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ERGONOMIC SYSTEM AND MANAGEMENT OF THE LIGHT CLIMATE ON WORKPLACES

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ABSTRACT:
This paper is about definition of complex light climate requirements in the work places from ergonomic point of view. Mutual interactions of each component of work system are showed and described in algorithm scheme. Manager approaches to the solution of optimal light climate on the workplaces are stressed.
KEYWORDS:
ergonomic system, light climate, system approach.

1. INTRODUCTION

Ergonomics is interdisciplinary science that deals about optimization of human activity in the work process. Within ergonomics system, multiple subsystems are acting to the final fulfillment of the work task by the worker in the given working environment. Partial component of working environment is also influence of the non-ionization radiation, which produces light climate on the workplace. Light in its natural, artificial or combined form is very important for health, comfort and safety of the worker during fulfillment of work tasks. Projection process, implementation and operation of workplaces cannot be linked just with fulfillment of technical requirements to the light as stable state. It is dynamic process, mainly in the stage of operation (e.g. production and services) that changes in the time.

The goal of this article is to define ergonomics subsystem of the light climate on the workplace with stress to the manager approaches.

2. REASONS FOR OPERATION ASSESSMENT OF THE LIGHT CLIMATE ON THE WORKPLACES

Solving of the light conditions on the workplaces in the various stages of workplace lifecycle is qualified by changes. Causes of these changes in the stage of operation (after final building approval) are following:

1. Differences in compare with projected solution occur (change of the construction components, colors, type of the light sources, etc.)
2. There is a change of interior on the workplaces (change of interior equipment, furnishing – shape, shielding, color, layout of the workplaces)
3. Changes made in the exterior can influence amount of daylight in the interior (surrounding buildings in the area, clerestory, etc.)
4. Light climate changes are also connected with process control of facility management – building administration, maintenance, cleanness, etc.
5. Changes related to worker, changes of work tasks without appropriate modification in the light climate, flexible production
6. Changes of the worker itself (sensorial changes related to the worker's age, health etc.)
7. Not respecting of individual characteristics of the worker and shielding by its own body – differences in the light distribution requirements for right and left handed workers.

Above mentioned changes and their impacts to the light climate of the workplace are often solved just in the projecting stage and very often there is no verification of the real values (e.g. measurements of daylight). In order to create general system of light climate control on the workplace, following algorithm has been proposed.

3. ALGORITHM OF ERGONOMIC LIGHT CLIMATE SUBSYSTEM OF THE WORKPLACE

To create general algorithm of ergonomic light climate subsystem in the company, individual approach to the each work place needs have to be applied. This means that every work place and work task in relation to the worker have to fulfill individual ergonomic requirements. Mathematically ergonomic subsystem can be expressed as sum of each partial subsystem.

$$ESS_{LC,F} = \Sigma\, ESS_{LC,WE} = \Sigma\Sigma\ ESS_{LC,WP} \quad (1)$$

where:
$ESS_{LC,F}$ – is overall ergonomic light climate subsystem of the company (firm),
$ESS_{LC,WE}$ - ergonomic light climate subsystem of the working environment, $ESS_{LC,WP}$ - ergonomic light climate subsystem of the workplace.

Principle of individualization could in practice bring complexity and high costs. Within simplification of operation and light climate on the workplace it is necessary to:

- find common, joint solutions for similar groups of work tasks (grade of work) and sort them on one workplace if it can be technologically applicable. On such workplaces it is appropriate to provide light e.g. by biodynamic systems,
- allow individual solutions on the workplace (additional lighting, shielding, regulation of light intensity, etc.),
- create areas for resting also from visual aspect, it means there, where work task is carried out under artificial light, resting should be under daylight conditions. In other words, suitable is change of the light with different spectrums,
- it is suitable for visual heavy works to avoid sensorial fatigue by use various work techniques (job rotation, job enrichment) and change or rotate workplaces,
- secure visual contact not just from inside but into exterior, where is it possible.

Figure 1. An example of work space shielding by mass of press and diagnostic machine

Proposed algorithm on the Fig. 2 is oriented to the human – worker as dominant part of the work system. Subsystem of the light climate should create conditions for optimal fulfillment of the work tasks by employee.

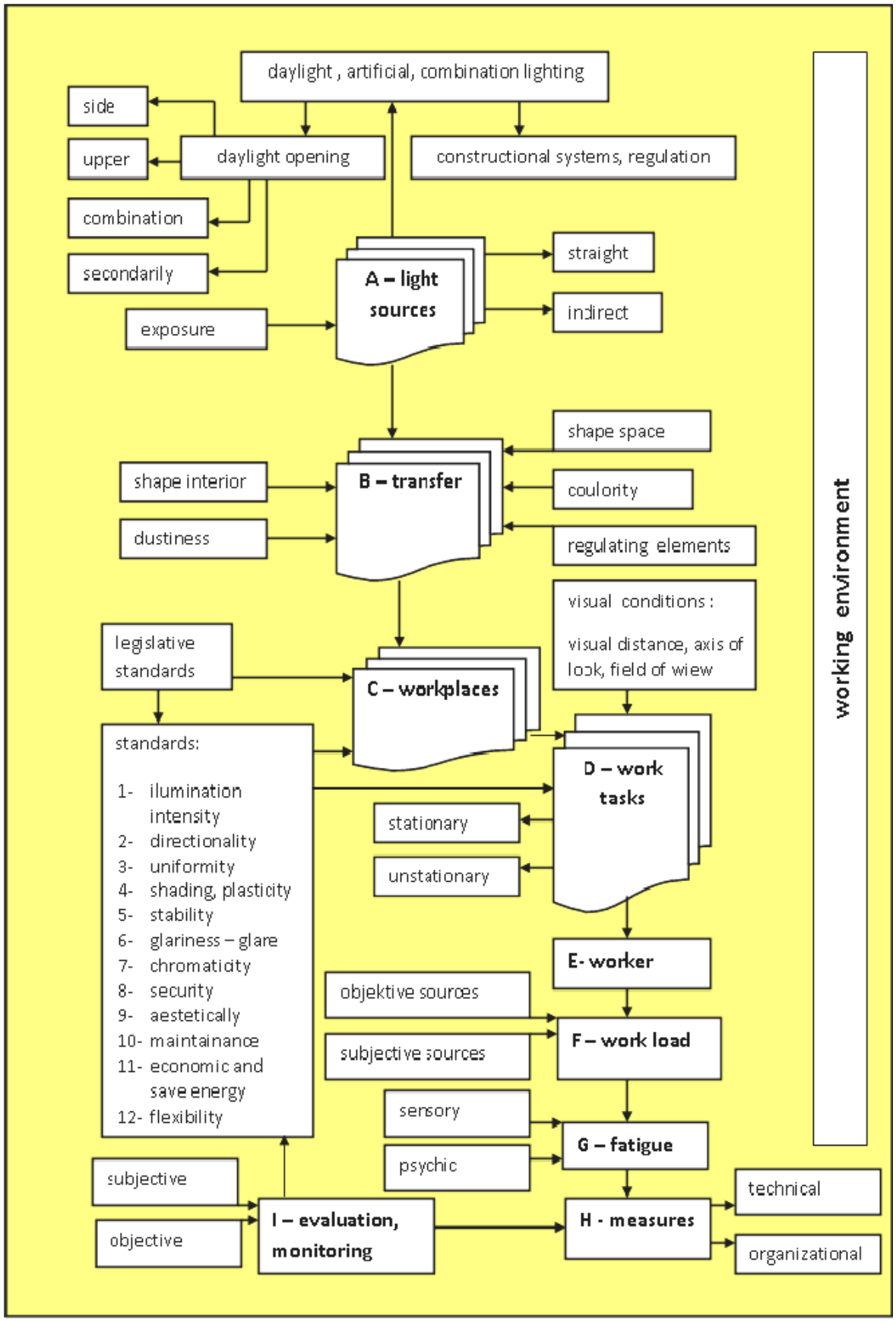

Figure 2. Example of general algoritm of light climate subsystem in workplace [1,2]

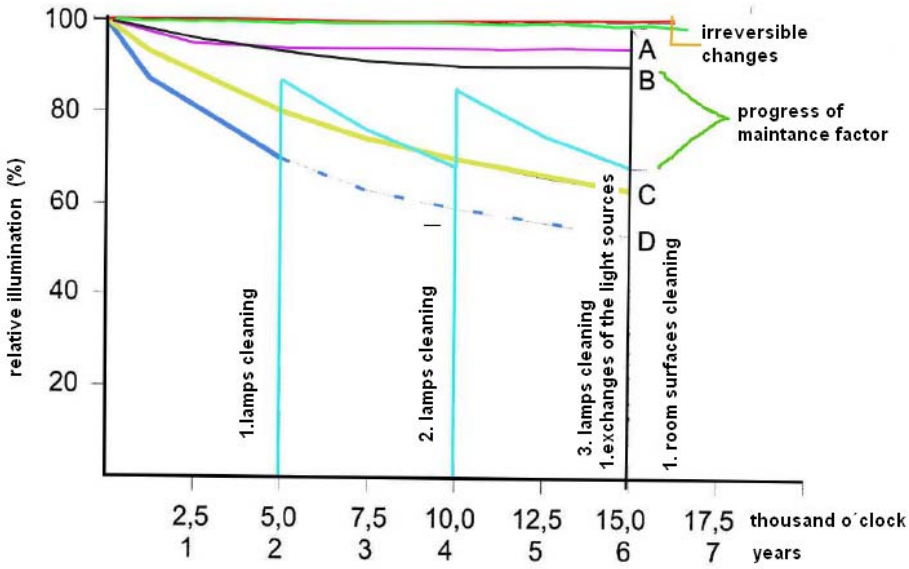

Figure 3. Changes of lighting in progress of durability system [5]

On the figure no.2, there are 12 legislative standards for light climate on workplace. It is necessary to analyze each of them – for example, it is necessary to evaluate illumination intensity for daylight, artificial and combinative lighting. At the artificial lighting, there is a demand to achieve maintain lighting E_m (lx) according to requirements of European norm for given job. It is influenced by cleanness and servicing of lights according to their durability – figure no.3.

4. CONCLUSION

The need of continual monitoring and assessment of the light climate is stressed in this system approach by use of measurements or by assessment of the worker's health condition. Assessment has to be carried out after each 7 above mentioned changes. During periods in-between it is suitable to monitor eyesight of the workers by doctor and evaluate sensorial load by use of questioners – subjective assessment

Mentioned ergonomic subsystem should be examined also from worker position and movements towards light sources to ensure that shielding of the light is not happening during the work task (by own body or technology).

Manager approaches in this area should be focused on:

- inspection of technological state of transparent constructions and light systems,
- preventive maintenance of the light systems and cleanness of the light systems, windows and work places,
- informing of the workers with sensorial work risks,
- continual monitoring of the light climate quality and taking measurements for its optimization and save energy.[3, 4]

The outcome effect should be satisfaction of the employees with the work environment and achievement of required work tasks with acceptable health risks. Mentioned system has to be elaborated to the specific conditions and should be implemented into ISO 9000, 14000 and 18000 quality systems within integral management systems in the particular company [6,7].

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