Reliability Engineering Techniques Applied to the Human Failure Analysis Process

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EXECUTIVE SUMMARY

Human reliability and human error are factors that are present in all areas: industrial, economic, social, etc. All these areas require to a greater or lesser extent a physical and mental effort to satisfy their own needs, those of others, or established requirements that, depending on the circumstances and the nature of the person, can lead to errors. Certainly, it is not possible to find a single human reliability method that can meet all the expectations and technical demands related to the analysis of human errors. However, it is important to note that the orientation of all human reliability methods is focused on the study and analysis of the risk factor (frequency by consequences). In other words, as can be observed throughout this chapter, all human reliability methodologies seek to help us reduce the uncertainty in the process of evaluating the frequencies of unforeseen events (human errors) and the consequences that such human errors can bring to safety, the environment, and the operations within the framework of an industrial production process.

INTRODUCTION

The study of human error can be as broad and varied as desired, depending primarily on the area in question. If we talk about the industrial sector, aviation, the nuclear sector, O&G, petrochemicals, construction can be examples. The level of demand and the depth of the analysis of human failures must respond to the magnitude of the possible consequences (human, environmental, social, operational) that these failures may bring within the environment in which they are interacting.

In either case, the error is taken as a generic term to include all the occasions in which a sequence of physical or mental activities fail to achieve the desired result (Reason, 2002). Human beings are not precision machines designed for accuracy. In fact, we are a completely different kind of device. Creativity, adaptability, and versatility are our best weapons. The inability to maintain constant attention and inaccuracy in both actions and memory are our weak points. Furthermore, the very characteristics that lead to such strength and creativity also produce errors (Blanchard et al, 1995). Human Reliability is defined by the EU (1998) as the body of knowledge that refers to the prediction, analysis, and reduction of human error, focusing on the role of the person in the design, maintenance, use and management of a socio-technical system (National Institute for Safety and Health at Work, 1994).

On the other hand, the previous definition can be complemented by stating that Human Reliability is the ability of a person (an operator) to fulfill a required function under given conditions for a given period of time. When you do not have this capacity, errors occur, and it is through the quantification and evaluation of these errors that the degree of reliability of the system is appreciated. In an industrial setting, technical and human reliability are two dimensions of the same system acting in permanent interaction.

According to (Reason, 2002) and (Institute for Nuclear Power Operations, 2009), over 80% of industrial accidents are caused by human actions, and 20% by mechanical failures. In this 80%, 70% are due to latent causes and 30% to individual errors. More results and surveys can be found at (Perrot, 1984). In the same reference, there is a systematic view of human error as a human tendency, where, in addition, the environment can lead to error (for example: a poor or inadequate design, differences between the demands of the system and human capacity, etc.). Likewise, there are contexts where mistakes are not forgiven (the culprit is found and punished), as well as other organizational factors such as inadequate company culture or a lack of a sense of belonging.

A fundamental aspect of the causes of human errors is ignorance. The increase in the possibility of committing human errors, is manifested when sometimes people do not have enough knowledge, skills and experiences that are related to the integrity of the activity or process in which they perform. This makes it difficult to understand the signals emitted by the operational context, which leads to inappropriate actions that cause mistrust, unreliability and, ultimately, generate human errors.

People and organizations are not fully aware of the risks and dangers present in any activity that requires physical effort. In fact, this awareness of risk is directly or indirectly related to people's own behavior, to human-machine interaction, and / or to the organization as a local environment (for example, noise and temperature). To the above, common conditions for the performance and use of HR can be listed. Some may be, for example:

- Adequacy of the organization.
- Working conditions.
- Adequacy of the human-machine interface and operational support.
- Availability of procedures / plans.