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Safety Climate-A Study on Private Sector Chemical Companies in Kerala

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***ABSTRACT**--The Indian chemical industry is a key contributor of national economy; it comprises small, medium and large scale units. It is the critical part of Indian economy has the huge potential for growth. A number of multinational and large Indian companies have invested in Indian Chemical sector and Government of India is rendering extensive support to give boost to this industry. Safety climate holds great potential in improving a company's health and safety performance and reducing workplace injury rates. The present study aims to analyse the present safety climate in the private sector chemical companies in Kerala. The study also tries to analyse the effectiveness of present safety measures implemented by the companies. The result indicates that, almost all the safety measures are effective in the private sector chemical industry in Kerala. The article suggested some safety measures or guidelines those must be implemented by the chemical companies for ensuring the safety of their employees.*

***Keywords**-- Safety Climate, Chemical Industry, Safety Guidelines, Private Sector, MSME Sector*

I. INTRODUCTION

Safety climate refers to workers' shared perceptions of their firms and their leaders' approach to safety. Safety climate is considered as the major ingredient of chemical industry. It can be defined as employees' shared perceptions of safety policies, procedures, practices, as well as the overall importance and the true priority of safety at work (Griffin & Neal, 2000; Zohar, 1980). The chemical industry may be described as the industry, which uses chemistry and manufactures chemicals. The prominent feature of the chemical industry is its hazardous nature. Any negligence at any stage from concept stage to design, erection, operation can result into disaster, loss of human lives and huge production losses, etc. Accordingly safety aspects deserve serious attention.

Private Sector Chemical Companies in Kerala

There are 16 private sector chemical companies registered as MSME in the Department of Industries and Commerce according to NIC code & EM Part II (Entrepreneurial Memorandum), but only 6 companies are working presently. From the six companies, 4 companies are selected which shown increasing trend in production and profit, namely Medilise Chemicals, G K Specialty Chemicals, Vembanad Chemicals and Fertilizers and Chalissery Chemicals &Laboratories.

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Medilise Chemicals, Kannur

Medilise chemicals is self owned ISO 9001-2008 company was established in the year 2001, situated at Vankulathvayal, Azhikode, Kannur, Kerala. Medilise has a wide range of products like laboratory chemicals and reagents.

G K Specialty Chemicals, Thrissur

Geekay Specialty chemicals (INDIA) Pvt Ltd which has emerged as one of the pioneering brands in Indian Chemicals Industries and is an ISO 9001-2008 certified company of Das Certification Ltd, UK. Geekay Specialty Chemicals(India) Pvt. Ltd is in to Manufacturing & Exporting and Consultants in the field of Galvanizing, Phosphating, Electroplating, Aluminum Anodizing, etc

Vembanad Chemicals and Fertilizers, Kottayam

Vembanad Chemicals And Fertilizers - Wholesaler of manure, chemical fertilisers & pesticides in Kottayam, Kerala. The main products of the company are, Manure, pesticides and insecticides.

Chalissery Chemicals &Laboratories

A Chalissery chemical is the leading private chemical company, established in the year 1990. They are the manufactures of grease and lubricant oil. It is currently running in Industrial Estate Ollur, Thrissur.

II. REVIEW OF LITERATURE

By taking primary data from 1806 workers in eight major accident hazard chemical industries in Kerala, **Vinodkumar**, undertook a study for analysing the structure of safety climate of the selected industries. The study identified that safety knowledge, safety compliance, safety attitude and safety priority of workers are significantly different with regard to qualification, age, years of experience and job category of workers.

By taking a sample of 273 employees **Adutwum (2010)** has done a cross- sectional survey to explore the safety climate-safety behaviour relationship in Ghanaian mining industry. It was observed that safety climate is the strongest significant predictor of both employee's safety compliance and safety initiatives over and above demographics, attitudes and risk perception

Health and Safety Authority (H&SA) (2006) published a report regarding the workplace safety and health management. The report elucidates the practical guidelines about the implementation and maintenance of occupational safety, health and welfare management system. It also emphasises that the Safety Audit is an important constituent of a safety and health management system.

Research Problem

The biggest problem facing employers today is the safety of their employees in the workplace. Every organisation has a moral responsibility to ensure the safety and well being of their members. Many of the products in the chemical industry are potentially hazardous at some stage during their manufacture and transport. These

chemicals may be solids, liquids or gases, flammable, explosive, corrosive and toxic. Because of this, the industry operates within the safety limits demanded by national and international standards. It is the duty of management personnel to comply with the provisions mentioned in the related acts and regulations pertaining to chemical processes and hazardous operations. Even though, there are strict guidelines and rigid rules, the chemical industry accidents are increasing day by day.

Scope of the Study

The study has selected private sector chemical companies in Kerala and made an attempt to analyse the perceptions of employees towards the safety climate in the companies.

Objectives of the Study

1. To identify the strengths and weaknesses of safety climate in the private sector chemical industry in Kerala.
2. To examine the present safety measures adopted by the private sector chemical companies in Kerala.
3. To analyse the perceived effectiveness of safety climate in the private sector chemical companies in Kerala.

Hypotheses

1. H_0: There is no significant difference between male and female employees with regard to the perception towards the effectiveness of safety climate.
2. H_0: There is no significant difference in the perceptions of employees with regard to the effectiveness of safety climate among the four chemical companies.

III. METHODOLOGY AND DATA BASE

The method of study is both descriptive and analytical in nature based on secondary and primary data.

The population of the present study consists of employees in private sector chemical companies in Kerala. The sample companies selected from the private sector are, Medilise Chemicals (Kannur), G K Specialty Chemicals (Thrissur), Vembanadu Chemicals and Fertilizers (Kottayam) and Chalissery Chemicals (Thrissur). The sample size consists of the 56 employees in four private sector chemical companies in Kerala.

Both secondary and primary data were used in the study. The secondary data for the study were collected from text books, journals and website. The primary data were collected from the employees in private sector chemical companies. A structured questionnaire was used for data collection. The main statistical tools used for the analysis are Mean, Standard Deviation and Percentage Analysis, Factor Analysis, One-Sample t Test, Independent Sample t test, One - Way ANOVA and Scheffe Test for Multiple Comparison.

Limitations of the study

- Due to the safety concern the mangers showed unwillingness to collect data from some hazardous sections in the company.

- The study covers only private sector chemical companies in Kerala, which are registered as MSME.

IV. RESULTS OF THE ANALYSIS

Table 1: Demographic Profile of Employee

Source: Survey Data

The table shows that 39.3% of the employees are coming under the age group of 41-50 years. Gender wise classification of employees shows that 51.8% are males. Majority of the respondents are married (91.1%). The

Characteristics	Categories	No. of Respondents	Per cent
Age Group	Below 30	4	7.1
	30-40	18	32.1
	41-50	22	39.3
	51 & above	12	21.4
	Total	56	100.0
Gender	Male	29	51.8
	Female	27	48.2
	Total	56	100.0
Marital status	Single	5	8.9
	Married	51	91.1
	Total	56	100.0
Qualification	School	22	39.3
	ITI	9	16.1
	Diploma	5	8.9
	Degree	16	28.6
	PG	4	7.1
	Total	56	100.0
Experience	Below 10 years	34	60.7
	10-20	18	32.1
	21-30	3	5.4
	31-40	1	1.8
	41 & above	0	0
	Total	56	100.0
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	21-30	3	5.4
	31-40	1	1.8
	41 & above	0	0
	Total	56	100.0

education level of the respondent shows that most of them are only school educated (39.3%). Majority of the sample respondents comes under the department of sales& production 32.1% of employees have 10-20 years of experience.

Strengths of Safety Climate

According to Factories Act and Occupational Safety and Health Administration (OSHA) regulations, every chemical manufacturing company must tag on some safety guidelines. The study has used these guidelines as variables to identify the strengths and weaknesses of the safety climate of the company. The variables used for the analysis are, sufficient mechanism for disposal of hazardous wastes, proper checking of hazardous instruments, policies and provisions of Factories Act 1948, clear-cut policies and principles of safety and security, the service of a Doctor for the examination of persons engaged in dangerous occupations or processes, gives priority to cleanliness and efficient system of fire and explosion protection.

The perception of respondents with regard to the strengths of the safety climate is presented in Table 2.

Table 2: Strengths of Safety Climate

Components	N	Mean	SD	t value	p value
Disposal of hazardous wastes	56	3.98	0.77	10.493	.000

Proper checking of hazardous instruments	56	3.95	0.64	9.458	.000
Organisation strictly follows policies and provisions of Factories Act 1948	56	4.00	0.56	9.518	.000
Clear-cut policies and principles of safety and security	56	3.71	0.53	6.015	.000
The service of a Doctor for the examination of persons engaged in dangerous occupations or processes	56	3.59	0.56	4.646	.000
Gives priority to cleanliness	56	3.64	0.86	5.003	.000
Efficient system of fire and explosion protection	56	3.69	0.79	4.996	.000

Source: Survey Data

Table 2 shows the perception scores of managers of chemical companies with regard to the strengths of the safety climate in the organisation; all the components are higher than the test value (3). Table also reveals that the difference between the perceived score and the test value of all the components are significant, since the p-value of all the components are less than 0.05. The components of the safety climate strengths of the organisation in the order of major strengths are Organisation strictly follows policies and provisions of Factories Act 1948 (4.00), Disposal of hazardous wastes (3.98), Proper checking of hazardous instruments (3.95), Clear-cut policies and principles of safety and security (3.71), Efficient system of fire and explosion protection (3.69), Gives priority to cleanliness(3.64) and The service of a Doctor for the examination of persons engaged in dangerous occupations or processes (3.59).

Factor Analysis: Strengths of Safety Climate

Factor analysis is carried out to make out the major strengths of safety climate of chemical companies in Kerala.

Table 3: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.836
Bartlett's Test of Sphericity	Approx. Chi-Square	397.127
	DF	21
	Sig.	.000

Source: Survey Data

KMO test revealed 0.836 of KMO sampling adequacy (Table 3.29) which is greater than 0.6 and the Bartlett's Test of Sphericity is significant (p = <.001) and the test value was high at 397.127 leading to the conclusion that the data set appropriate for factor analysis (EFA).

Table 4: Communalities and Component Matrix

Components	Initial	Extraction
Disposal of hazardous wastes	1.000	.834
Proper checking of hazardous instruments	1.000	.748
Organisation strictly follows policies and provisions of Factories Act 1948	1.000	.748
Clear-cut policies and principles of safety and security	1.000	**.853**
The service of a Doctor for the examination of persons engaged in dangerous occupations or processes	1.000	.655
Gives priority to cleanliness	1.000	.623
Efficient system of fire and explosion protection	1.000	.530

Extraction Method: Principal Component Analysis.

Source: Survey Data

Table 5: Total Variance Explained

Components	Initial Eigen values			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
Clear-cut policies and principles of safety and security	4.991	71.295	71.295	4.991	71.295	71.295
Disposal of hazardous wastes	.860	12.288	83.583			
Proper checking of hazardous instruments	.550	7.859	91.442			
Organisation strictly follows policies and provisions of Factories Act 1948	.303	4.323	95.765			
The service of a Doctor for the examination of persons engaged in	.168	2.404	98.169			

dangerous occupations or processes				
Gives priority to cleanliness	.078	1.115	99.284	
Efficient system of fire and explosion protection	.050	.716	100.000	

Source: Survey Data

The table 5 shows that 'clear-cut policies and principles of safety and security' is the major strength of safety climate as perceived by the employees and which contributes 71% in total.

Weaknesses of Safety Climate

In addition to the strengths of safety climate, the weaknesses of safety climate are also examined. There are nine components of weaknesses of safety climate specifically; poor /inadequate safety measures and equipments, no periodical safety awareness programs, no sufficient training for handling hazardous equipments, does not follow the rules and regulations regarding safety and security, no safety audit programs, no efficient safety management system, no clear-cut policies and principles regarding safety and security, no system for storing and disposal of hazardous wastes, and there is inadequate risk assessment.

The perception of managers with regard to the weaknesses of safety climate of chemical company is presented in table 6.

Table 6: Weaknesses of Safety Climate

Components	N	Mean	SD	t value	p value
Poor /inadequate safety measures and equipments	56	2.0893	.92002	7.408	.000
No periodical safety awareness programs	56	2.2679	1.03557	5.291	.000
No sufficient training for handling hazardous equipments	56	1.8929	.52841	15.679	.000
Does not follow the rules and regulations regarding safety and security	56	1.7321	.55567	17.075	.000
No safety audit programs	56	1.8393	.49642	17.497	.000
No efficient safety management system	56	1.8750	.60490	13.917	.000
No clear-cut policies and principles regarding safety and security	56	1.8750	.54146	15.548	.000
No system for storing and disposal of hazardous wastes	56	1.9286	.32233	24.875	.000

There is inadequate risk assessment	56	1.8571	.48349	17.689	.000

Source: Survey Data

It can be seen from the table 6, the calculated mean score of all the components of weaknesses of safety climate is less than the test value (3), which indicates the disagreement with the statements. In all the components the difference between calculated weaknesses score and the test value is significant, which point out that the components are not the weaknesses of safety climate in the private sector chemical companies as perceived by the managers.

Effectiveness of Safety Climate

This part deals with the analysis of employees' response towards the effectiveness of safety climate in the private sector chemical companies in Kerala. Table 7 shows employees' perception on present safety measures adopted by the private sector chemical companies in Kerala.

Table 7: Effectiveness of Safety Climate

Items	Mean	SD	t value	p value
Periodical health & safety awareness programs	3.9821	.70042	10.493	.000
Efficient system of disposal of effluents	3.9464	.74881	9.458	.000
Priority to the health and safety of employees	4.0000	.78625	9.518	.000
Proper checking of hazardous materials	3.7143	.88860	6.015	.000
Adequate storage facilities for chemicals	3.5893	.94920	4.646	.000
Safety committee	3.6429	.96160	5.003	.000
Safety audit programs	3.6964	1.04307	4.996	.000
Mechanism for disposal of hazardous wastes	4.2143	.80259	11.322	.000
Checking of hazardous instruments	4.2321	.85261	10.814	.000
Followers Factories Act 1948	4.1786	.93628	9.420	.000
Clear cut policies and principles of safety and security	4.1071	.94731	8.746	.000
Efficient system of fire and explosion protection	4.1429	.90310	9.470	.000
Provides service of a Doctor for the examination of persons engaged in dangerous occupation	4.2143	.86790	10.470	.000
Cleanliness	4.1964	.90292	9.916	.000

Source: Survey Data

It can be seen from the table that the mean perception score of every safety climate components in the company is above the test value and the p value (.000) is less than the significance level 0.05, therefore the safety climate is effective in the companies as perceived by the employees. It is also clear from the table that the two safety climate components have mean scores which are above and beyond the scores of all other items, hence it is concluded that the safety climate components such as Checking of hazardous instruments (4.23), Mechanism for disposal of hazardous wastes (4.21) and Service of Doctor (4.21) are the most effective components of safety climate.

Independent Sample t test

The study has used Independent Sample t test for analyzing the significant difference between male and female employees with regard to the perceptions towards the effectiveness of safety climate.

Table 8: Comparison of Effectiveness of Safety Climate between Male and Fe male Employees

Gender	N	Mean	SD	t value	p value
Male	28	29.25	5.4	.101	.920
Fe male	27	29.41	6.1		

Source: Survey Data

As per table 8, the mean perception score of effectiveness of safety climate obtained by the male employees of the company is 29.25 with standard deviation 5.4 and that of female employees are 29.41 and 6.1 respectively. Further, the calculated p value (.920) is greater than the significant level of 0.05, which indicates that there is no significant difference between male and female of chemical companies with regard to the effectiveness of safety climate.

Effectiveness of Safety Climate: Comparison between the Selected Companies

The study has also analysed whether there is any significant difference in the effectiveness of safety climate among the chemical companies from the perceptions of employees of the company. In order to check the difference Analysis of Variance (ANOVA) is applied, the result is presented in the table 9.

Table 9: One Way ANOVA on Company wise Analysis of Effectiveness of Safety Climate

Name of the Company	N	Mean	Std. Deviation	F value	p value
Medilise Chemicals	17	30.41	5.01	6.383	.001*
Vembanad chemicals	17	30.23	3.36		
G K Specialty Chemicals	12	31.50	3.03		
Chalissery Chemicals	10	23.10	8.26		
Total	56	29.28	5.68		

Source: Survey Data

*Significant at 0.05 level

From the analysis of the effectiveness of safety climate on the basis of companies, it is found that employees of G K Specialty Chemicals reported a high mean value of 31.50 with SD 3.03. The mean scores for Medilise Chemicals, G K Specialty Chemicals and Chalissery Chemicals, are 30.41 (SD 5.01), and 23.10 (SD 5.68) and 30.23 (SD 3.36) respectively.

The result of the ANOVA shows that there is difference among the four companies regarding the effectiveness of safety climate and the difference is statistically significant. In order to check the difference precisely, the Post Hoc test (Scheffe) is applied and the result is presented in table 10.

5.8.2 Scheffe Test for Multiple Comparison

Scheffe Post Hoc test is used for inter group comparison, the result is presented table 10.

Table 10: Post Hoc Test: Effectiveness of Safety Climate

(I) Name of the Company	(J) Name of the Company	Mean Difference (I-J)	Std. Error	Sig.
Medilise Chemicals	Vembanad Chemicals	.17647	1.71438	1.000
	GK specialty Chemicals	-1.08824	1.88452	.953
	Chalissery Chemicals	7.31176*	1.99193	.007
Vembanad Chemicals	Medilise Chemicals	-.17647	1.71438	1.000
	GK specialty Chemicals	-1.26471	1.88452	.929
	Chalissery Chemicals	7.13529*	1.99193	.009
G K specialty Chemicals	Medilise Chemicals	1.08824	1.88452	.953
	Vembanad Chemicals	1.26471	1.88452	.929
	Chalissery Chemicals	8.40000*	2.14011	.003
Chalissery Chemicals	Medilise Chemicals	-7.31176*	1.99193	.007
	Vembanad Chemicals	-7.13529*	1.99193	.009
	G K specialty Chemicals	-8.40000*	2.14011	.003

Source: Survey Data

The result of Post Hoc analysis describes that there is significant difference between Medilise Chemicals and Chalissery Chemicals and between Medilise Chemicals and G K specialty Chemicals with regard to the effectiveness of safety climate. At the same time based on safety climate effectiveness, there is a disparity between Chalissery Chemicals and G K specialty Chemicals, since the p values are less than 0.05 and the null hypothesis is rejected at 5 % level of significance.

V. CONCLUSION

The study has identified the major strengths of safety climate of private sector chemical companies in Kerala. It is found that, 'clear-cut policies and principles of safety and security' is the major strength of safety climate. Majority of the employees are disagreed with all the statements given in the questionnaire as weaknesses, which means there are no such weaknesses in the company. The study has also identified that safety climate is effective in the private sector chemical companies in Kerala. The study also found that, there is significant difference among the selected companies with regard to the effectiveness of safety climate.

Safety policies have been framed to protect the employees and the environment from the hazardous emissions released during the production of chemicals.

VI. SUGGESTIONS

- Even though majority of the respondents are satisfied with the safety climate in the private sector chemical companies, many of them are fully satisfied; hence it is very essential to formulate an effective safety committee to capture the problems, issues and grievances of employees regarding safety and security.
- The flammable substances should be stored in a specially designed container and such containers should be stored in an explosion proof cabinet. Hazardous chemicals must be kept in a secured area. The storage of such hazardous chemicals requires compliance to the rules, codes, practices and legislation strictly.
- It is observed that majority of the safety policies and measures are not implemented properly by the management. There are number of National and International organisations running for providing safety guidelines and strategies to the chemical industry. The management should be involved in implementing important safety policies and strategies of such organisations for ensuring the safety of employees.
- Personal Protective Equipment (PPE) protects workers from injuries likely to be caused by hazardous environment. Statutory regulations have made the availability of PPE mandatory to workmen exposed to hazardous environment Hence careful selection is needed to meet the protection against specific hazard to which a work man is likely to be exposed.
- The company must give awareness to the workers regarding the need and importance of hazardous materials checking and disposal of hazardous waste.
- Inspections of hazardous materials should be carried out at regular intervals and to repair and replace the faulty materials and machines as soon as practicable and before its next use.
- The safety audit programs helps to check the present state of industrial hazard control, fire control and industrial hygiene, supervisory participation, motivation and safety training, accident investigation, statistics and reporting procedure etc.

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