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USING CREAM TECHNIQUES FOR INVESTIGATING HUMAN ERROR WITH COGNITIVE ERGONOMICS APPROACH IN THE CONTROL ROOM OF CEMENT INDUSTRY

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ABSTRACT

Human errors are known as the most noble and most key factor in industrial accidents. Investigating different methods to assess human errors, development of new methods for the analysis of human errors, checking more errors, and more detailed understanding of the factors affecting the occurrence of errors will be appropriate and effective to reduce human errors.

This study is a case study and research population is community control room of the cement industry.In this study, after assigning tasks and jobs crisis using analysis of HTA,CREAM techniques was used for the analysis of human error. Finally, based on the results, the major causes of error are detected.

HTA findings of techniques include analysis of tasks of shift chief engineer, shift supervisor, the central control room operator. Twenty main tasks and 77 sub-tasks were analyzed. In CREAM, the highest probability of error is related to monitoring and control of the operator with 0.207 probabilities. 85 cases of errors were identified.

Human errors are detected through the basic method of "doing two or more simultaneous task",”circadian full time work-rhythm" and "the quality of the training and work experience" and with extensive knowledge of the errors . Application error of 43%, interpretation error of 26%, planning 20% and 11% observation were obtained.

Keywords: Human Error, Reliability, CREAM, Control Room, Cement Industry

INTRODUCTION

Infrastructure including construction and expansion of the building and construction activities are the most important factors in economic growth and development.

Cement industry is a huge industry and is important with respect to the use and role of cement in various sectors. Iran is one of the few countries with great seriousness seeking development of the industry **[1]**. Like other industries, in cement industry, the roleof the control room operators in guidance and control of the process is very important. Due to the sensitive and criticality of operations in the Room, operator error leads to severe damage to human lives and economic potential. **[2]** Studies in the field of industrial accidents has shown that human factor is the most important and the main cause of accidents, as the statistics show, is the cause of more than 80% of accidents **[3]**.

Human errors are a selection of human procedures that violate the norms and pre-defined standards **[4]**. Many writers developed and promoted measurement techniques for human reliability(Like THERP, HEART, HEROS, MEDA, and JHEDI) with the aim of facilitating the contribution of risk assessment of human factors, through the analysis of errors and reducing the size of the actual error.

Given the increasingly complex systems and industrial processes and emerging technologies and processes on the one hand and also fallible and unpredictability of human error, it has become the cause of decline in the reliability of the system. Therefore, identification, prediction and analysis of human error seem necessary **[5]**. The error analysis with emphasis on human cognitive reliability (Cognitive Reliability and Error Analysis Method) CREAM was presented in 1998 by Eric Hollnagel.

This technique is from the second generation of the human reliability assessment (HRA) and the feature focuses on the cognitive aspects of human behavior. The most important advantages of CREAM than other techniques of evaluation of human error include systematic approach for defining and quantifying human errors both prospectively (predictable human error) and retrospectively (analyzing events). CREAM technique was used for the analysis of Swedish towns Eksjö and NässjöQtarbyn accident that occurred in 1996 **[6]**.

METHODOLOGY

This study is a case study. In this study unit control room has been selected as the site. Cement industry automatic control room of the human role in controlling the process of cement production technology in using the evolutionary tools to measure progress **[8]**. The unit chief engineer, operator and shift supervisor at work, after interview with all the stakeholders, direct observation of

activities, reading daily reports, reviewed documentation obtained. Jobs and critical tasks based on complexity, stress, fatigue and stress were determined and tasks identified by HTA ((hierarchical task analysis were analyzed. The error analysis techniques with emphasis on human cognitive reliability CREAM was done in 2 steps.

Step 1: Initial approach: assess conditions affecting the performance of the user (CPCs) Common Performance Conditions After analyzing the job, at this stage, the overall characteristics of the task and working conditions affecting the performance of the operator CPCs done. Grdd.jht determine the overall risk of cognitive failure (cognitive failure probability total) CFP t the following formula was used.

$$CFPt=[0.0056 \times 10^{0.25\beta}]$$

Improvement of performance-rate reduction of beta coefficient= beta coefficient

Step 2: CREAM approach: specific cognitive demands associated with each of the different parts of each job or job functions were determined. Then the cognitive errors may be identified for each job.Using the formula for the probability of bit error cognitive task (cognitive failure probability) CFP i was estimated **[9]**.

$$CFPi=[CFPtotal \times 10^{0.25PII(Performance\ Influence\ Index)}]$$

RESULTS

After job analysis and identify errors in the related tasks, the number and the Probability of error for the different tasks set were calculated. Findings of HTA techniques included analysisof chief engineer jobs, shift supervisor, the central control room operator tasks. For each job, 8-6-6 main task and 29-25-23 sub-tasks were analyzed, respectively. The results of the technique based on the separation of duties, the probability of error have been calculated and sorted in **Table 1**.The highest probability of error for the monitoring and control (operator) has probability of 0.207. 85 cases errors were identified (**Table 2**).

DISCUSSION

In recent decades, the incidence of adverse and disastrous events such as Felix Euro (1976-UK), three Mile Island (1979-America), Bhopal (1984-India), Chernobyl (1986-Russia) due to human error showed that despite significant advances in the application of advanced technologies and the use of automation in industry and industrial processes, again, people have so sensitive and critical roles in some jobs that occurrence of a simple human error can cause an unfortunate incident and regret **[10]**.

In the early 30th, Heinrich stated unsafe acts as the main reason of events **[11]**. CREAM

method has the ability to determine the likelihood of human error or part of the causative fault and is backed by extensive theoretical focus and high sensitivity on the cognitive aspects of human behavior (such as perception, memory, reasoning, and motor response).

Identification of factors affecting the performance of the individual: the factors include having simultaneous tasks to do, present guidelines, state of work shift and job-training programs availability.

The results obtained in this study matched with previous studies, including the study of human errors in the control room petrochemical industriesBy Mustafa HamzeyanZiaratiusing CREAM technique [11].

CONCLUSION

Human errors are detected through the basic method of "doing two or more simultaneous task"," circadian full time work-rhythm" and "the quality of the training and work experience" and with extensive knowledge of the errors . Application error of 43%, interpretation error of 26%, planning 20% and 11% observation were obtained.

Table 1: Calculated error of CREAM technique

row	Task and job	probability
1	Monitoring and control (operator)	0/207
2	Control signs (operator)	0/201
3	Coordination to solve the problem (the supervisor)	0/089
4	Continuity of production (chief engineer)	0/065
5	Relationship with a local operator (operator)	0/063
6	Relationship with supervisor (operator)	0/063
7	Work permit (supervisor)	0/056
8	Decisions about abnormal conditions (chief engineer)	0/039
9	Coordination for Academic Affairs (chief engineer)	0/019
10	Receive data and instructions (operator)	0/018

Table 2: Identified error by CREAM technique

Row	Task and job	Number of identified errors
1	Chief engineer	31
2	Supervisor	28
3	Operator	26
Total		85

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