Evaluation of Safety Management System for Chemical Industry

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Abstract— This dissertation is to evaluate performance of safety management for chemical industry. The main concern for chemical industry is to reduce accident rate. Reduction of accident in substation manner is a one type of tool for performance assessment. Chemical industry has wide range of critical and hazardous operation where people, machine and chemicals work together to get the desired product. In order to evaluate safety performance for chemical industry two tools has been adopted first one is Accident/ incident reduction rate performance and second one is to assess employee perception level towards safety. Both the tools are different from each other and have many more advantage for the organization. Leadership and basic framework for industrial safety plays vital roles in accident prevention or accident reduction.

Keywords: Chemical Industry, Safety Management System, Accident

I. INTRODUCTION

Emergency The measurement of safety performance is useful to all management to know the progress of safety culture. It promotes safety in all walks of life like road safety, home safety, industrial safety and safety at the sea and the sky. The industries are paying crores of rupees every year in terms of workmen compensation and other benefits. Many insurance companies pay the huge amount for accident injuries, deaths, and property damage. If they know the real measurement of safety performance they may try to suggest necessary safety measures to reduce the premium amount. The objective of this dissertation is to evaluate the safety performance based on the Accident and Incident statistics. To asses safety Awareness levels of different categories of employees in our company premises. To highlight the strengths and weaknesses with respect to the employees perception and awareness about their role in Safety Management, Fire Prevention & Protection and Emergency Preparedness. To make recommendations for improving the areas related to safety wherever required. This dissertation has been prepared for chemical plant Navin Fluorine International Limited Dewas, Madhya Pradesh.

II. METHODOLOGY

The evaluation of safety management system for NFIL shall be assessed on below two methods.

1) Method 1 - Safety Awareness Survey
2) Method 2 – Performance of Accident / Incident Trend Analysis.

A. Method 1 - Safety Awareness Survey-

There three main components in the approach to this evaluation:

– Safety Management Systems
– Behavior Based Safety
– Safety Culture

The survey shall be intended to address the following:

– Management and Line Organization Commitment to Safety
– General Fire & Safety requirements including emergency handling.
– Training, Competence and Awareness of Responsibilities
– Perception towards Accidents / Incidents and their reporting system

1) Process- Following below process shall be followed.

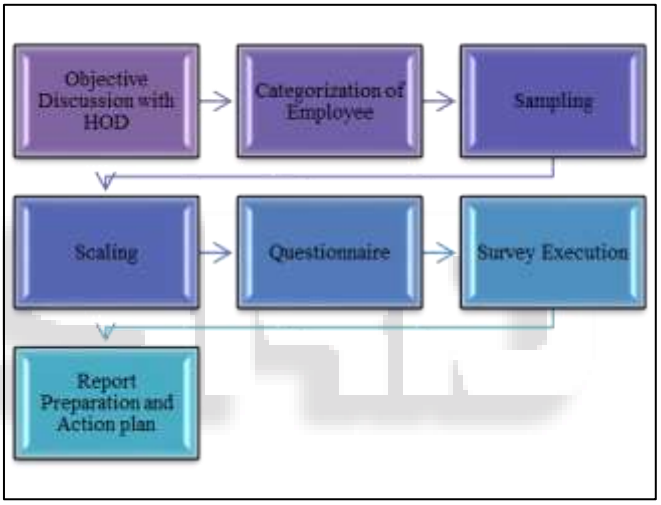

Fig. 2.1: Process Flow Diagram for SAS

2) Employee Categorization Criteria - Employee will be categorized within the level group like Manager etc.
3) Sampling - Sampling of Population should be less than 20 %
4) Questionnaire - Questionnaire will be prepared at least 20 with equal 5 marks in English and local language (Hindi)
5) Evaluation Criteria – Evaluation criteria will be followed as:-

Awareness Level	Marks Range
Poor Awareness	0 - 20
Borderline Awareness	21 – 40
Satisfactory Awareness	41 - 60
Good Awareness	61 - 80
Very Good Awareness	80- 100

Table 2.1: Safe-T-Score

B. Method 2 - Performance of Accident / Incident Trend Analysis.

1) Performance of accident / Incident analysis can be assessing on the basis of below criteria.
Frequency Rate:- It is defined as number of reportable accidents per million man-hours worked by factory.

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Frequency Rate $= \frac{\text{Number of Reportable Accident x } 10^6}{\text{Total Man–Hours Worked}}$

2) Severity Rate:- It is defined as number of man days lost per million man-hours worked.

3) Severity Rate $= \frac{\text{Number of Man Days Lost Due to Reportable Accident x } 10^6}{\text{Total Man–Hours Worked}}$

4) Incidence Rate:- It is the ratio of number of accidents to number of employees during the period under review.

Incidence Rate $= \frac{\text{Number of Reportable Accident x } 10^6}{\text{Average Number of Person Employed}}$

5) Safe-T-Score:- Positive (+) STS indicates a worsening record while negative (-) STS indicates an improving record over the past.

Safe-T-Score $= \frac{\text{Frequency Rate New} - \text{Frequency Rate Past}}{\sqrt{\frac{\text{Frequency Rate Past x } 10^6}{\text{Man–Hours Worked New}}}}$

Safety T Score	It Indicates
Between +2 & – 2	Change is not significant. There may be random fluctuation only.
More than +2	Record is worsening than it was in the past. Something wrong has happened
Less than – 2	Record is improving than it was in the past. Something better has happened.

Table 2.2: Safe-T-Score

III. PLANT DESCRIPTION

To evaluate the safety management system of NFIL (Chemical industry), It is necessary to have lights on its safety management system and its elements how does it work and hot its contributed to safety performance of the organization.

Navin Fluorine International Limited belongs to reputed industry house of Arvind Mafatlal group in India which has headquarter in Mumbai. It is public limited company listed in BSE and NSE. Besides Dewas, NFIL has manufacturing and R & D facility in Surat (Gujarat state) and one more Research Centre in United Kingdom. NFIL located in Dewas and Surat is a manufacturer of various organic and specialty chemicals, drugs and drug intermediates. The cGMP facility of Dewas is operational since 2011.

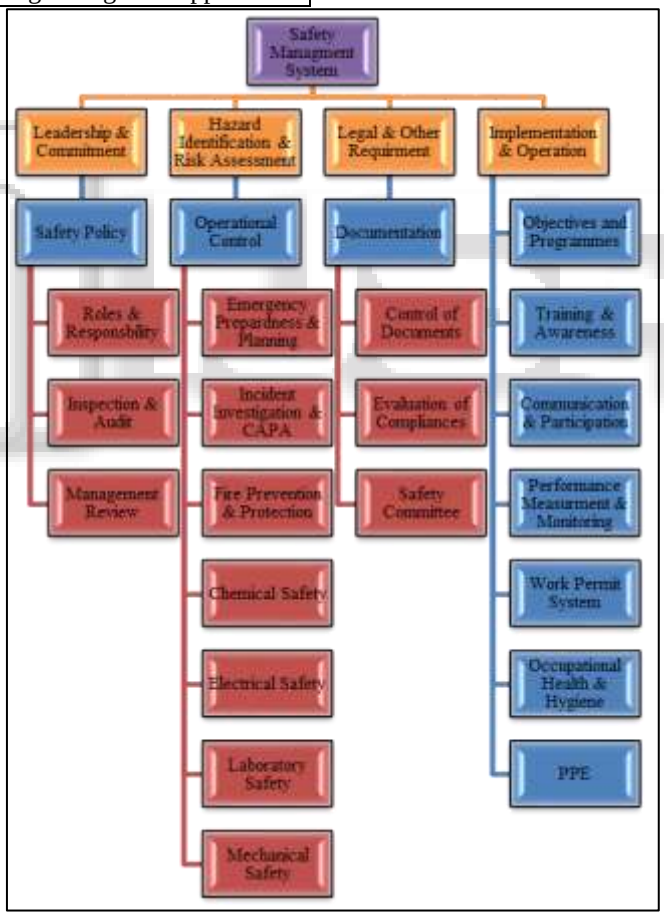

Fig. 3.1: Elements of Safety Management System

Accident Trends analysis for NFIL is followed as.

Year	Fatal	Lost Time Injury	Total Permanent Disability	Total Man Hours Worked
2017	0	0	0	372512
2018	0	0	0	473416

IV. EVALUATION OF SAFETY MANAGEMENT SYSTEM

A. Evaluation of safety management system for NFIL is followed as.

1) Employee Categorization

Category- 1	Category-2	Category-3
Top Management (Sr. Manager &	All Employee (Up to Dy.	All Contractual

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Above)	Manager)	Employees

Table 4.1: Employee Categorization

2) Sampling

Category -	Level of Employee	Average Manpower	Percentage %	Sample
1	Top Management (Sr. Manager & Above)	8	60%	5
2	All Employee (Up to Dy. Manager)	60	25%	15
3	All Contractual Employees	124	20%	25

Table 4.2: Sampling

3) Questionnaire

Category-	Level of Employee	No. of Question	Marks	Total Marks
1	Top Management (Sr. Manager & Above)	20	5	100
2	All Employee (Up to Dy. Manager)	20	5	100
3	All Contractual Employees	20	5	100

Table 4.3: Questionnaire

Results for Safety Awareness Survey

The awareness level of employee and contract worker of NFIL, Dewas are as follows:-

Category	Marks Obtained (Average)	Awareness Level
Top Management (Sr. Manager & Above)	74.0	Good Awareness
All Employee (Up to Dy. Manager)	82.3	Very Good Awareness
All Contractual Employees	67.8	Good Awareness

Table 4.4: Results for Safety Awareness Survey

The Average Safety Awareness of All Employee and Contract workers is found Good Level.

Area of Improvement- Awareness to be increased in Following below area

1) Emergency Management
2) Work Permit System
3) General Safety Awareness

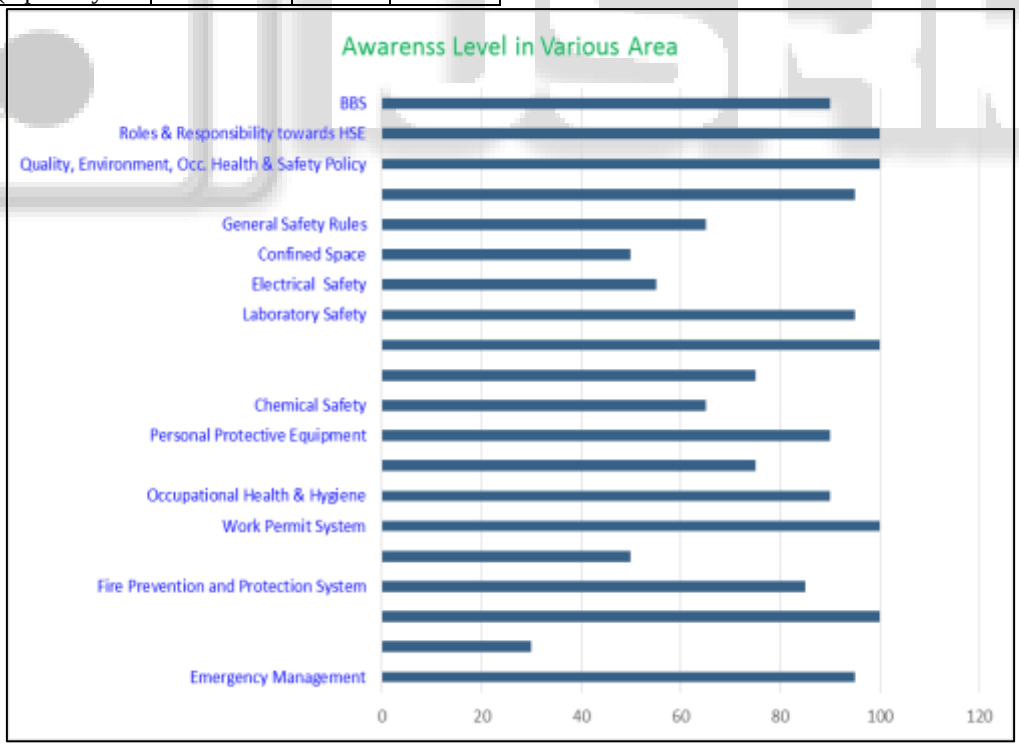

Fig. 4.1: Safety Awareness Level for Employees

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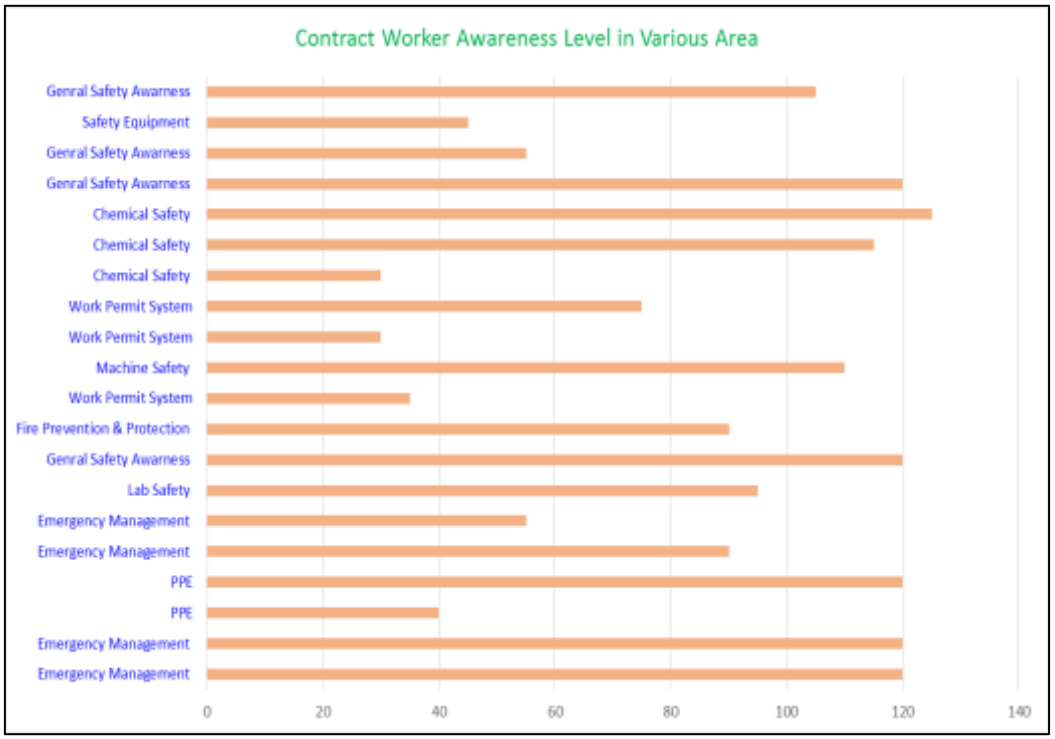

Fig. 4.2: Safety Awareness Level for Contract Workers

B. Result for Accident / Incident Statistics:-

1) Frequency Rate:- It is defined as number of reportable accidents per million man-hours worked by factory.

   Frequency Rate = $\frac{0 \times 10^6}{4734156} = 0$

2) Severity Rate:- It is defined as number of man days lost per million man-hours worked.

   Severity Rate = $\frac{0 \times 10^6}{473416} = 0$

3) Incidence Rate:- It is the ratio of number of accidents to number of employees during the period under review.

   Incidence Rate = $\frac{0 \times 10^6}{473416} = 0$

4) Safe-T-Score:- Positive (+) STS indicates a worsening record while negative (-) STS indicates an improving record over the past.

   Safe-T-Score = $\frac{0-0}{\sqrt{\frac{0 \times 10^6}{473416}}} = 0$

V. CONCLUSION

Based on above methodology it has been concluded that the Safety management system of Navin fluorine International Limited is Highly appreciable and its management commitment towards safety, health and environment is fully reliable and committed to EHS front. The awareness level of employees and contractual people are very good however some of area where improvement is required to sustain this EHS culture. The statistics data in terms of qualitative and quantitative both numbers are very good which is required continual improvement to achieve sustainability.

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