Influence of Demographic Factors on the Process of Safety Management (PSM) in Fireworks Industry in Sivakasi, Virudhanagar District

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***Abstract*--The establishment of good process safety management (PSM) is widely considered as the most effective means of improving safety levels in fireworks industry. A study was conducted to evaluate the feasibility of implementing PSM in Sivakasi fireworks industry. This study focuses on emergency response planning, employee training for learning the firework process and investigation on industrial accidents. This study concludes that the establishment of a sound PSM system in the fireworks industry is feasible.**

Keywords: Fireworks industry, Process safety management, emergency response planning, employee training, and investigation on industrial accidents.

INTRODUCTION

In fireworks industry, raw materials are converted into intermediates or final products applying physical and/or chemical processes. In these units, in production, storage and transportation, the use and disposal of chemicals are inherently dangerous and the potential for catastrophic accidents is very high [(1)]. As accidents in these units may lead to loss of life and damage to equipment, economic losses and environmental pollution, great efforts have been made to improve safety. This has been promoted by traditional safety measures and a passive approach toward developing preventive laws and regulations, such as the introduction of process safety management (PSM).

PSM was introduced in 1990 by the U.S. Occupational Safety and Health Administration (OSHA) and its final, complete version was published in 1992. Accident prone industries have since used this management system to limit and control chemical risks. OSHA estimated that 6 to 10 years after the implementation of PSM, the risk of accidents had decreased 80% and nearly 264 deaths and 1,534 injuries or illnesses had been prevented each year. A study of fireworks industries of Chinna found that seven years after the implementation of PSM, the number of deaths, injuries and "near misses" had been reduced by 62%, 58% and 82%, respectively. Additionally, quality and productivity had improved.

Fireworks industry is a very important sector in Virudhunagar District. The units due to the nature of the flammable and toxic materials they process, operational conditions, and thereby experience severity of consequences resulting from accidents (3).

REVIEW OF LITERATURE

Derek J. Howarth and Chakib Kara-Zaitri (2005)[4], discusses fire safety management in passenger terminals. Describe the design, development, implementation and validation of a fire safety management model for use in airports, railway and bus stations. The research carried out is based on a comprehensive analysis of 25 terminals (air, bus, rail and sea) in the UK and Europe. The study find out the relationship existing between fire risk, people and fire safety management. Although the model is still being reviewed and augmented, it has already produced interesting results and has proved to be an efficient, robust and quantifiable tool for use by fire safety managers.

Alan H.S. Chan W.Y. Kwok Vincent G. Duffy, (2004)[5], in their study used the hierarchy process (AHP) method to determine the priority of processes outlined in the BS8800 Guide to Occupational Health and Safety Management Systems for the Hong Kong construction industry. Analysis of variance was used to further investigate the differences among three different kinds of construction enterprises: joint venture (JV), well-established (W-E) and small and medium sized (SME) enterprises. This study of 32 construction enterprises suggests that JV and W-E enterprises are able to demonstrate stronger commitment to strategic safety issues whereas SMEs focus more on the short-term safety issues in implementation of safety management system. The results also indicate that "Safety Training" may be a problem area in all three groups. When considering differences shown between groups, these rankings can be used as a guide for the practical implementation of the British Standard BS8800 Safety Management System in construction enterprises in Hong Kong.

OBJECTIVE OF THE STUDY

To study the influence of demographic factors on process safety management in fireworks industry.

RESEARCH METHODOLOGY

Data Sources: The study depended on both primary and secondary data. A sample survey was conducted during February-April 2016. The completed questionnaires were checked immediately on the spot in order to avoid revisits.

Sampling design: In the absence of a concrete sampling frame about the total number of workers working in the fireworks industry on the data of sample survey, it was decided to have a reasonable sample size of two hundred employees. However, thirty questionnaires were found to be incomplete, and so the author were able to analyses only the remaining one hundred and seventy completed questionnaires.

Research Design: The study design is of descriptive type of conclusive one.

Statistical Tool

The collected data has been analyzed with the help of the following statistical tools: Chi-square test and One-Way ANOVA.

Chi-squared Test

The user, who is analyzing the data on the computer and using a statistical package, can request a Chi-square squared test along with any cross-tabulation such as Cross tabulation on most statistical packages have the opinion of doing a Chi-squared test.

In the manual technique, a Chi-squared statistic has to be calculated from the number in the cross tabulation. This has to be compared with the Chi-square value from the Chi-square table for the given degree of freedom, and a given confidence level. But in the computer user's case, none of these manual steps are needed.

ONE-WAY ANOVA

ANOVA technique is used when an independent variable is of nominal scale with more than two categories and the dependent variable is metric or at least on interval scale. In the present study, one-way ANOVA was performed to find the relationship between certain demographic characteristics and investigation on industrial accidents in fireworks industry.

RESULT AND DISCUSSION

First Chi-square test was made to verify the following null hypothesis.

H0: There is no signification association between Respondents educational qualification and emergency response planning.

Output

Table-1: Chi-Square Test Education qualification and emergency response planning

	Value	DF	Asymp. Sig. (2-sided)
Pearson Chi-Square	22.202	6	.035
Likelihood Ratio	23.106	6	.027
Linear-by-Linear Association	.200	1	.654
N of Valid Cases	170		

The above table shows that the significant association between educational qualification of the respondents and hazarded analysis of fire accidents in fireworks industry. Since the p value is less than 0.05 (0.05>0.035), the null hypothesis is rejected. The small value of Person's Chi-square test clearly states that there exists a significant relationship between the dependents variable and independent variable.

Chi-square test was also made to verify to following null hypothesis.

H0: There is no signification association between age group of the respondents and Training for learning the safety process.

Output

Table-2: Chi-Square Test

Age group of the respondents and Training for learning the safety process

	Value	DF	Asymp. Sig. (2-sided)
Pearson Chi-Square	37.850	16	.002
Likelihood Ratio	37.193	16	.002
Linear-by-Linear Association	.138	1	.710
N of Valid Cases	170		

The above table shows that the significant association between age group of the respondents and training provided by management in fireworks industry. Since the p value is less than 0.05 (0.05>0.002), the null hypothesis is rejected. The small value of Person's Chi-square test clearly states that there exists a significant relationship between the dependents variable and independent variable.

A parametric test namely, One-Way ANOVA was performed to test the following null hypothesis.

H0: There is no signification association between year of experience of the respondents and investigation on industrial accidents.

Output

Table-3: One-Way ANOVA

Years of experience of the respondents and investigation on industrial accidents

	Sum of Squares	DF	Mean Square	F	Sig.
Between Groups	12.594	4	3.148	3.083	.018
Within Groups	168.518	168	1.021		
Total	181.112	170			

The result of analysis of variance is including the variance between groups, within groups, total sum of squares and mean square. The F-ratio of this analysis is 3.083 with probability of .018. At 5% level of significance (95% level of confidence), this analysis does not support the null hypothesis of difference in the sample means, that is, homogeneity of mean of years of experience of the respondents and investigation on industrial accidents.

SUGGESTIONS AND CONCLUSION

Emergency response planning is important process of fireworks industry. It's helpful to reduce the fire accidents. As training is reduces accidents in fireworks industry, it is suggested for organizing a number of training progress meant

for helping the employees to learn to safety process in fireworks industry.

Investigation on industrial accidents is major part of process of safety management in fireworks industry. It's useful for reducing the fire accident in step by step. It is suggested that the management of fireworks units may arrange for accidents studies. That would reduce the hazards accident in the future. Although PSM implementation costs are estimated to be high, the companies implemented it have achieved equal or higher benefits and are happy with it.

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