

Ergonomic initiatives at Inmetro: measuring occupational health and safety

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Abstract. This work studies biomechanical hazards to which the workforce of Instituto Nacional de Metrologia, Qualidade e Tecnologia Industrial (Inmetro) is exposed. It suggests a model for ergonomic evaluation of work, based on the concepts of resilience engineering which take into consideration the institute's ability to manage risk and deal with its consequences. Methodology includes the stages of identification, inventory, analysis, and risk management. Diagnosis of the workplace uses as parameters the minimal criteria stated in Brazilian legislation. The approach has several perspectives and encompasses the points of view of public management, safety engineering, physical therapy and ergonomics-oriented design. The suggested solution integrates all aspects of the problem: biological, psychological, sociological and organizational. Results obtained from a pilot Project allow to build a significant sample of Inmetro's workforce, identifying problems and validating the methodology employed as a tool to be applied to the whole institution. Finally, this work intends to draw risk maps and support goals and methods based on resiliency engineering to assess environmental and ergonomic risk management.

Keywords: Ergonomical assessment, work place evaluation, occupational health and safety

1. Introduction

Inmetro is the federal autarchy in charge of ensuring the quality of industrial goods available to Brazilian consumers, setting standards, plus technical and administrative procedures that promote services and goods evaluations, and regulate evaluation of goods and services within the Brazilian territory. Inmetro needs the cooperation of certified state institutions which perform tasks involving legal metrology, scientific metrology, adequacy evaluation and fiscalization. Many professionals and offices are involved in such coordinate operations. According to Inmetro guidelines (Inmetro Conformity Assessment Manual) [1] adequacy evaluation aims at promoting fair competition, ensuring a healthy work environment and preserving nature.

Inmetro has several offices in the states of the federation. Its headquarters lie in a vast area in Rio de Janeiro. The facilities in the main office include administrative rooms and several technical and metrological laboratories. Workers are subject, therefore, to health hazards, illnesses and injuries

brought about by inadequate workstations and buildings. The present study bases itself on Brazilian law in order to assess such hazards and risks, and decide upon actions to be taken (legislation 3214/19, related to work health and safety) [2].

2. Method

A case study gathers the largest amount possible of detailed information, uses many different research techniques in order to grasp a given situation and describe the complexity of a fact. (LAKATOS, 2008) [3].

Here, we have adopted the case study as research method. The present study aims at developing a model to identify, log in, analyse, evaluate and handle workstation-related risks that could be adopted by every sector of Inmetro, in according to management risks reference criteria [4]. The present study responds to the increasing changes resulting from a turbulent environment (subjected to technological, legal, and economic disturbances) to which Inmetro's is insert. The research was motivated by the request

of a technician of Inmetro's offices, a Coordenação da Rede de Metrologia (CORED), thus becoming the pilot Project for ergonomic assessments in all Institute. It gathers data on the environment, staff, tasks and duties of CORED. Staff answered to questions, anthropometric measurement was taken, furniture was evaluated, pictures were taken.

In according to reference [5], a cognitive system can be defined as "a system which can change its behavior based on its own experiences, aiming to achieve a desired goal without losig control". This prospective will be used applying resilience engineering principles, considering the organization ability to assess their risks, apply control actions and management, keeping its purposes.

3. Results

Measurements have been compared to Standards defined in Brazilian guidelines NBR-5413 (on indoor brightness levels) [6] and NBR 10152 (on comfortable noise levels) [7], established by ABNT [8].

Results of these comparisons (adequate or inadequate) are described below. Technical Standards of evaluation are those mentioned in NR-17 Ergonomia [9]. Therefore, they have been taken as legal benchmarks as concerns occupational health hazards. Twenty-two offices have been measured and compared to legal Standards as regards brightness, noise, temperature, air humidity and furniture.

Indoor brightness levels

Out of twenty-two offices, 57% followed the guidelines established by Rule NBR-5413 [6] and 43% did not. [6]

Noise comfort levels

Out of twenty-two offices, 23% followed the guidelines established by Rule NBR 10152 [7] and 73% did not and 4% have not been tested..

Indoor temperature

In all measured workstations, temperature was above comfort level established by rule NR-17 Ergonomia[9], which is between 20 and 23 Celsius degrees.

Air humidity

In all measured workstations, air humidity was above the minimal level established by recommended NR-17 Ergonomia (40%) [9].

Furniture adequacy to guideline NR-17 Ergonomia [9]

Chairs: 23% of measured chairs are adequate to guideline and 77% are not.

Tables: all measured tables are adequate to guideline .

Employee satisfaction survey

Workers were given a questionnaire so that they could answer questions about their perception of working conditions and hazards. Results are such as follow:

Satisfaction levels regarding furniture and adequacy to guideline NR-17 Ergonomia [9]

Satisfied – 30% Dissatisfied - 65% Did not answer - 5%

Physical discomfort levels

Yes (declared pain or discomfort) - 85%

No (did not declare any pain or discomfort) - 15%

Satisfaction levels regarding office brightness

Satisfied - 70%

Dissatisfied - 30%

Satisfaction levels regarding noise comfort

Satisfied - 70%

Dissatisfied - 30%

Satisfaction levels regarding indoors temperature and humidity

Satisfied - 80%

Dissatisfied - 20%

4. Discussion

Brightness levels

The research has found brightness levels which are either below or above standard. Both can be hazardous to workers' health in the long run. As regards distribution, guidelines recommend even and uniform lightening, which does not occur today. More than half workstations lie outside the guideline NBR 5413 [6].

Noise levels

Many measurements have stayed within standards. The research has found above standard noise levels. It is worth mentioning that instantaneous measurement results lie within what is considered tolerable by reference [7]. However, employee report discomfort due to long exposure to noise.

5. Conclusion

Comparison between questionnaire replies and measurements show that most people readily perceive when furniture, temperature and noise levels are inadequate [8]. However, they do not detect inadequate brightness as readily.

Results and recommendations

Some issues can be settled through education of the workforce, as regards the correct usage of furniture and computer screens. In some cases, furniture must be replaced and supports (for feet etc.) must be provided. As regards brightness levels inadequate to guideline NBR 5413 [4], a lighting project can fix them.

Preventive measures

A company workout plan has been suggested and implemented in recent times, which aims at physical, psychological and social benefits.

Next steps

To ensure continued work conditions improvement, many professionals (engineers, physical therapists, physicians, managers, psychologists) have been invited to give workshops to the management sector of Inmetro (managing board, maintenance, safety and

health offices). Cooperation must aim at deciding action guidelines and control, prevention, and containment measures.

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