



CONTRIBUTION OF ERGONOMICS TO THE DEVELOPMENT OF PROACTIVE SAFETY, RISKS AND EMERGENCIES OF WASTE FROM FIOCRUZ'S HAZARDOUS PRODUCTS

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Abstract

This paper aims to present the contribution of Ergonomics to the development of Proactive Safety, Risks and Emergencies of Hazardous Waste at Fiocruz. This proposal aims to help prevent negative events, such as the explosion at the Port of Beirut of the Hazardous Waste Storage Facility. Proactive Safety combines the traditional concepts of Safety Management and is enhanced with the approaches advocated by Ergonomics. The methodology is based on ergonomic analysis adapted to discover the Proactive Safety Demands related to physical overloads and organizational, cognitive, risk and emergency aspects, aiming to organize actions to improve the overall performance of the system. The demands were selected based on technical visits to the sites, conversations with employees, examination of existing documentation, survey of applicable legislation and standards, photographic and video records of the activities, and development of a checklist for an initial survey of nonconformities in the analyzed process, which indicated possible opportunities for improvement: review of the product disposal process and rearrangement of the Fiocruz Hazardous Waste Center. Proactive Safety is developed based on proposed actions to minimize or eliminate the problems detected, impacting the facilities, the health of workers and their productivity. By implementing 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 Safety, Risks and Emergencies.

1. INTRODUCTION

The present 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 happened, such as the case of the explosion at the Port of Beirut, of the warehouse of dangerous products at this site. However, why are

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events of this type still occurring? These are complex events that require a systemic approach to develop proposals for the prevention of these negative events (Lima et al., 2015; Amalberti et al., 2018), and the proposal of Proactive Safety, Risks and Emergencies, seeks to improve this prevention, including Ergonomics in the safety management of dangerous products.

Safety management usually 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 the "soft" questions, which are represented by Ergonomics and its methods of work analysis.

In the "soft" approach, we focus on the activities of employees, at the various levels - operational, supervision, management and direction - to seek opportunities for improvement through the analysis of the activities performed in the workplaces through interviews, filming, photos and analysis of the activities. With the combination of opportunities for improvement of the "hard" and "soft" issues, we have a diagnosis that is the basis for an action plan for Proactive Safety, Risks and Emergencies.

For this work, it was sought to identify opportunities for improvement to improve issues related to efficient, safe, comfortable work, well-being, against hardship and reduction of risks to the organization's assets and image. By incorporating concepts, precepts and methods of Ergonomics, the proposal of Proactive Safety, Risks and Emergencies seeks to include an aspect of the organization's Safety Culture in safety management.

The term safety culture (Gonçalves Filho, et al., 2011) was conceptualized for the first time in the technical report on the accident at the Chernobyl nuclear power plant in Ukraine, in the 1980s, as being: "Set of characteristics and attitudes of organizations and individuals, which ensures that the safety of a nuclear plant, due to its importance, will have the highest priority." Although there is no consensus regarding the various 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: 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: it is the behavior and actions of the individual in relation to the occupational safety management system and the risks present in the work environment and aspects related to the organization: it is the organization's practices and structure to support



the individual and the occupational safety management system. These aspects of the safety culture reflect what the organization has.

The Safety Function can be broken down 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 certain risk below the tolerated value, the objects of risk control 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 has as its main objective to propose Proactive Safety, Risks and

Emergencies of Waste from Dangerous Products of Fiocruz.

The general objectives of this work are:

- Evaluation of documentation;
- Map the risks, emergencies and opportunities to improve the work processes of Fiocruz's Hazardous Product Waste, aiming to meet the demand.

2. METHODOLOGY

The methodology of this work is ergonomic appreciation, which consists of a set of technical visits to the sites, conversational action with the employees and examination of the existing documentation about the agreed appreciated places.

The Ergonomic Analysis of Work (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 for 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: offer of work situations of risks and emergencies for the analyst's observation, through the problems perceived by the company's managers;



- Global Analysis: study made by the analyst on the elements of the general organization of work in the company, to get to know it and start directing it to the sector that will be the focus of the analysis;
- Demand for Proactive Safety, Risks and Emergencies: the situations initially pointed out 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 certain task and/or activity and/or workstation, seeking details about the work process and being able to use various tools;
- Diagnosis/Operating Model: proposition prepared by the specialist based on previous studies and analysis of the work processes;
- Validation and Restitution: phase of application of the operating model, aiming at the legitimization of what was proposed (validation) and the reestablishment of the time dedicated to participation 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 the ergonomic analysis (VIDAL, 2003) interactional methods and techniques are used, conversational action, listening to spontaneous and provoked verbalizations, and application of dynamic scripts and questionnaires, observational methods and techniques, open and systematic observations aided by filming and photographs.

3. FINDINGS

3.1. Fiocruz's appreciation

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

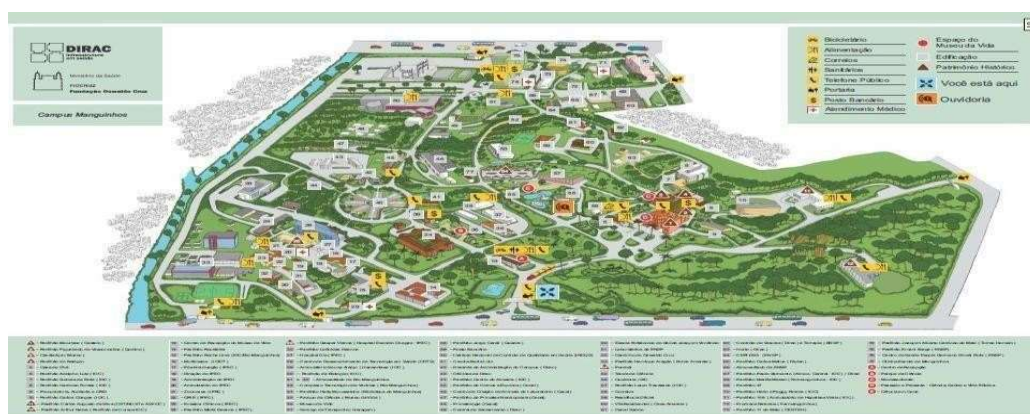


Figure 2. Manguinhos Campus, Fiocruz, Rio de Janeiro

3.2. Contact Itinerary

The Fiocruz Hazardous Waste Management Activity was selected due to the high risk of negative events (fire, explosion, among others) involved in this activity. An explosion at the Fiocruz hazardous products warehouse, similar to the photo of the explosion at the Port of Beirut hazardous products warehouse, 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 for the importance of this Hazardous Waste Management activity for studies in the area of ergonomics, forced postures, physical efforts and problems of organization of physical space and equipment; the Head of the Department of Environmental Management and the Coordinator of Hazardous Waste Management at Fiocruz were also contacted to validate this demand proposal.



Figure 3. Explosion of the Dangerous Goods Depot at 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 of 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 – are the ergonomics specialists who promote the conduct of ergonomic action and the people responsible for ergonomics in the company.
- Support Group – these are the company's managers, the people who have the power to make decisions at work and who must be informed of the progress of activities.
- Monitoring Group – are those who monitor and supervise the work.
- Focus Group – are the sectors of managerial demand, that is, the sectors that will be the object of analysis for choosing the ergonomic demand.

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

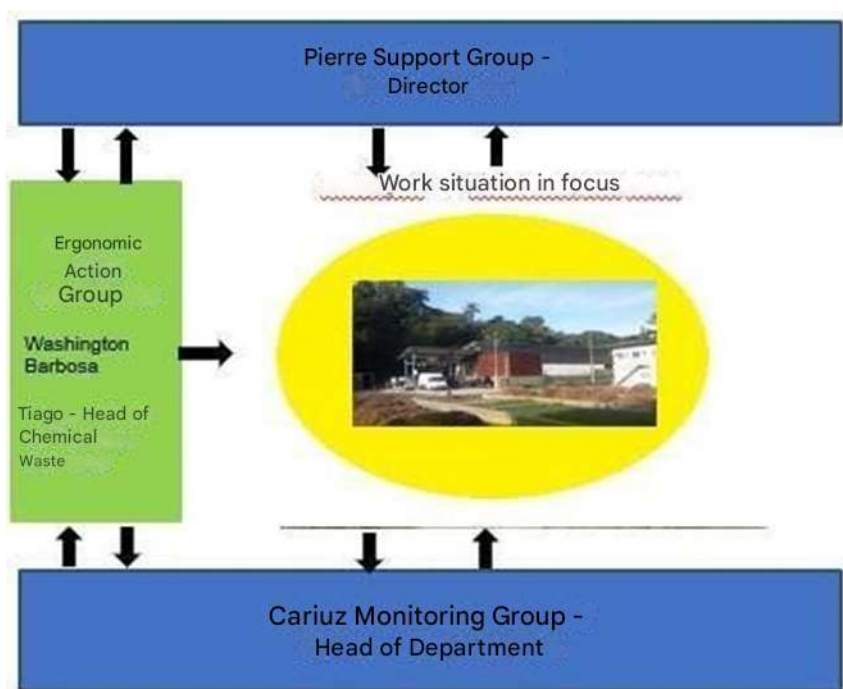


Figure 6 Social construction

3.4. Service Provision Process Outline

Next, the illustration of how the service provision process is configured, from the receipt of the service order (SO) for waste collection to the transportation of hazardous waste to incineration.

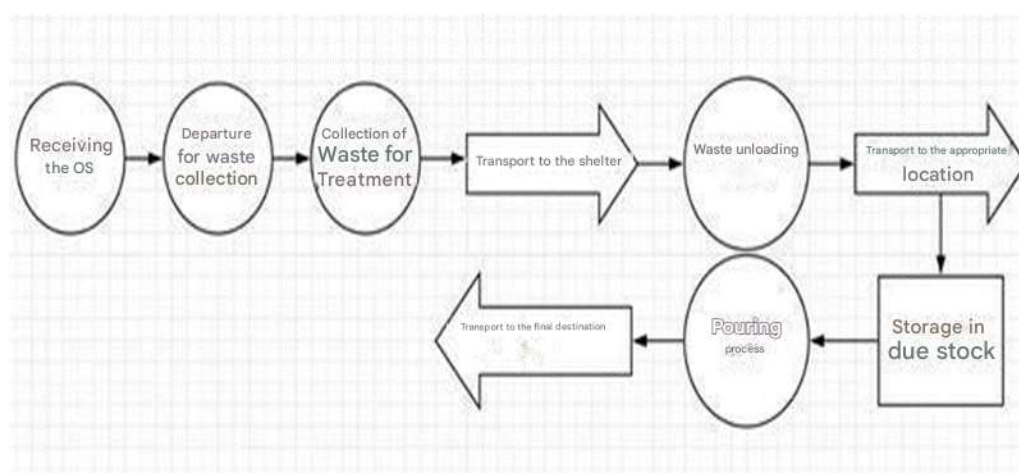


Figure 7 – Service delivery process

The sector is organized in an administrative shift, from 8 am to 5 pm.

It has a staff of 6 employees per shift. Being 1 chief, 1 supervision and 4 technicians.



3.5. Proactive Safety Demand, Risks and Emergencies

To meet the demand of Proactive Safety, Risks and Emergencies, the facilities and the work process in the management of hazardous waste at Fiocruz were verified, checklists were applied related to external risks, facility design, work process, people and compliance with technical legislation, 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 process of pouring products and the rearrangement of the Hazardous Waste Center.

3.5.1. Product Shedding Process Review

The review of the product pouring process was chosen because it was reported as the most dangerous activity.

Figures of the storage area and the movement in the storage area are shown below.



Figure 8 Area of the Fiocruz Hazardous Products Waste Deposit

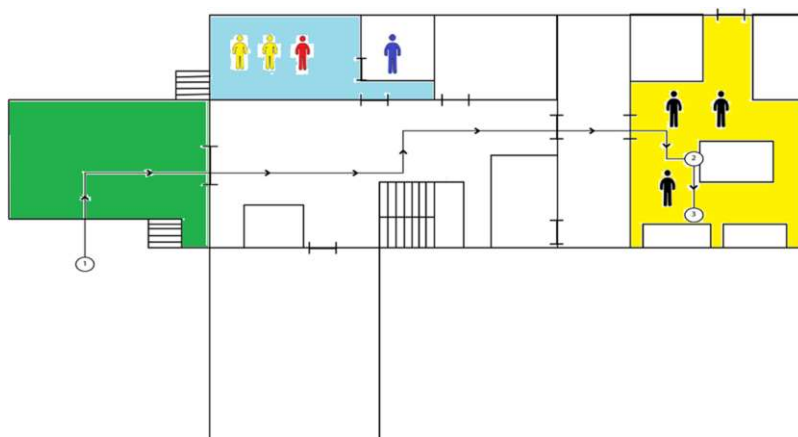




Figure 9. Movement in the area of the Fiocruz Hazardous Products Waste Deposit

In the activity of pouring products, a metal barrel is used as an adaptation to support the containers of chemical products, this adaptation is inadequate, and may potentiate a chemical spillage accident.

Although the hazardous products warehouse is well ventilated, when the chemical product is poured from the containers into the canister there is also the formation of a cloud of chemical products in the warehouse, in reports from employees, the smell of this cloud of chemical product lasts for several hours, even being felt in the administrative area of the warehouse.



Figure 10. Chemical Shedding Activity

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



Figure 11. Chapel sketch for chemical waste

3.5.2. Rearrangement of the Hazardous Waste Center.

The location of flammable products in the basement of the hazardous products warehouse, can be a place of fire outbreak with spread to the entire hazardous products waste warehouse, the need to organize these products and the need to remove the administrative office from inside the hazardous products warehouse, are the causes of this demand.

To meet this demand, a project was developed to readjust the site, to meet the needs pointed out, below is presented this project.

In phase 1:

- Construction of an administrative core for 15 employees;



Figure 12. Location for the implementation of the Administrative Nucleus

- Execution of a hazardous waste shelter.



Figure 13. Place for the implementation of the hazardous waste shelter.

In phase 2:

- Adequacy in the Hazardous Waste Center, to meet the needs reported by employees.

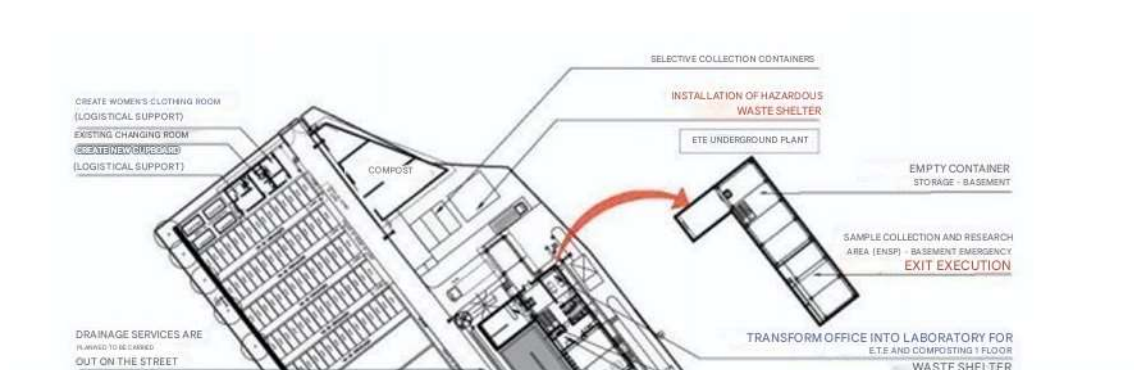


Figure 14. Adjustment plan at the Hazardous Waste Center

3.6. Validation and Refund

In the validation and restitution, proposals for adjustments and projects were presented to the 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.

The 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 waste management process of Fiocruz's hazardous products made it possible, through the application of the concepts of Proactive Safety, Risks and Emergencies,



to propose adjustments in the environment and in the work activity in order to prevent negative events in 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, to the institution's assets, to improve the organization of work and the layout of the sector, and to reduce risks to the institution's assets and image.

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