene of workers in Europe. The framework directive was first transposed into Portuguese law through Decree-Law No. 441/91, of november 14th [2], which was subsequently amended by Decree-Law No. 133/99, of april 21th [3]. In this area, Law n° 102/2009, of september 10th, as amended by Law no. 3/2014 of january 28th [3], which continues to transpose the principles of the framework directive and was then amended by directive 2007/30 / EC, of the Council, of june 20th [4].

This directive includes eleven general principles regarding the prevention of occupational risks, the protection of safety and health, the elimination of risk and accident factors, information, consultation and participation, in accordance with the national laws and / or practices. The training of workers and their representatives, as well as the guidelines to be observed with a view to their application in the field, are also considered.

The 11 General Principles of Prevention, according to Directive 2007/30 / EC [2, 3, 4] are:

- To avoid the risks;
- To use a plan of prevention as a coherent system that integrates technical evolution, work organization, working conditions, social relationships and the influence of environmental factors;
- The identification of foreseeable risks in all activities or services, in the design or construction of facilities and construction sites, as well as the selection of equipment, substances and products, with a view to their elimination or, when that it is not viable, the reduction of their effects;
- The integration of the risk assessment, for the safety and health of the worker in the set of activities or service, adopting the appropriate protective measures;
- To combat risks at source, in order to eliminate or reduce exposure, and increase protection levels;
- To ensure that exposures to chemical, physical and biological agents and psychosocial risk factors do not constitute a hazard to the safety and health;
- The adaptation of work to man, especially with regard to the design of jobs, the choice of work equipment, methods and production, with a view, inter alia, to alleviate monotonous and repetitive work and reduce psychosocial risks;
- The adaptation to the state of the art, as well as to new forms of work organization;
- The substitution of what is dangerous by what is safe, or less dangerous;
- Prioritizing collective protection measures, over individual measures;
- The elaboration and dissemination of understandable and adequate instructions to the worker activity.

Council Directive 92/57 / EEC of June 24th 1992 [5], referred to as the directive on construction sites, deals with the implementation of the minimum safety and health requirements to be applied in temporary or mobile sites, transposed into Portuguese law through Decree-Law No. 155/95, of 1st of July [6] and currently revoked by Decree-Law No. 273/2003, of October 29th [6]. Decree-Law no. 273/2003 has the basic purposes of instituting general rules for planning, organising and coordinate to promote safety, hygiene and health in construction works.

The construction industry has a large loss ratio, with its temporary and mobile construction sites, that don't allow that occupational health and safety issues are treated in the same way as in a traditional industry. In fact, construction workers do not normally have a fixed job, the working environment is constantly changing and the tasks performed by workers are not very repetitive. These particularities of the construction industry make it difficult to implement some fundamental safety and prevention principles in the framework directive. Decree-Law no. 273/2003, of October 29th, even describes the «special risks» for the safety and health of workers, verifying that some of them are present in almost all construction works.

As previously mentioned the framework directive 89/391 / EEC, of June 12th, was published by the European Commission with the purpose of implementing measures to promote the improvement of workers' safety and health. This directive was transposed into Portuguese domestic law through Decree-Law no. 441/91, of November 14th [2], and came to establish, for the states of the European Union, a common and innovative platform for the prevention of occupational risks, thus setting out a number of fundamental principles.

In the scope of prevention, avoiding or eliminating risks is one of the first attitudes to be taken. This principle translates fundamentally, according to Cabral & Roxo [7], in the following actions: - At the project level - risk forecast and its definitive suppression through adequate design solutions;

- At the level of intrinsic safety - selection of products, equipment and materials that are excluding the risk;
- At the level of work methods and processes - work organization that results in the absence of risk.

Once identified the risks that may not be avoid under the first PGP, they should be assessed. The evaluation consists of an analysis process that will lead to characterize the phenomenon in terms of its origin, nature and harmful consequences on safety at work and worker health. According to Cabral, Roxo [7], if the risk is high, new architectural or technical options should be sought. If the risk is moderate, the most appropriate preventive measures should be identified and adopted to avoid accidents, or reduce the effects resulting from their occurrence.

Combat the risks at the source: this principle results from the general criterion of effectiveness that should guide prevention. In effect, the effectiveness of prevention is all the greater the more the intervention is directed to the source. In this way, eliminating the spread of risk (or reducing its scale), also, the protection of other risks should be avoided. In addition, reducing the need to use complementary control processes. To combat the risks, in all situations that may be hazardous to the safety and health of workers, resulting from physical, chemical or biological agents and, above all, ergonomic deficiency at work.

Adapt work to man: there is a real need to intervene in terms of the material components of work, namely tools, equipment, methods, processes and work space, with a view to adapting work to man, humanization of work with respect for the capacities and characteristics of the workman [7, 8].

All of this should be done with the purpose of avoiding monotonous and isolated work. The definition of working schedule should be done in order to meet the chronological biology of life and work rhythms. This will also respect the physical and mental capacities of workers, especially of the most vulnerable groups.

Take into account the state of the art evolution: "Prevention cannot be limited to interventions on the existing, equipment and machines" [9]. Nowadays, with the development of technologies, "characterized by the continuous and rapid development of techniques, new equipments, work materials, it will be necessary to adapt permanently prevention to the state of the art and its evolution" [7]. "Resulting in a productive process the choice of components that are free from danger, or less dangerous, or the replacement of dangerous components with others that are free from danger, or less dangerous should be considered. It will also result in the choice of protective equipment, more effective in the face of risk, more suitable for work and more adapted to man" [7, 10].

Replace what is dangerous with what is safe, or less dangerous: according to Cabrito *et al* [11], this general principle of prevention has implications, both in the techniques, production processes and auxiliary work equipments, materials and equipment to be incorporated, as well as in the organizational measures of the work. This principle refers to opting for more efficient equipment in view of the risk, for materials less hazardous to health and to organize work in a safer way, that is, to better adapt prevention to work. If there are techniques, equipment or materials that are known to be dangerous to safety and health, even if they are not prohibited by law, it is important whenever possible to replace them with others that are free from danger or less dangerous. The same situation occurs with the organizational measures.

Prevention plan: it resides in the need to be associated with the implementation of organizational measures and the assessment of their impact, in terms of safety and health conditions [12]. Indeed, the introduction of such organizational measures will always result in a certain effect, (positive or negative) in terms of the prevention of professional risks [7].

Thus the organization of work as a principle of prevention, will allow:

- Isolate and / or remove the source of risk;
- Eliminate and / or reduce the time of exposure to the risk;
- Reduce the number of workers exposed to the risk;
- Eliminate the overlap of incompatible tasks, either in space or time;
- In general, integrate the various preventive measures in a coherent way.

Giving priority to collective protection measures over individual protection measures: this principle should be considered, if and only, the risk elimination is not technically possible. The implementation of collective protection consists of an action established preferably at the level of the source of the risk, encompassing the material components of the work and the environment. The objective is to establish a protection of considerable effectiveness, against any and all people who are exposed to that risk. This principle will lead us to interventions, fundamentally in the scope of the choice of materials and equipments, that have integrated protection and the involvement of risks, through protection systems applied at the source [7,13].

Individual protection, in turn, will be an option resulting from not being able to effectively control the risk, so it is only possible to carry out real prevention in order to adapt work to men and not to try to adapt men to work [13].

Individual protection can also be justified as a measure to reinforce prevention in the face of an unforeseeable or unavoidable residual risk.

However, the proper application of these prevention principles is dependent on the observance of the following fundamental criteria:

Regarding collective protection:

- Stability of its elements;
- Strength of materials;
- Permanence in space and time. Regarding individual protection:
- Suitability of the equipment to man;
- Adequacy of the equipment to the risk;
- Suitability of the equipment for work;
- Provide appropriate instructions to workers.

Information as a general principle of prevention, means a permanent system of feeding and circulation of knowledge appropriate to the production process [7]. Presenting itself in the form of several types of instruments, the information must:

- Allow a deeper knowledge of the components of the production process, which allows the identification of the risks associated with them;
- Integrate knowledge in order to prevent these risks;
- Introducing itself properly to users, from directors, company executives to workers, keeping itself permanently accessible.

Training, as a general principle of prevention, aims to prevent the risks associated with the action of each professional, in order to ensure greater efficiency and the correct implementation of preventive measures.

Materials and methods

In order to use a methodology for applying the general principles of prevention, a construction work was chosen: the Mina de Mateus, in Vila Real, Portugal.

The present work was elaborated considering the signs of rupture revealed by a landslide, in the vicinity of the alignment of the water source mine, behind the existing dwellings on the site. The Mateus Mine is a water source, dating from 1938, as inscribed on the exit mouth of the mine. According to the information provided by the Parish Council, it has a permanent and continuous flow throughout the year, in the order of 187 l / min, which represents a significant value.

This situation was initially detected in 2010, having evolved over time, and in 2017 presented dimensions that could put the stability of the present structures at risk. After a technical visit, it was found that the situation of instability is contiguous to two dwellings and the alignment of the mine. This landslide was about 3.0 m in diameter and reached a depth of about 5.0 m, with the foundations of the housing being visible, which were in the cantilever.

Taking into account the identified situation, in June 2014, the Preliminary Study was issued with the analysis of the instability and the proposal for the “Mine Repairation”. In this document, due to the risk associated with the stability of the dwellings, a solution was proposed which consisted of rebuilding the mine with concrete shackles, at a distance of 10.0 m from the dwellings affected by the landslide, with three visit boxes and filling with concrete the existing mine. The excavation for the reconstruction should be carried out in the open. It was proposed concrete filling of the detected voids, caused by landslides.

In Figure 1, a photograph is presented with the location on the floor of the mouth of the source of the Mina and the yield zone detected, contiguous to the dwellings. An inspection was carried out, inside one of the two semi-detached houses adjacent to the instability, which allowed to verify the existence of some pathologies that could be associated with the ruin of the mine, such as cracks and moisture stains.



Figure 1. Location plan for the Mateus Mine and the detected instability (google maps, 2017).

This house had an unevenness in the terrain between the main façade - ground floor coinciding with the entrance, garage and public road; and the rear facade - at the level of the first floor; of the order of 4.0 m. It was found that the wall of the garage, on the rear facade, was built below the level of the ground in stone masonry (granite), being this in contact with the ground. According to the information provided by the owner, it is a century-old construction, having been rehabilitated about 12 years ago. The owner also informed that the land clearing was initially detected, about 4 years ago, with a centimetric dimension, on the land that is at the rear of the two houses and in the connection area between them.

Then, the land was observed at the back of the houses, which was without buildings where the mine alignment was located. In this place, it was found the existence of a depression, of relevant importance, caused by the landslide. This location of the soil was covered with boards and adjoins the back façades of the two houses, as it may be seen in figure 2.



Figure 2. Location and view of the detected instability - land clearing up to about 5.0 m (Henrique, 2017).

As this yield zone was detected in an area adjacent to the mine alignment, and adjacent to the existing dwellings, in which it was observed that the foundations were in a cantilever, two solutions were initially defined. The solutions differ in the area of intervention and, consequently, in the size of the measures to be implemented. The main solution, being the execution of a “by-pass” of the mine with filling of the existing alignment with concrete, and the alternative solution, involved the reconstruction of the mine, in the same location, with a pile curtain and a level of anchorages in the critical yield zone.

Depending on the risks inherent to the implementation of the alternative solution, as the deformations that could be caused to the houses, it was planned to implement the main solution with intervention outside the transfer zone, in order to guarantee the stability of the structures in the affected area.

The recommended solution included the reconstruction of the mine with Ø1200 mm concrete shackles, at a distance of 10.0 m from the houses affected by the landslides, with three manholes and filling the existing mine with fluid concrete. Provision was also made for the temporary containment of the existing ventilation chamber.

Results and discussion

According to A. Cabrita [15], all these principles are evidenced in the “risks” of risk management, presenting three forms of approach.

In the first approach, it was proposed to act in the assessment / elimination of risks, the second in risk control and, finally, action in risk communication.

Risk assessment / elimination should be the first objective to achieve. It means assessing the risk and stopping it. Now, ceasing to exist, it will certainly not be able to cause accidents at work or occupational diseases;

Risk control should only be considered after it has been found that it is not possible to eliminate risks [15], that is, to intervene on it, minimizing its effects to an acceptable level. The effectiveness of control depends, therefore, to a large extent on such action, focusing on the source of its genesis and directing itself towards adapting work to man.

Risk communication should be understood as a dynamic process of constant dialogue between stakeholders to exchange information about the nature, magnitude and control of risk.

In the study of the general principles of prevention, phase of execution and work, it was found that it was not possible to work exclusively in risk-free situations. It was also implied that the risks must be properly controlled, so as not to result in damage to the health of the employees. workers.

After the application of the methodology the general principles of prevention in the work of the Mateus Mine, the results of this investigation were presented as examples of its good implementation, which has contributed to a reduction in the number of accidents.

Eliminate / Avoid risks

This first preventive attitude must take place not only in the working phase, but also in the conception and project phase. However, all this action is only possible within a framework of developed management skills and integration of prevention at the decisive moments of the project and planning. In the construction work, this principle has particular application in the activity developed around the enterprise before the opening of the shipyard, namely in the scope of the processes related to the elaboration of the project, as well as with the definition of the work program and with the elaboration of the project shipyard. In the execution phase, the elimination of risks must be a constant concern in the context of the planning actions and verification of the conditions for carrying out the work, either in terms of existing constraints, either in terms of working methods and processes and conditions use of equipment, materials and products knowing that construction work is considered an eminently dangerous activity, but many of the risks can be avoided. For example: to avoid risks of burial, due to the collapse of the existing ventilation chamber, a provisional containment solution was planned in order to guarantee the stability of the structure during the connection of the new alignment of the mine to the existing one (figure 3). This provisional containment solution was of the Berlin wall type with the installation of 4 metal profiles with a minimum height of 12.0 m, to guarantee their embedding.

Burial is the most common cause of death in civil construction in Portugal. The causes include working in ditches without any type of ditch or embankments with slopes inappropriate to the type of soil. It is possible to reduce the risks through the use of divination and delimitation of the work.



Figure 3. Berlin retainer used on site (Henrique, 2017).

Assess non-eliminable risks

Once a certain risk has been detected and it has not been possible to eliminate it under the first general principle of prevention, it must be evaluated. The risk results from an undisclosed danger that will persist in the work situation, with the interaction of one or more workers. Assessing risks means developing a whole process that aims to obtain the necessary knowledge from risks to define a preventive strategy (source, nature, consequences, workers exposed to risk). In the construction activity, the risk assessment must take place from the design of the project, through planning, to the supervision of the various operations that make up the construction process. This systematic process will give rise to the planning of preventive measures in several plans:

- In the PSS elaborated during the project;
- In the development introduced to this PSS for the execution phase of the work;
- In the Technical Compilation, where the assessment aims to prevent the risks associated with the interventions that take place in the building after its construction.

Combat risks at source

This principle applies to all situations, which may cause risks to the health of workers during the construction phase. Combating risks at the source is always more effective, as it avoids its spread or reduces its extent, damage and potential victims. For example: it will not be necessary to apply a slippery floor sign when it is possible to replace or repair it. In view of the maximum possible effectiveness in prevention, the risk should preferably be combated in terms of the work factors that give rise to it. In the construction activity, this principle must be taken into account particularly in the preventive approaches that take place on the operating modes, as well as on the equipment, materials and products used. And above all, consider ways of confining and neutralizing the risk at the source, such as reducing the noise of the equipment to be used or using less noisy equipment, also taking into account the noise protection of the equipment (Figure 4).



Figure 4. Swivel and cylinder used on site (Henrique, 2017).

Adapt work to man

Characterization should be carried out with regard to the design of jobs, as well as the choice of work equipment and work and production methods, with a view, in particular, to mitigate monotonous and slow work and reduce their effects on workers' health.

And to reduce the risks, it is essential:

- Use agronomically appropriate equipment and, above all, analyze the risks in the equipment selection process and construction methods;
- Avoid unnecessary pressure on planning, appropriately allocating the time necessary to reduce each construction operation;
- Conduct regular inspections of workers' health.

This principle is of great application in construction, due to the provisional nature of the work elements and the large quantity and diversity of work processes, equipment, products and materials, with a concrete pump used in the work of the mine. It did not lack the presence of a worker (Figure 5).



Figure 5. Concrete pump for mine buffering (Henrique, 2017).

Meet the state of the art

According to [16], one should take advantage of technical and technological progress, to improve working methods making them safer and to apply more assertive risk assessment techniques, it means that the option is not possible by old-fashioned and admittedly unsafe methods.

Monitor technological developments in order to detect new risks, but also new preventive solutions integrated into the work components (safer machines, non-toxic products, etc.) and new, more effective methods of assessing and controlling risks. The relevance of this principle in the construction activity is related to the intense technological innovation that is verified in the construction processes, construction site equipment and construction materials, as well as in the protection equipment available, in particular the collective protection equipment.

In the work in question, only certified equipment was used in accordance with the applicable legislation and standards (Figure 6).



Figure 6. Certified equipment used on site (Henrique, 2017).

Replace what is dangerous with what is safe, or less dangerous

Technological evolution solves some situations of danger (eliminating or reducing it), and therefore the improvement of work factors should be enhanced. Thus, the entire source of existing danger must be known and the search for the best solutions must be constantly pursued. In construction, in particular, the application of this principle should be taken into account with regard to architectural options, construction methods and methods, materials and products, where there is a considerable evolution of alternatives with lower levels of danger. On the other hand, technological development is increasingly allowing the replacement of work based on human effort by the action of machines, as is the case, for example, in earthmoving technologies and lifting and handling of loads, minimizing the risk of muscle injuries, due to manual handling of loads.

In cargo handling work, workers involved in lifting operations must not be allowed to put others in danger or vice versa. In cases where it is not possible to avoid manual movement, tasks should be organized that limit the number of physical movements and the distance traveled to perform them. Workers should be trained on how to avoid risks and what techniques to use. In this work, the use of works that implied manual handling of loads, were only those that could not be executed through machines, being used a rotary for the execution of the ditch and embankment (Fig. 7).



Figure 7. Machine used in the final settlement of the mine land (Henrique, 2017).

Planning prevention with a coherent system

Planning and prevention involve all dimensions of work, all aspects of the organization's life and its internal and external relations systems. Prevention measures only produce a lasting and effective effect when they are coherently articulated (technical measures on the material components of work, articulated with measures of work organization and measures on the skills of workers), with the logic of production and with the company management policy.

The planning of prevention assumes a decisive importance in the construction activity, inasmuch as the dynamics of the construction process requires considerable anticipation in the forecast of measures, either to ensure their integration in the project definitions and in the work scheduling, or to make feasible the articulation of the necessary measures (prevention, training, collective and individual protection measures). In the work in question, it was taken into account the access of people and machines to the workplaces. The layout of distinct and delimited paths for the passage and movement of equipment was also considered and the vehicles' traffic routes were kept in good condition. Regarding the execution of the visit boxes, they were carried out, only after the opening of the ditch was completed and with the embankment executed in accordance with the legislation in force and using certified formwork panels so as not to put workers at risk when pouring it, as it may be seen in Fig.8.



Figure 8. Prevention in the execution of the formwork and concreting of a mine visit box (Henrique, 2017).

Prioritize collective protection over individual protection

Protection measures should only be used when the preventive measures (collective protection) are exhausted and are not sufficient to control the risk. Regarding collective protection systems, the following rules must be observed:

- Be implemented as close as possible to the point of risk manifestation, in order to translate into a sufficiently effective degree of worker protection;
- Take into account the work situations and take into account the factors of strength of the materials and stability of the structures;
- To be guaranteed the necessary permanence (in space and time).

As for individual protection, it should be noted that it is the last stronghold of worker protection and hence its placing last in the list of general principles of prevention. In the face of collective protection, individual protection should apply when / and if collective protection is technically impossible or insufficient. Thus, individual protection is complementary and, when used, it must be adapted:

- Risk;
- The worker;
- The work situation.

The specificity of construction work determines a very high need for the use of collective protection and individual protection measures, so it is important to ensure an adequate management of these measures in accordance with the priority established in this principle, which must be given to collective protection. In the execution of the contract in question, it was considered the execution of the embankment, the containment of the manhole, formwork and the containment of the manhole to be built, together with other mandatory personal protective equipment.

In the accomplishment of the contract in question, the execution of the slope, the containment of the manhole, formwork and the containment of the manhole to be built, together with other mandatory personal protective equipment, helmets, shoes with steel insoles and toecaps, were considered. Used equipment may be seen in Fig.9.



Figure 9. PPE's used in mine work (Henrique, 2017).

Train, inform and consult

Training and information are the central preventive approach, as the development of skills necessary for the generalized participation of all workers in prevention depends on it. Training and information are of exceptional importance in the construction activity, given the diversity of high risk factors and the high number of participants in the construction process. On the other hand, such importance is also related to the

need to permanently guarantee the integration of the performers in the various work planning processes, which are registered during the work as well as in the new technologies used. The transmission of information or instructions addressed to workers:

- It must be simple and with the necessary and sufficient details;
- Consider the visual communication, the different languages for these instructions according to the origin (country) of the workers involved in the work;
- Promote periodic meetings on safety and health.

Workers must understand the risks that exist, the consequences of these risks and the precautions they must take to act safely. The training should focus on real situations such as problems that have occurred, what has not worked properly and how to prevent the situation from recurring. It is necessary to address risks, preventive measures, emergency procedures, reporting on problems, personal protective equipment, work equipment, etc.

In this work, initial training was given to all workers, informing them of the risks to which they were subject and the measures to be taken to avoid them, this awareness was carried out before the work started.

Limitation

In the research related to the works, there was a limitation on the time of their execution.

Conclusions

As a result of this work it was found that the application of the general principles of prevention on site and the new preventive measures had a preponderant factor so that the number of accidents was null in this work, despite all its peculiarities and being a work with special risks according to Decree-Law No. 273/2003 [6].

Besides, having invested more in the application of new safety measures resulted in a reduction in costs according to C. Reis [17], because if the number of accidents decreases, the costs on the part of the company will decrease [18].

The Construction Directive, published in 1992, established the main line of force for most countries in the European Union to develop their own legislation, to improve working conditions in construction sites [18].

The European Commission considers Safety and Health at Work to be a priority area within the scope of European policy, with a view to recognizing that prevention pays. That is, the reduction of accidents and illnesses related to work increases productivity, reduces costs, improves the quality of work and values human capital.

The identification of the specificities of the construction sector in comparison with other sectors of economic activity justified the publication of a Directive that took into account these specificities and the high risks to which construction workers are exposed [20, 21, 22]

Safety Hygiene and Health at Work in construction sites is an important and primary issue, when the main purpose is to build safely, while preserving human life. It is essential that the company is concerned with promoting initiatives that make it possible to reduce accidents and occupational diseases in the workplace.

The training / information of workers is extremely important, as it is only possible to put into practice the general principles of prevention, through this mechanism. Companies must invest in the training / information of their workers in order to raise their awareness on the issue of health and safety, the reduction of accidents at work, the minimization of risks, and the reduction of occupational diseases. These measures are essential when you want to maintain a healthy and safe work environment.

In the repair work of the “Mina De Mateus”, the opening of trenches and the placement of shackles, the prevention of professional risks involves the analysis and assessment of risks.

It highlights the importance of the health and safety plan (PSS), as the main instrument in the prevention of professional risks in construction sites and with the need to comply with all the specific requirements of the work Cristina Reis *et al*, [23].

The main objective of the Safety and Health Plan is to mobilize all the work involved in the implementation of safety and health measures, with the benefit of all workers, from the opening of the shipyard, to the execution and conclusion phase. The main objective of this research project was to know the influence of the correct application of the general principles of prevention, with a view to mitigating the risk of accidents at work, using operational tools for SHST management.

Workers were subjected to several types of risks, exposure to noise / vibrations risk of burial (opening of ditches), thermal environment (cold and heat). In the risk of burial, one of the most worrying problems in civil construction yards, land containment was made using “Berlin” walls.

This work met expectations and its objective was achieved, showing that companies are concerned with the safety of all workers present in the shipyard, based on the application of the general principles of prevention, health promotion, correct supervision, planning of activities and in the good use of the equipment, although there were several aspects that could be improved in terms of safety and health.

It is important to emphasize that working in a safe place is not a privilege, but a fundamental right, which must be exercised. The prevention of various risks, derived from work, with the aim of preventing accidents and preventing occupational diseases is a task for all workers and employers.

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