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CONTRIBUTION OF ERGONOMICS TO THE DEVELOPMENT OF PROACTIVE SAFETY, RISKS AND EMERGENCIES FROM WASTE FROM DANGEROUS PRODUCTS AT FIOCRUZ

Washington Ramos Barbosa
Universidade Federal do Rio de Janeiro
COGIC e Biomanguinhos, FIOCRUZ, Manguinhos, Rio de Janeiro
E-mail: washington.fiocruz@gmail.com

Paulo Victor R. de Carvalho
Instituto de Engenharia Nuclear
Cidade Universitária, Ilha do Fundão, Rio de Janeiro
E-mail: paulov@ien.gov.br

Mario Cesar R. Vidal
GENTE/COPPE
Cidade Universitária, Ilha do Fundão, Rio de Janeiro
E-mail: mvidal@pep.ufrj.br

Summary

This work aims to present the contribution of Ergonomics to the development of Proactive Safety, Risks and Emergencies of Hazardous Product Waste at Fiocruz. This proposal aims to help prevent negative events, such as the explosion in the Port of Beirut of the Dangerous Goods deposit there. Proactive Security combines the traditional concepts of Security Management, and is improved with the approaches recommended by Ergonomics. The methodology is based on ergonomic analysis adapted to discover Proactive Security Demands relating to physical overloads and organizational, cognitive aspects, risks and emergencies, aiming to organize actions to improve the overall performance of the system. The demands were selected based on technical visits to sites, conversational action with employees, examination of existing documentation, survey of applicable legislation and standards, photographic records and videos of activities, and development of a checklist for initial assessment of non-conformities in the process analyzed, which pointed out as possible opportunities for improvements: the review of the product pouring process and the rearrangement of the Fiocruz Hazardous Waste Center. Proactive Safety is developed based on action proposals to minimize or eliminate detected problems, impacting facilities, workers' health and productivity. With the implementation of the recommendations, it is expected to improve productivity, reduce physical effort, minimize risks to the health of employees, improve work organization and the layout of the sector, and reduce risks to the institution's assets and image.

Keywords: Ergonomics. Diagnosis. Method. Risk management. Proactive Security, Risks and Emergencies.

1. INTRODUCTION

This work presents a proposal for Fiocruz's Proactive Safety, Risks and Emergencies of Hazardous Product Waste.

Despite the efforts made by companies, organizations, private sectors and the government, a series of major negative events have occurred, such as the explosion in the Port of Beirut, the warehouse of dangerous products there. However, why are events of this type still occurring?

These are complex events that require a systemic approach to develop proposals to prevent these negative events (Lima et al., 2015; Amalberti et al., 2018), and the Proactive Security, Risks and Emergencies proposal seeks to improve this prevention, including Ergonomics in the safety management of dangerous products.
Security management typically uses standards, checklists, operational procedures, legislation, and risk and emergency management to analyze technical issues, which we can call “hard”. To develop Proactive Safety, Risks and Emergencies, this “hard” analysis is complemented with “soft” issues, which are represented by Ergonomics and its work analysis methods.
In the “soft” approach, we immerse ourselves in the activities of employees, at different levels - operational, supervisory, managerial and management - to seek opportunities for improvement through the analysis of activities carried out in the workplace through interviews, filming, photos and analysis of activities. By combining opportunities to improve “hard” and “soft” issues, we have a diagnosis that is the basis for a Proactive Security, Risks and Emergencies action plan.
For this work, we sought to identify opportunities for improvement to improve issues related to efficient, safe work, with comfort, well-being, against hardship and reducing risks to the organization's assets and image. By incorporating concepts, precepts and methods of Ergonomics, the Proactive Safety, Risks and Emergencies proposal seeks to include an aspect of the organization's Safety Culture in safety management.
The term safety culture (Gonçalves Filho, et al., 2011) was first conceptualized in the technical report on the accident at the Chernobyl nuclear power plant in Ukraine, in the 1980s, as being the: “Set of characteristics and attitudes of organizations and individuals, which guarantees that the safety of a nuclear plant, due to its importance, will have the highest priority”. Although there is no consensus regarding the different concepts of safety culture, there is similarity and convergence between them. Many aspects present in the different concepts of safety culture presented above are common and can be grouped as follows: aspects related to the individual: these are the values, beliefs, attitudes and perception of individuals in relation to occupational safety management. These aspects of the safety culture reflect what the organization is: work-related aspects: the individual's behavior and actions in relation to the work safety management system and the risks present in the work environment and aspects related to the organization: they are the organization's practices and structure to support the individual and the workplace safety management system. These aspects of the safety culture reflect what the organization has.
The Security Function can be divided into two auxiliary functions: risks and emergencies. The first aims to control latent factors and the second, the manifestations of risks in facts. Therefore, there are two complementary forms of action: preventive and corrective (Cardella, 2012).
A risk control system aims to keep a given risk below the tolerated value. The risk control objects are:
Internal and External Risks:
External Risks: Fire, Theft, Vandalism/Terrorism, External Fraud and Natural Disasters
Internal Risks: Facilities and equipment/Systems, People, Products/Processes This work's main objective is to propose Proactive Security, Risks and
Fiocruz Hazardous Product Waste Emergencies.
The general objectives of this work are:
● Documentation evaluation;
● Map risks, emergencies and opportunities to improve work processes for Fiocruz's Hazardous Product Waste, aiming to meet demand.

2 METHODOLOGY

The methodology of this work is ergonomic assessment, which consists of a set of technical site visits, conversational action with employees and examination of existing documentation on the combined assessed locations.
Ergonomic Work Analysis (AET) is a methodological model that, from the point of view of the

activity, seeks to understand and correlate determinants of work situations with their consequences for the production system and workers (Guérin, 2001).
In order to focus on the key issues of this work, below is presented the adapted Ergonomic Analysis that will constitute the Demand for Proactive Safety, Risks and Emergencies
● Managerial Demand: offering risky and emergency work situations for the analyst to observe, through the problems perceived by the company's managers;
● Global Analysis: study carried out by the analyst on the elements of the general organization of work in the company, to understand it and begin targeting the sector that will be the focus of the analysis;
● Demand for Proactive Security, Risks and Emergencies: the situations initially highlighted may or may not be confirmed and the initial demand will be reconstructed, based on the aspects observed by the analyst and reported by the workers.
● Systematization: directing the analysis to a specific task and/or activity and/or job, seeking details about the work process and being able to use different tools;
● Diagnosis/Operating Model: proposition prepared by the specialist based on previous studies and analysis of work processes;
● Validation and Restitution: phase of application of the operating model, aiming to legitimize what was proposed (validation) and reestablish the time dedicated to participating in the study, as well as safety, comfort and efficiency in the production process (restitution) ;
● Results: explanation to the company of the work performed
In ergonomic analysis (VIDAL, 2003), interactional methods and techniques are used, conversational action, listening to spontaneous and provoked verbalizations, and the application of dynamic scripts and questionnaires, observational methods and techniques, open and systematic observations aided by filming and photographs.

3. RESULTS

3.1. Appreciation of Fiocruz

The work was developed at the Manguinhos Campus in Rio de Janeiro, which has an area of approximately 800,000m2 and is a complex physical infrastructure system with approximately 185 buildings with varying degrees of complexity.

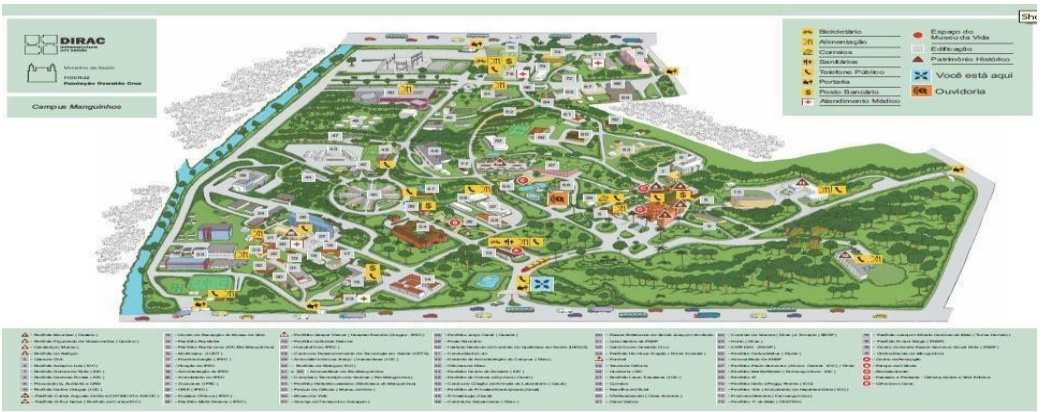

Figure 2. Manguinhos Campus, Fiocruz, Rio de Janeiro

3.2. Contact Itinerary

Fiocruz's Hazardous Waste Management Activity was selected due to the high risk of negative events (fire, explosion, among others) involved in this activity. An explosion in the Fiocruz dangerous products warehouse, similar to the photo of the explosion in the dangerous products warehouse in the Port of Beirut, see the figure below, shows us the damage that can cause to the Fiocruz institution and its surroundings, an event similar to this explosion at the Fiocruz hazardous products warehouse; and this service was also selected due to the

importance of this Hazardous Waste Management activity for studies in the area of ergonomics, forced postures, physical efforts and problems of organizing physical space and equipment; The Head of the Environmental Management Department and the Coordinator of Hazardous Waste Management at Fiocruz were also contacted to validate this demand proposal.

Figure 3. Explosion of the Dangerous Goods Warehouse in the Port of Beirut

Figure 4. Hazardous Products Waste Deposit

Figure 5. Transport of Hazardous Product Waste

3.3. Social Construction

Social construction is a device in the AET methodology that enables interaction between people in the company and the ergonomics team. According to Guizze, et al., 2007, social construction simultaneously produces involvement and effectiveness.

● Ergonomic Action Group – these are ergonomic specialists who promote the conduct of ergonomic action and the people responsible for ergonomics in the company.
● Support Group – these are the company's directors, the people who have the power to make decisions at work and who must be informed about the progress of activities.
● Monitoring Group – are those who monitor and supervise the work.
● Focus Group – these are the sectors of managerial demand, that is, the sectors that will be the object of analysis to choose the ergonomic demand.

Below is an illustration of how the social construction of this ergonomic action was configured.

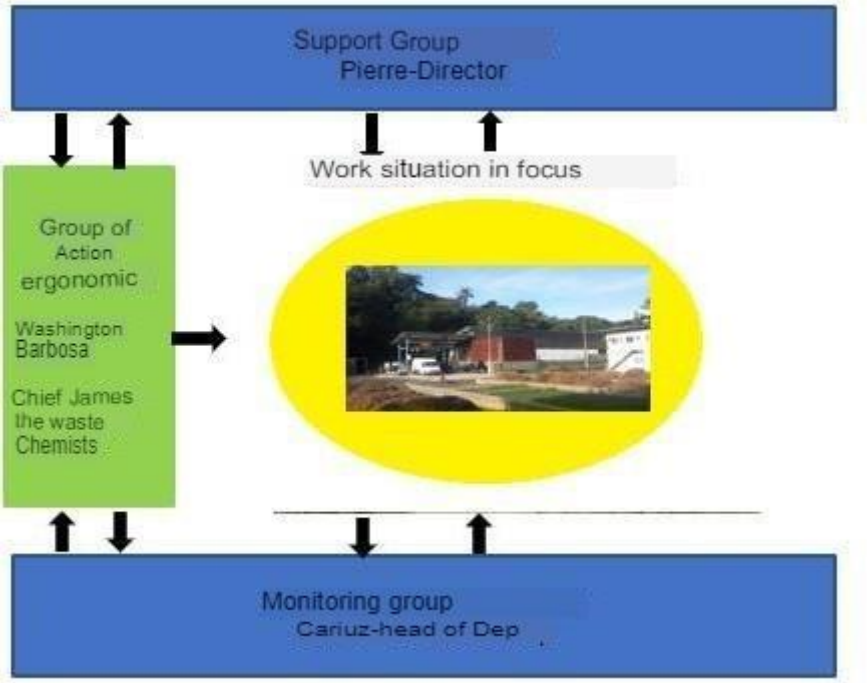

Figura 6 Construção social

3.4. Service Provision Process Scheme

Below is an illustration of how the service provision process is configured, from receiving the waste collection service order (OS) to transporting hazardous waste for incineration..

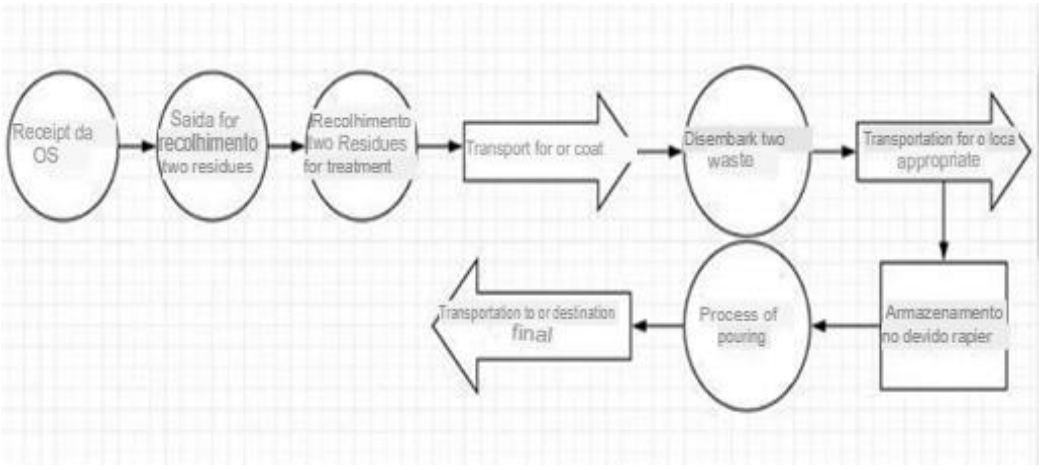

Figure 7 – Service provision process

The sector is organized into an administrative shift, from 8 am to 5 pm.
It has a staff of 6 employees per shift. There are 1 boss, 1 supervisor and 4 technicians.

3.5. Demand for Proactive Security, Risks and Emergencies

To meet the demand for Proactive Security, Risks and Emergencies, the facilities and work process in Fiocruz's hazardous waste management were checked, checklists were applied relating to external risks, facility design, work process, people and compliance with legislation techniques, to identify needs for adjustments and improvement of work processes.

Within the issues evaluated in the risk assessment process, for the demand, two important issues were selected, validated by employees and managers: the review of the product pouring process and the rearrangement of the Hazardous Waste Center.

3..5.1. Review of the process of pouring products

The review of the product pouring process was chosen as it was reported as the most dangerous activity.
Figures of the warehouse area and movement in the warehouse area will be presented below.

Figure 8 Fiocruz Hazardous Product Waste Deposit Area

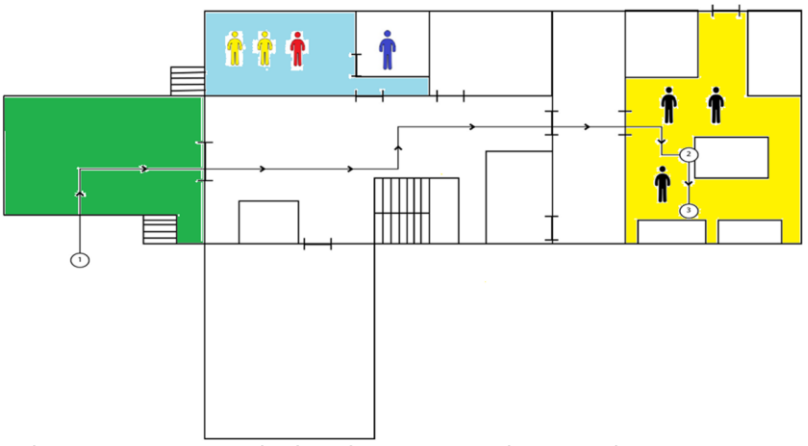

Figure 9. Movement in the Fiocruz Hazardous Products Waste Deposit area

When pouring products, a metal barrel is used as an adaptation to support chemical product containers. This adaptation is inadequate and could potentially lead to a chemical spill accident.
Although the dangerous products warehouse is well ventilated, when the chemical product is poured from the containers into the cylinder, a cloud of chemical products is also formed in the warehouse. According to reports from employees, the smell of this chemical cloud lasts for several hours. , becoming felt in the administrative area of the warehouse.

Figure 10. Chemical pouring activity

To meet this demand, in a meeting with the group of collaborators involved in the activity of pouring products and consultation with Fiocruz's body of mechanical engineers to seek guidance for the project, the sketch below was developed of a chapel for chemical products, in this chapel there is an area to support the chemical product containers, exhaust and the bench itself is inclined so that in the event of a chemical spill, the product is sent to the drum.

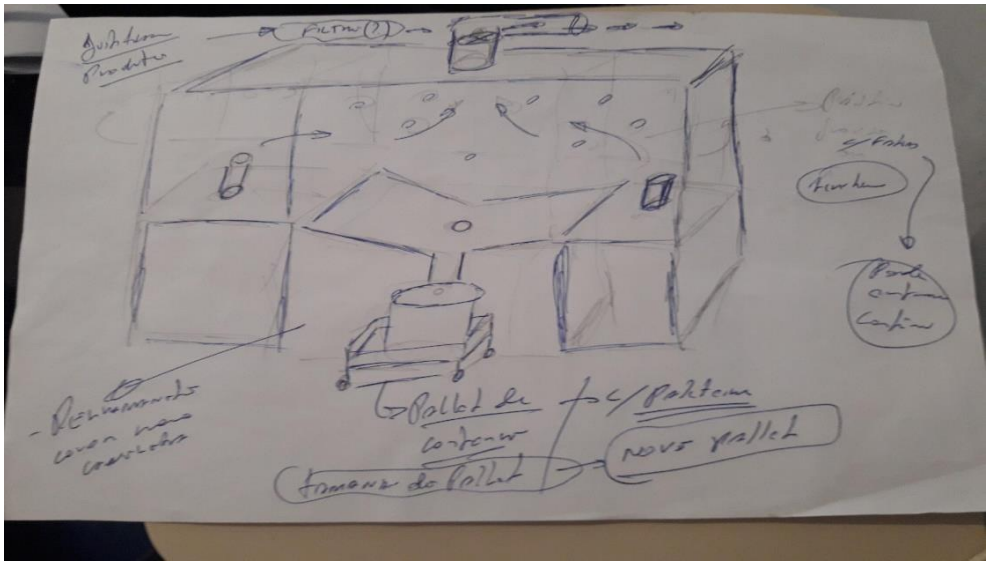

Figure 11. Sketch of chemical waste hood

3.5.2. Rearrangement of the Hazardous Waste Plant.

The location of flammable products in the basement of the hazardous products deposit can be a place for fires to spread throughout the hazardous waste deposit, the need to organize these products and the need to remove the administrative office from within the deposit of dangerous products, are the causes of this demand.
To meet this demand, a site readjustment project was developed to meet the needs identified, this project is presented below.

In phase 1:
- Construction of an administrative nucleus for 15 employees;

Figure 12. Location for implementing the Administrative Center

- Execution of hazardous waste shelter

Figure 13. Location for implementing the hazardous waste shelter.

In phase 2:

- Adaptation of the Hazardous Waste Center to meet the needs reported by employees.

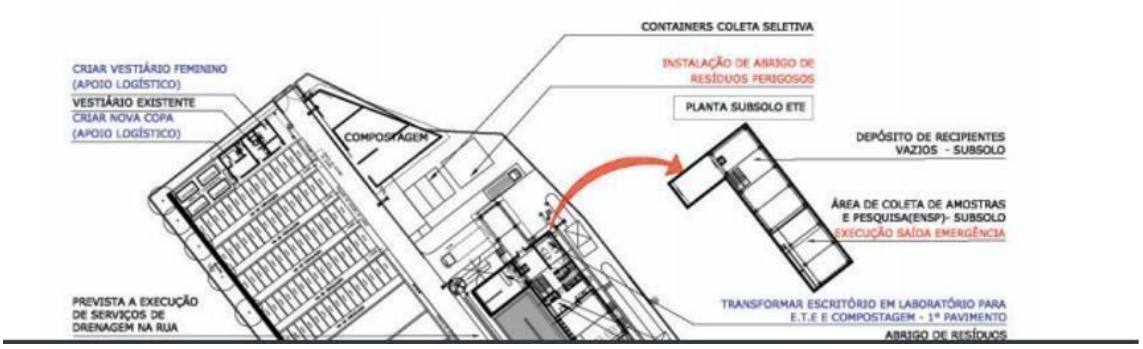

Figure 14. Adaptation plan at the Hazardous Waste Center

3.6. Validation and Refund

During validation and restitution, proposals for adjustments and projects were presented to managers and employees who agreed with the proposals.

4. CONCLUSION

This assessment was carried out at the Fiocruz Campus, located in the municipality of Rio de Janeiro in Manguinhos.
Problems of dangerous work, forced postures, physical effort requirements, and problems with the organization of physical space and equipment were verified.
This study of the Fiocruz hazardous product waste management process made it possible, through the application of the concepts of Proactive Safety, Risks and Emergencies, to propose adjustments to the environment and work activity in order to prevent negative events involving people, image and property.
With the implementation of the recommendations, it is expected to improve productivity, reduce physical effort; risks to the health of employees, the institution's assets, improving work organization and the layout of the sector, and reducing risks to the institution's assets and image..

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