

ORIGINAL RESEARCH PAPER

Comparison of Two Human Error Evaluation Techniques (HET and SHERPA) in Gas Supply Operations using AHP

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ABSTRACT

Introduction: The development of residential and industrial areas has led to increasing gas consumption and overcrowding in gas supply networks. Accordingly, hazards and risks caused by human errors, processing and mechanical failures in pipelines, and gas leaks are on a rise. Several techniques have been so far proposed for identifying and controlling human errors. The main purpose of this study was to compare two human error evaluation techniques, namely, Human Error Template (HET) and Systematic Human Error Reduction and Prediction Approach (SHERPA) in gas supply operations using the analytic hierarchy process (AHP) to select a suitable method.

Material and Methods: This cross-sectional descriptive study was to identify the human error modes in one of the gas supply projects operating by Kurdistan Gas Company, Kurdistan, Iran. Different tasks in gas supply operations were accordingly determined by the health, safety, and environment (HSE) unit, then the ones susceptible to human errors were selected and analyzed through task analysis technique. The next step was to weight and rank the human errors by evaluating indexes based on many variables including accuracy, sensitivity, and quantity of the errors as well as usability, time, and education analysis using the Expert Choice software (ver. 11).

Results: According to the findings of this research, the criteria were ranked based on accuracy (0.339), sensitivity (0.322), quantity of errors (0.118), usability (0.116), time (0.056), education (0.050), and analysis. The inconsistency ratio was also equal to 0.1, which meant that the subjective judgments were accepted.

Conclusion: The results also showed that the analysis of human errors, using the HET, required less training and time, while the number of the detected errors and applicability in the SHERPA was greater. Considering the weight of the criteria, their importance in determining the superior technique and the weight of each one in relation to the criteria, the contribution of that method in the relevant criterion was expressed. Calculating the final weight of the techniques revealed that SHERPA with a weight of 0.53 was more practical compared with HET with a weight of 0.46.

Keywords: Human Error, HET, SHERPA, Analytic Hierarchy Process

1. INTRODUCTION

The development of residential and industrial areas has led to increasing gas consumption and overcrowding in gas supply networks. Accordingly, hazards and risks caused by human errors, processing and mechanical failures in pipelines, and gas leaks are on the rise. The results of the root cause analysis of processing accidents in urban gas stations show

that the rate of occurrence of human errors per year is more than twice than that of processing and mechanical failures (1). However, human errors are the main cause of 70-90% of work-related accidents in industry (2). Investigating different incidents have further shown that human errors can arise as a result of a combination of personal, managerial, and organizational factors, complexity of work, environmental conditions, design of equipment

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and devices, training, monitoring, as well as presence or absence of work instructions. Hence, it is not possible to introduce only one factor as the main cause of human errors and their consequences (3). Studies have also demonstrated that early identification and correction of human errors can prevent many catastrophic events (4). This process requires comprehensive and appropriate methods or techniques. Accordingly, there are several techniques for identifying and controlling human errors. However, the main purpose of this study was to compare two techniques, i.e., Human Error Template (HET) and Systematic Human Error Reduction and Prediction Approach (SHERPA) in gas supply operations using analytic hierarchy process (AHP) and to select a suitable method.

2. MATERIALS AND METHODS

This cross-sectional study was to identify the human error modes in one of the projects operating by Kurdistan Gas Company, Kurdistan, Iran. To this end, different tasks in gas supply operations were determined by the health, safety, and environment (HSE) unit, then the ones susceptible to human errors were selected and analyzed through task analysis technique. In this study, human errors were identified by the HET and SHERPA techniques.

The HET has been developed specifically as a diagnostic tool for the identification of design-induced errors. The steps in this technique included: (a) identifying error modes (there are twelve error modes to specify in this method), (b) providing a description (for each credible error) of error mode, (c) determining consequences associated with errors, and (d) estimating error likelihood (low, medium, or high) and criticality (low, medium or high) (5, 6)

The SHERPA was another technique exploited to identify human errors in this study. In this sense, each task step was classified into one of the five following error types: action, retrieval, checking, selection, and information communication (6). The steps in the SHERPA included: (a) determining credible error modes for a task in question, (b) describing error mode, (c) establishing consequences associated with errors and any future task steps that might lead to recovery from errors, (d) providing an ordinal likelihood of errors occurring, assigned with low, medium or high, together with criticality (low, medium or high), and (e) offering potential design remedies (i.e. the



Fig. 1. Pair-wise comparisons between HET and SHERPA

way interface design could be modified to remove errors) (6).

At the next step, AHP was utilized to compare the two techniques. For this purpose, the research team determined the comparison criteria according to expert judgment. These criteria consisted of accuracy, sensitivity, quantity of errors, usability, time, and education. Finally, the weight and the rank of the human errors were calculated using the Expert Choice software (ver. 11).

3. RESULTS AND DISCUSSION

According to the study findings, the relative criteria of the pairwise comparisons were ranked based on accuracy, sensitivity, quantity of errors, usability, time, and education, as presented in Fig. 1. Accordingly, the weight of the SHERPA and HET techniques were calculated by 0.53 and 0.46, respectively. The inconsistency ratio was also equal to 0.1, which meant the subjective judgments could be accepted

4. CONCLUSION

The results revealed that human error analysis, using the HET required less training and time, while the number of detected errors and applicability in the SHERPA was greater. Considering the weight of the criteria, their importance in determining the superior method and the weight of each one in relation to the criteria, the contribution of that method in the relevant criterion was expressed. Calculating the final weight of the technique revealed that the SHERPA with a weight of 0.53 was more practical compared with the HET with a weight of 0.46. Therefore, it was concluded that the SHERPA could better identify human error modes

compared with the HET in this study.

5. ACKNOWLEDGMENT

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6. REFERENCES

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