iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 9 **Issue:** XI **Month of publication:** November 2021

DOI: https://doi.org/10.22214/ijraset.2021.38956

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue XI Nov 2021- Available at www.ijraset.com

Ergonomic and Psychological Bases of Operational Safety

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Abstract: Depending on the working conditions, jobs are divided into different groups. Of these, special attention should be paid to high-risk and harmful conditions. High-risk work includes work that can result in a high level of injury, trauma, and accidents to the worker during work.
Keywords: technical, sanitary, harmful work, harmful factors.

I. INTRODUCTION

The main causes of risk in high-risk work are divided into organizational, technical, sanitary, hygienic and psycho-physiological reasons, which are determined on the basis of accidents that may occur due to high risk. Such work includes workplace equipment, height of the workplace, unloading of awkward shapes and sizes from above, working in soil depths, work with excessive humidity, work with air pressure and temperature above or below normal, with toxic chemicals performance, work with a high risk of explosion, work with high levels of radioactivity. Highly harmful work is defined as work that results in a high level of occupational diseases and loss of health during work. These jobs can include jobs that exceed the norm of harmful factors. In this case, it is important to take into account the conditional work, which is mainly harmful substances in the air - harmful gases and dust. This is because harmful factors in the air are taken into account when calculating any work under favorable working conditions.

Excessive levels of harmful factors such as noise, vibration, heat radiation, radioactivity, laser beams, etc., also lead to the inclusion of work in the category of work with high harmful conditions. Types of work with harmful and toxic substances that have their harmful effects on human health are also included in the type of highly harmful work.

II. MAIN PART

Ergonomic, meteorological requirements and conditions of labor protection In the study of the subject "Safety of life" data of other social, technical, humanities disciplines are taken into account. Among them, the knowledge of the science of ergonomics is also of great importance. The word ergonomics is derived from Latin and means "ergo" - (work) work, "nomika" - (science) science, i.e. "work science". Ergonomics solves certain important tasks related to comfort, safety in the process of human labor. Thus, ergonomics as a unit that solves important tools tries to bring technology closer to man, considers the existing problems in the system "man - technology". Within ergonomics, there are five types of compatibility - informational, biophysical, energetic, spatial-anthropometric and technical-aesthetic adaptation, the provision and implementation of which ensures the successful completion of the task. The various processes performed and the equipment associated with it, the device that transmits and displays information within the devices - the machine model, the operator performs control work, even in a complex system. In order to perform the task, it is necessary to create an information model from the ergonomic point of view, which will give a timely description of the machine, so that the operator can tirelessly, thoughtfully and attentively receive and process information.

The solution of a complex task depends on the safety of the operator, accurate quality work, labor productivity, as well as the suitability of the human psychophysiological capabilities to the information model. Biophysical compatibility refers to the ability of the operator to work, the creation of an environment that provides a normal physiological state. This task is related to labor protection requirements. Many environmental factors, limit quantities are defined by law and they may not be permanently related to the operator's job function and they may not be permanently related to the operator's job function. Therefore, special inspection of all units such as noise, vibration, air environment is required in the creation of machines. Human strength and energy ability have a certain limit. Therefore, fatigue in the control system during operation can lead to inappropriate consequences. It also reduces the accuracy of the operating system. Such a limitation or environmental situation, factors must be taken into account.

Energy compatibility represents the agreement in the control of the machine with the power required, power expended, accuracy and speed of movement based on the optimal capabilities of the operator.

Spatial-anthropometric compatibility means taking into account the size of the human body, the possibilities of the influence of external space, the position of the operator in the work process, the position of the body. In the correct solution of the task, the size of the workplace, the distance the operator moves, the height, the distance to the control panel and other indicators are determined.

The diversity of anthropometric indicators in humans in ensuring compliance leads to a complex situation, and ergonomics helps in solving this task.

Technical-aesthetic compatibility means providing a person with satisfactory conditions in the process of work, in communication with the machine. Artists, designers, painters and others are involved in solving numerous and extremely important technical and aesthetic issues.

The meteorological conditions of the production zones of industrial enterprises are characterized by air temperature (0S), relative humidity (%), air pressure (mm. Mercury or Pa) and air velocity (m / s). In addition, there are production factors that affect the meteorological conditions, that is, various equipment in the production facilities and the materials being processed, the heat rays emitted from the surface of the substance lead to an increase in air temperature. The air environment formed under the influence of these factors in the production zone is called the industrial microclimate.

Each of the meteorological units and factors, individually or in combination, has a huge impact on a person's ability to work and health.

In some cases, such exposure may be beneficial. For example, when the relative humidity increases due to the heating factor in cold conditions and at the same time due to the vapors and vapors released from the technological processes, it can be a normalizing factor.

In some cases, the combination of factors can increase the level of harmful effects. For example, an increase in relative humidity and temperature creates severe conditions for humans. In addition, an increase in air movement in the workplace gives a positive result when the temperature is high, and a negative result when the temperature is low, which can disrupt the heat management of the human body.

Thermal management of the human body means the ability to maintain body temperature within the same range (36-37 0C) based on physiological and chemical processes.

Maintaining a constant body temperature in the face of constantly changing meteorological conditions ensures the normalization of biochemical processes in the body, which is the basis of human life. An increase in body temperature above the above level is called "warming" and cooling is called "cooling". Heating and cooling can create a catastrophic situation that disrupts labor activity. Therefore, there is a physiological mechanism of "heat management" in the human body, which is under the control of the central nervous system. The main function of this physiological mechanism is to maintain the heat balance by releasing the excess heat released as a result of metabolism in the body into the external environment. Thermal management can be of two types - physical and chemical.

Chemical heat management can reduce the body’s metabolism during the warm-up period and increase metabolism as a result of cooling. However, chemical heat management is less important than physical heat management in the face of abrupt changes in the external environment.

Basically, physical heat management is important when transferring heat to the external environment. There are three ways heat can be released from the body into the external environment:

1) By infrared radiation from the general surface of the human body (radiation) air exchange.
2) Heating of the air environment surrounding the body.
3) As a result of sweating, evaporation of the skin and evaporation of fluids through the respiratory tract. Under normal conditions, with weak air movement, a sedentary human body loses 45% of the heat produced by radiation, 30% by convection (heating) and 25% by perspiration. In this case, more than 80% of the total heat through the skin, 13% and about 5% through the respiratory system is used to heat food, water and air.

Heat loss through radiation and convection can only occur when the ambient temperature is lower than body temperature. The lower the ambient temperature, the stronger the heat loss. If the ambient temperature is higher or equal to body temperature, then the heat release is due to sweating and evaporation. 2.5 kJ (0.6 Kcal) of heat can be lost due to evaporation of one gram of sweat.

The amount of sweat excreted in the body depends on the ambient temperature and the category of work performed. In an immobile organism, the ambient temperature is 150C, while the amount of perspiration is very small (30 ml per hour).

At high temperatures (300S and above), especially when doing heavy work, the body's sweating is greatly increased. For example, in hot shops, as a result of hard work, the amount of perspiration is enough for 1-1.5 liters per hour, and this amount requires 2500-3800 kJ (600-900 Kcal) of heat to evaporate sweat.

Heat dissipation through sweating occurs only when it is stimulated from the surface of the body. Evaporation of sweat depends on the movement of air, relative humidity, the material of clothing worn.

When heat loss is carried out only through perspiration, when the relative humidity of the air is more than 75 - 80%, the evaporation of sweat becomes difficult, and "warming" can occur as a result of a violation of the body's thermal management.

The first sign of warming is a rise in body temperature. Weak warming can be characterized by a slight rise in body temperature, excessive sweating, intense thirst, shortness of breath and rapid heartbeat. If there is a strong heat, it is difficult to breathe: severe headache, dizziness, difficulty speaking. This type of heat head aging disorder and a sudden rise in body temperature is called heat hyperthermia.

The second sign of heat is caused by the loss of large amounts of salt by the human body when sweating (45g). This condition is caused by a decrease in the ability of the skin to retain water with a decrease in salt in the skin cells. The constant sweating of drinking water exacerbates thirst, which can lead to intoxication. This causes tremors in the parts of the body, heavy sweating and liquefaction of blood, followed by heat stroke. The body temperature rises to 40-41 0S, the person loses consciousness and the vascular warfare weakens. At this time, sweating from the body stops completely. Tremors and heat stroke can end in “death”. Not only high temperature but also low temperature affects the human body. Prolonged exposure to low temperatures leads to disruption of basic physiological processes, impaired ability to work and disease of the organism.

Under the influence of low temperatures, blood vessels constrict, as a result of prolonged exposure, the activity of capillaries is disrupted, after which the body feels completely cooled. Freezing of the external nervous system can lead to radiculitis in the skeletal system, rheumatism in the legs, arms and waist, its joints, as well as "pleurisy", bronchitis and other infectious diseases associated with colds. The effect of cold on the human body, especially the movement of air, is strong. The effect is especially strong when the relative humidity of the air is high, because cold, humid air at room temperature conducts heat well and increases heat loss through convection.

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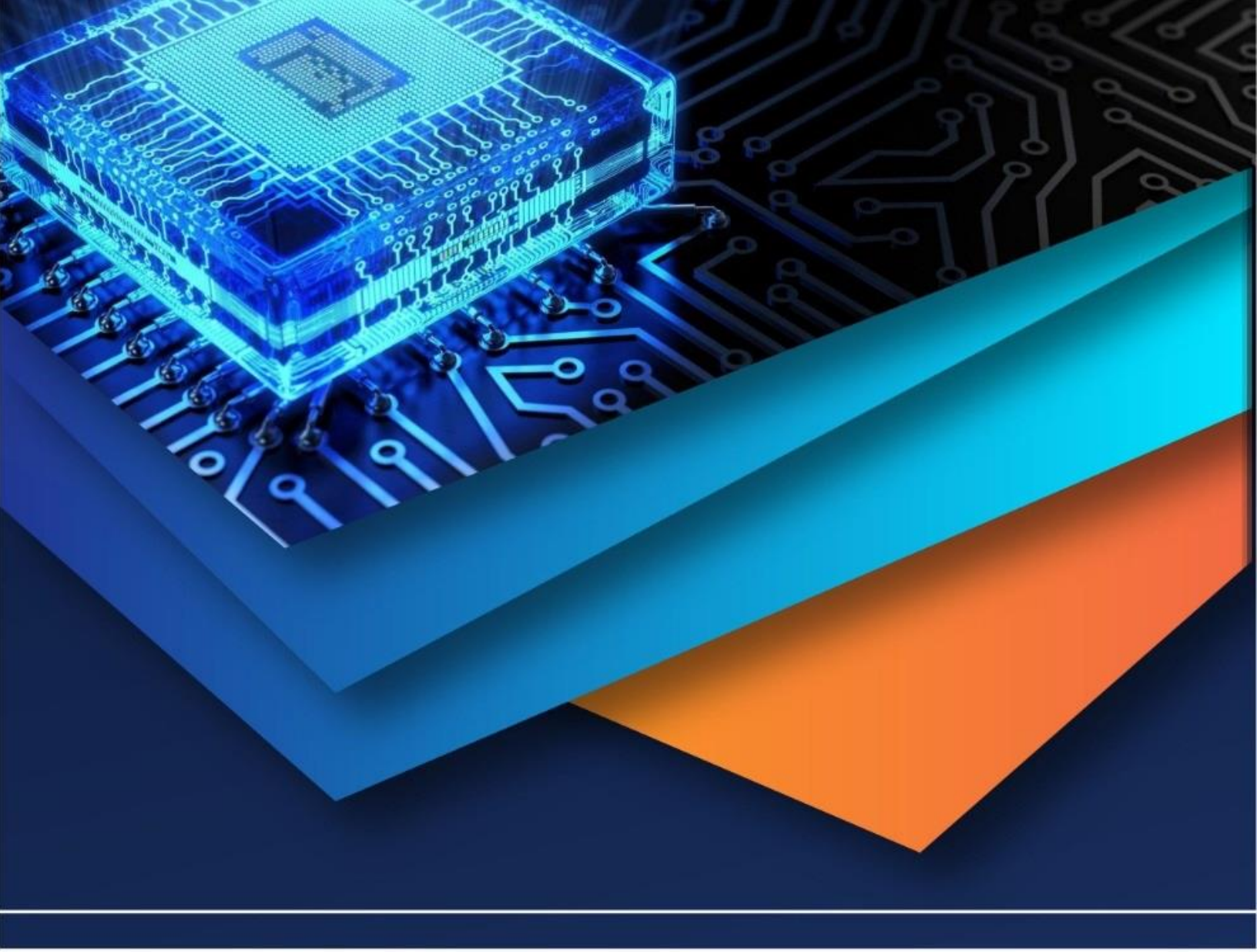

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