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CORPORATE ERGONOMICS PROJECT: PROPOSED ANALYSIS CATEGORIES

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Abstract

The corporate ergonomics project discussed in this article was carried out in thermal power plants. The aim of this project was to improve performance and working conditions, as well as to broaden workers' perception of the contributions of participatory ergonomics. The sample consisted of 25 ergonomic analysis reports, carried out in 5 thermal power plants. A content analysis of 100 project reports was performed, proposing a structure of categories for the following dimensions: problems identified, causes diagnosed, and planned actions. This categorization showed, as a result of the project, the expansion of the scope of ergonomic interventions in these thermal power plants. Evidence was observed of the importance of the integrative and participatory methodology adopted. Opportunities for improving the corporate ergonomics program were also identified. These were mainly related to the performance of ergonomics committees and the integration of participatory ergonomics into other programs for the continuous improvement of occupational health and safety, quality, and productivity.

Keywords: Macroergonomics, Ergonomic Work Analysis (AET), Corporate Ergonomics Projects, Participatory Ergonomics.

1. INTRODUCTION

The energy company discussed in this text has had a corporate ergonomics program for more than 10 years, including training actions, creation of local ergonomics committees in the Operational Units (OU), establishment of indicators, procedures, development of software to support the management of ergonomic actions, among other initiatives. However, the implementation phase is heterogeneous in the different business areas and in the different OUs, being more recent in Thermal Power Plants (UTE).

Ergonomics actions in the company's Thermal Park until 2013 were mostly carried out independently by the operational units (OUs), focusing mainly on the evaluations of administrative workstations and some control rooms. The Safety, Environment, Energy Efficiency and Health Management (SMES), responsible for the UTEs at the time, observed that workers predominantly saw ergonomics as dealing mainly with postural analysis, Work-

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Related Musculoskeletal Disorders (WMSD) and acting mainly in furniture changes in administrative activities.

This limited view of ergonomics is not exclusive to the Brazilian thermal park. Despite the definition of Ergonomics provided by the International Ergonomics Association (IEA) and the publication of several studies (HAINES et al., 2002; HENDRICK, 2008; MONROE et al., 2012, TOMPA et al., 2013) reinforcing the potential contribution of participatory ergonomics to system performance and workers' health and safety, this is not the predominant perception among most workers, including organizational leaders, even in other countries. Dul and Neumann (2009) identified that managers generally do not associate ergonomics with business performance.

In many cases, ergonomics programs are not even integrated into an occupational health and safety management system (YAZDANI et al., 2015). In the case studied here, this disintegration was evidenced in some statements, such as that of a manager who, during the phase of evaluating the demands, said: "But this is a risk of accident, it is a safety issue, it has nothing to do with ergonomics".

In this context, the company decided to review the actions of the corporate ergonomics program in the thermal park. Among the actions carried out, the corporate project, the subject of this text, which has been developed in partnership with the Department of Production Engineering of a Brazilian federal university since 2013, stands out. The focus of the project is the industrial area, aiming to promote the improvement of performance and health and safety conditions. The project also aimed to promote training and change the workforce's perception of the potential contribution of ergonomics. This corporate project includes the performance of 80 Ergonomic Work Analyses (EWA), carried out in 16 different Thermoelectric Power Plants (UTE).

This article aimed to propose a method for consolidating and analyzing information from a subset of 25 EWA experiments, carried out in 5 UTEs. Through the content analysis of 100 project reports, a category structure was developed to consolidate and analyze the EWAs in the following dimensions: problems identified, causes diagnosed and actions planned.

2. ERGONOMIC INTERVENTION

The methodology of the Ergonomic Analysis of Work (AET) clarifies the fundamental participation of workers in the analysis of work activities and in the design of improvements in working conditions (GUERIN et al., 2001; DANIELLOU and BÉGUIN, 2007). Taking the

Participatory Ergonomics Framework – PEF (HAINES, 2002) as a guiding basis for planning and describing this participatory ergonomics project, several dimensions of the project were defined, such as: phases, participants, role of ergonomics specialists, duration, scope, focus of analysis, among others.

2.1. Ergonomic intervention methodology

The object of this corporate ergonomics project is to carry out Ergonomic Work Analysis (EWA) services, in accordance with the requirements established by the Brazilian Regulatory Standard No. 17 (BRASIL, 2007) and with the methodology recommended in the Manual for the Application of the Brazilian Regulatory Standard. No. 17 (BRASIL, 2002), which was structured in four main phases: Phase 1 – Identification, prioritization and selection of demands; Phase 2 – Development of the EWA until validation of the preliminary recommendations; Phase 3 – Development and validation of improvement recommendations; and Phase 4 – Planning and monitoring of the implementation of the prioritized actions.

The overall coordination and supervision of the project is carried out by the corporate management of SMEs, which has an ergonomics specialist. At each UTE, the project is monitored locally by a company that specializes in occupational health and safety, responsible for facilitating interaction between the university's team of experts and the UTE workforce.

The university's technical team, allocated to carry out 5 EWAs in each UTE, is composed of the following professionals: a technical coordinator (working in the 4 phases), two ergonomics specialists (working in phase 2) and an ergonomics specialist (working in phase 3).), the latter necessarily with experience in conceptual ergonomics. The technical coordination of the project is carried out by a professor from the production engineering department with knowledge and experience in ergonomics. Given their training and professional training, in line with recommendations of authors such as Hendrick (2008) and Dul and Neumann (2009), the technical coordination of the project is familiar with the strategic "language" of several stakeholders (e.g.: Total Quality Management - TQM, Lean Production, Business Process Management - BPM, etc.).

Managers and other workers of the UTE participate in all phases of the project. The participating teams are constituted and reorganized on demand and voluntarily, considering the nature of the activity, the stage of the EWA (problem identification, risk assessments, solution design, feasibility assessment, etc.), as well as the interests and potential contributions of the

different knowledge holders among workers in operations, maintenance, laboratory, supplies, warehouse, management, engineering, health and safety, environment, etc.

Phase 1 – Identification and prioritization of demands (duration: 15 days) – This phase begins with a study carried out by the technical coordinator, which includes a global analysis of the company, business unit, technical processes, labor, organizational structure, production, health and safety results, among others. Subsequently, during a two-day technical visit to the UTE, the unit's management and the technical coordinator seek to involve as many workers as possible, who are encouraged to identify the difficulties they face in their work activities (risks of accidents, situations that cause pain or discomfort, generating rework or loss of time, etc.). Through field interaction, approximately 30 demands (problems) are identified in each UTE. Considering criteria such as centrality to the business, severity, frequency, severity of the problem, as well as ease and estimated investment for the solution, the problems to be analyzed during the 5 EWAs to be carried out in the unit are chosen in a meeting with the multifunctional and multihierarchical group. An additional guideline in this selection process was to look for a set of EWAs involving different teams of workers.

Phase 2 - Development of the EWA until validation of the preliminary recommendations (duration: 75 days) - The intermediate objective of this phase is to diagnose the causes of the problems identified and prioritized in the first phase. Two ergonomists from the technical team, under the guidance of the coordinator, go through the stages of the EWA, promoting the participation of workers and managers of the UTE. Various methods (IIDA, 2005; SALVENDY, 2006; STANTON et al., 2005) are used in each case and stage to identify, record and analyze problems and causes. This phase culminates in the construction and validation of a set of preliminary ergonomic recommendations, validated in a meeting, to solve the problems selected in phase 1.

Phase 3 – Development and validation of improvement recommendations (duration: 30 days) – In the third phase, the university's technical team, consisting of the coordinator and a design ergonomist, builds on the preliminary recommendations validated in phase 2 to develop, refine, and create a set of detailed recommendations or conceptual designs. These are presented, discussed and validated in a face-to-face meeting at the UTE, with the participation of the leaders and representatives of the other workers who participated in the 5 EWAs.

Phase 4 - Planning and monitoring of the implementation of the prioritized actions: During the planning stage, the technical coordinator (university), the contract inspection (corporate), managers and workers (UTE) interacted remotely (via email, telephone and

videoconference) to develop the implementation plan of the project components. During the follow-up phase, the technical coordinator remains available for one year to guide the OU in case of doubts regarding the implementation of actions or the need for adjustments in the recommendations. In addition, they visit the unit to verify and document the progress of the planned actions, the results achieved and any need for replanning. The UO ergonomics committee is responsible for continuing to monitor the implementation of the planned actions after the end of the contract with the university.

3. RESULTS AND DISCUSSIONS

The partial results presented in this article are concentrated in 5 UTEs, where 25 Ergonomic Work Analyses (AET) were performed, related to activities performed by several teams: Operation (12 AET), Laboratory (7 AET), Maintenance (4 AET), Warehouse (1 AET) and Engineering (1 AET). During the 25 AETs, 67 problems were analyzed, for which 117 causes were identified, and 140 improvement actions were planned.

In this research, content analysis of the 100 reports was carried out, referring to the 4 phases of the 25 AETs carried out. As a result, a category structure was developed to characterize the set of AETs in the three dimensions: Problems Identified, Causes Diagnosed, and Planned Actions. Several categories were defined for each dimension, the most frequent being presented in the following figures.

In phase 1, about 30 problems were identified in each UTE. The problems were prioritized and, through participatory methods, the problems to be analyzed in each unit were chosen, totaling 67 in the 5 UTEs. Figure 1 presents the classification of the 67 problems analyzed in the proposed categories, highlighting physical discomfort (27%) and risk of accidents (24%) as the most frequent categories.

In the thermoelectric park, the perception of ergonomics was mainly related to postural issues in the analysis of administrative workstations. The fact that the risk of accidents was the second most frequent problem category (Figure 1) shows advances in the integration between the ergonomics program and the management of the HSE. The distribution of the set of problems by several categories (Figure 1) led to the involvement of several work teams and showed that this project expanded the scope of ergonomics, including issues related to safety, productivity, among others.

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Figure 1 - Relative frequency of the problem categories analyzed

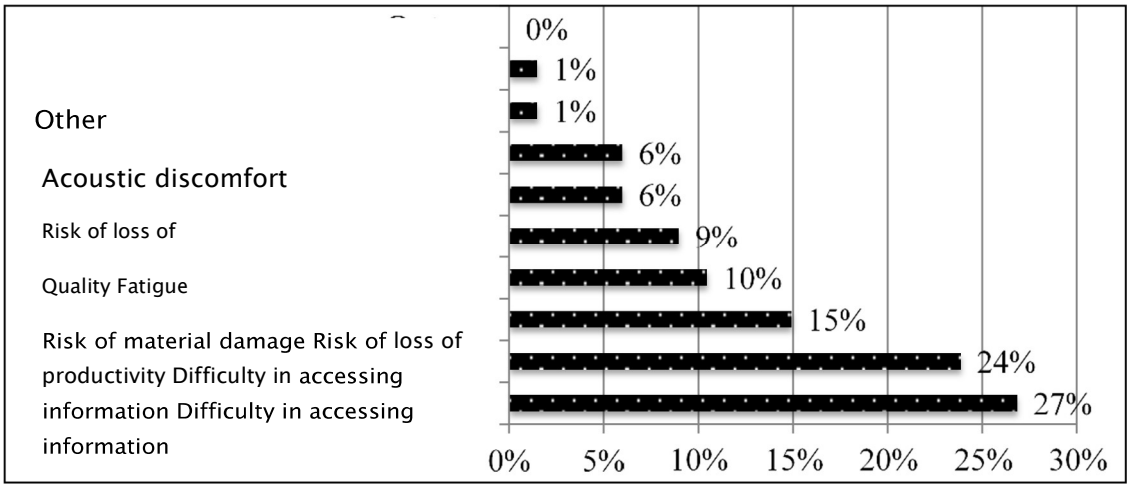
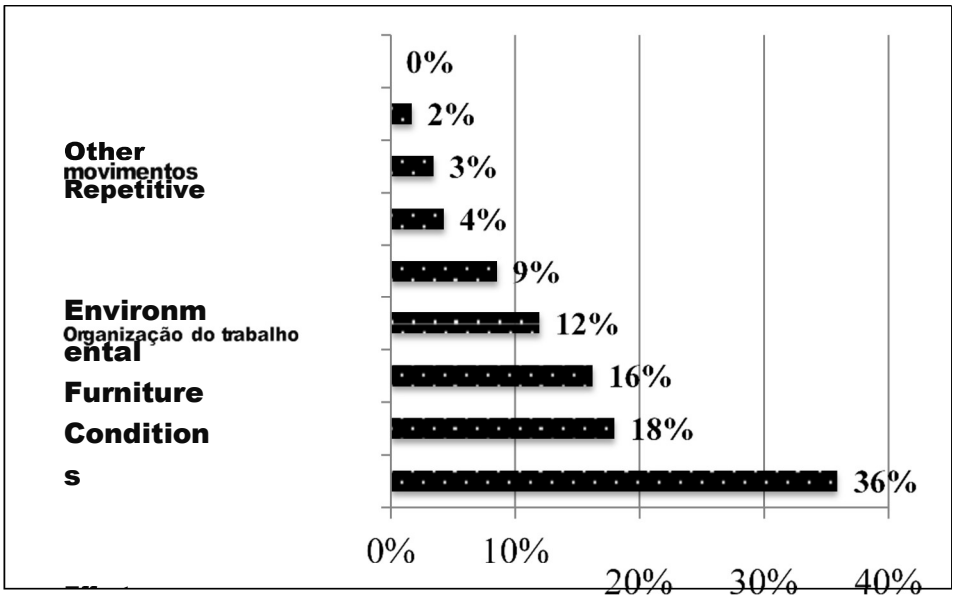


Figure 2 shows the distribution of the 117 causes identified for the 67 problems analyzed in the proposed categories.

Figure 2 - Relative frequency of the categories of diagnosed causes

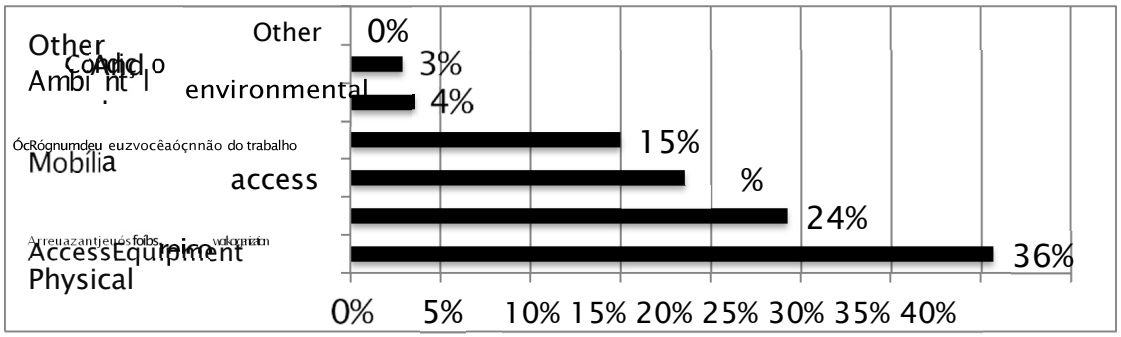


In phase 2, the teams were instructed to adopt different methods to diagnose the root causes, which reside in the working conditions, explaining the modes of operation adopted and resulting in the problems identified. Thus, for example, the classic "adoption of unfavorable postures" does not appear in Figure 2, as it was considered in these analyses as an intermediate cause. Those involved in the EWS were encouraged to seek answers about what working conditions lead workers to adopt such attitudes. Is it the difficulty of access? The pace of work? The equipment activation system?

Figure 2 highlights the causes related to the physical arrangement (36%) and equipment (18%), which in most cases are conditions defined during the design phase of the plant and are often difficult to change.

Phase 3 of the project carried out in the 5 Centers resulted in a set of 140 planned actions. Figure 3 summarizes the results of phase 3 of the project, showing the distribution of the planned actions among the categories.

Figure 3 – Relative frequency of the categories of planned actions



As expected, the categories of actions align consistently with the root causes of the problems. The inversion between the two predominant categories can be explained in the continuous process industry by the difficulty of changing the physical arrangement in the industrial areas. Most of the actions related to the physical arrangement were carried out in control rooms and laboratories. In some cases, in the industrial area, it was possible to adopt equipment and procedures (work organization) that allowed remote operation, at a safe distance from the risk situation, without the need to change the physical arrangement. The category of actions on equipment (e.g., use of pumps, mixers, forklifts) also addressed problems such as physical discomfort or risk of accidents associated with causes such as repetitive movements, excessive effort or difficulty in access. The higher percentage of actions in the organization of work, in relation to the percentage of causes associated with this category, occurs because some planned changes in other categories, such as equipment, require changes in the organization of work, as they alter requirements related, for example, to procedures, personnel, and duration of the task.

At the end of phase 4, during the technical visits carried out in the 5 units, progress was made in the completion of the planned actions. However, part of the actions was scheduled for 2019 because the restrictions imposed by the crisis came to suspend investments and temporarily paralyze the project in the units. The actions still planned should be monitored by the local ergonomics committees.

4. CONCLUSION

In order to verify the scope of the role of ergonomics in the corporate project in question, a proposal for a categorization structure was developed in this research to consolidate and analyze the results of the Ergonomic Work Analysis (EDM) in terms of problems addressed, causes identified and planned actions. The analysis made it possible to highlight the expansion of the focus of ergonomics in the company's Thermoelectric Power Plant Park. It was observed

that the problems analyzed and the planned actions had a broader scope than what prevailed in the ergonomic actions that were carried out in the Thermoelectric Plants before the project.

The results also show that the contributions of this corporate ergonomics project are related to the integrative and participatory character of the ergonomic intervention performed. As foreseen in the MOU methodology, the project promoted the integration of objectives (performance, health and safety), solutions (in the technical and organizational domains), and for this it required the integration of knowledge, logic, interests and priorities of the stakeholders.

The progress in the integration between the ergonomics program and the Health, Safety and Environment (HSE) management was exemplified by the fact that the risk of accidents is among the most frequently selected problem categories for analysis in the EDMs. To further integrate ergonomics and safety, it is suggested to try the merger of ergonomics committees, which have not been permanent in Thermoelectric Power Plants, and the Internal Commission for Accident Prevention (CIPA), which has its education, training and actions regulated.

The organizational restructuring that occurred during the project, including staff reductions and replacement of managers, contributed to some projects being temporarily discontinued, requiring the new manager to know the ergonomics project. This points to the importance of change management systems being applied to organizational change as well.

The lack of integration between the computerized systems for controlling the actions planned in the ergonomics project and in the other continuous improvement programs in the company have become challenges perceived by the actors and indicate the integration of the systems as an opportunity for improvement.

The indication of progress in the integration of ergonomics with other management and continuous improvement programs existing in the company was also noted in the study by Monroe (2012) research, which highlights that this integration takes advantage of limited resources and makes the most of the time of workers and managers. Dul and Newmann (2009) indicate that, in order to capture all the benefits of ergonomics, it must be integrated into the organization's strategies and planning and control cycles. As an example that corroborates this indication, in the analyzed project, some budgetary difficulties were overcome for actions that had their contribution to performance (productivity, loss reduction, etc.) recognized and could be included in budgets and improvement programs outside the scope of HSE.

REFERENCES

DANIELLOU, François; BÉGUIN, Pascal. (2007). Metodologia da ação ergonômica: abordagens do trabalho real. Ergonomia, pág. 281-301.

DUL, janeiro; NEUMANN, W. Patrick. (2009).Contribuições da ergonomia para estratégias empresariais. Ergonomia Aplicada, v. 40, n. 4, pág. 745-752.

GUÉRIN, Françoise *outros*. (2001). Compreender o trabalho para transformá-lo: a prática da ergonomia. In: Compreender o trabalho para transformá-lo: a prática da ergonomia.

HAINES, Helene *outros*. (2002). Validar um quadro para a ergonomia participativa (o PEF).

Ergonomia, v. 45, n. 4, pág. 309-327.

HENDRICK, Hal W. (2008). Aplicando ergonomia a sistemas: algumas "lições aprendidas" documentadas. Ergonomia aplicada, v. 39, n. 4, pág. 418-426.

IIDA, Itiro; WIERZZBICKI, Henri AJ. (2005). Ergonomia. Projeto e produção. 2ª ed. São Paulo: Edgard Blucher.

MONROE, Kimberley; FICK, Faye; JOSHI, Medina. (2012). Integração bem-sucedida da ergonomia em iniciativas de melhoria contínua. Trabalho, v. 41, n. Suplemento 1, pág. 1622-1624.

SALVENDY, Gabriel. (2006). MANUAL DE FATORES HUMANOS E ERGONOMIA.

STANTON, NA*e outros*. (2005). Métodos defatores humanos – um guia prático para engenharia e design. Hampshire: Ashgate Publishing Limited.

TOMPA, Emílio; DOLINSCHI, Roman; NATALE, Julianne. (2013). Avaliação económica de uma intervenção ergonómica participativa numa fábrica têxtil. Ergonomia aplicada, v. 44, n. 3, pág. 480-487.

YAZDANI, Amine *outros*. (2015). Quão compatíveis são os programas de ergonomia participativa com os sistemas de gestão de saúde e segurança ocupacional?. Jornal Escandinavo de Trabalho, Meio Ambiente e Saúde, p. 111-123.