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# **EFFORTS TOWARDS ACHIEVING ZERO LOST TIME INJURY IN PT. PETROKIMIA GRESIK.**

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## **ABSTRACT**

**As one of the biggest fertilizer and chemical company in Indonesia with total number of employees of 3600, PT. Petrokimia Gresik. has many potential hazards that may create accidents to its employees and facilities.**

**Study on factors that affect accident rate had been carried out for 5 years to achieve such objectives, as the identification of dominant factors that affect accident frequency rate, and finding the right ways to reduce them.**

**On the identification of factors affecting accident frequency rate, 8 factors had been found as dominant, namely, management commitment and involvement on safety, safety communication and information, operational guard system, safety procedure, employee competency, safety training, work planning and control. Those factors simultaneously contributed 88.4 % to accident rate.**

**Through analyzing the lack of dominant factors fulfillment, the needs of remedial action is defined. Then, when corrective action programme is implemented, the result is more than 10 million working hours without lost time injuries**

## **I. PT. PETROKIMIA GRESIK OVERVIEW**

PT. Petrokimia Gresik is a state-own company which mainly produce fertilizer and chemicals. Besides producing fertilizer and chemical, the company has side business, such as: engineering and construction, inspection, laboratory tests, and hospital services.

The company was established in 1972, and is located in Gresik, East Java. Indonesia and covers a total area of 1000 acres. Total revenue 2,5 trillion Rupiahs or US \$ 300 million per year with the total number of employees in 2003 at 3600.

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The Company has 3 main units of plants:

Unit 1:

Ammonia plant,	Capacity 445,000 tons/year.
Urea plant,	Capacity 450,000 tons/year.
Ammonium sulphate Plant I,	Capacity 200,000 tons/ year.
Ammonium sulphate Plant III,	Capacity 200,000 tons/ year.
Air separation unit,	Capacity 750,000 tons/year N and 600,000 ton/year O <sub>2</sub> .

Unit 2:

Phosphate Fertilizer Plant I,	Capacity 400,000 tons/year.
Phosphate Fertilizer Plant II,	Capacity 600,000 tons/year.
NPK-Phosphka Plant,	Capacity 300,000 tons/year.
NPK- Blending Plant,	Capacity 75,000 tons/year.
Di Ammonium Phosphate Plant	Capacity 125,000 tons/year.

Unit 3:

Phosphoric Acid plant	Capacity 170,000 tons/year.
Sulfuric Acid plant	Capacity 310,000 tons/year.
Cement retarder plant	Capacity 440,000 tons/year.

Raw materials:

Natural Gas	pumping from Panggerungan Island North Bali.
Phosphate rock	imported from Joerdan, Egypt and China.

Products are mainly supplied to domestic market. Excess products may be exported to other countries.

The Company complies with:

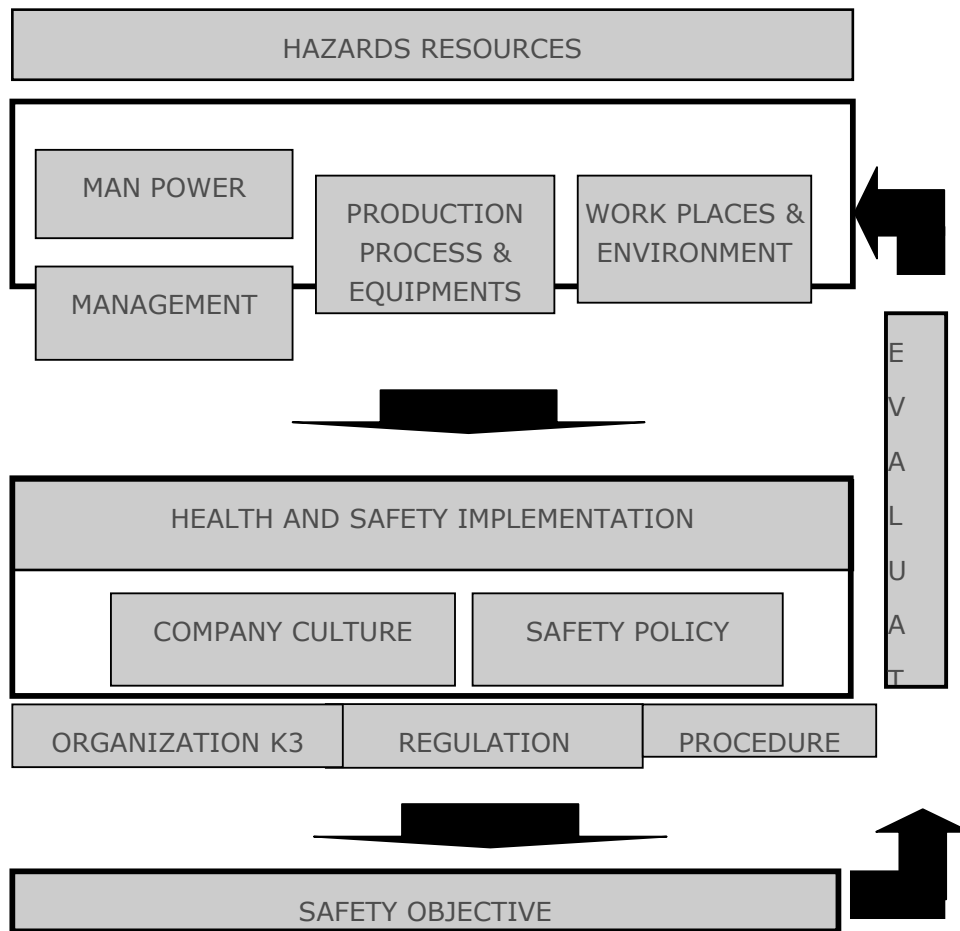
Quality Management System ISO 9001-2000

Environment Management System ISO 1401.

Safety Management System.

## **2. SAFETY MANAGEMENT SYSTEM OF PETROKIMIA GRESIK**

As a fertilizer and chemical producing company, PT. Petrokimia Gresik always deals with hazard which can affect employees and facilities. In order to comply with Safety Act and Regulation, and to achieve its safety objective, PT. Petrokimia Gresik applies safety management system with the model as shown in Fig 2.1.



**Figure 2.1. Model Safety Management System of PT. Petrokimia Gresik.**

This system tells that hazard in the company may be revealed from one or combination of man power/human, production process/equipment including material used, work place and environment, and management. These hazards are managed and handled by company culture, safety policy, safety regulation, organization and safety program in order to reach the safety objective. This system is integrated with other management system, such as: Environment management system ISO 1401, Quality Management System ISO 9001 and overall management system for achieving the main company objective.

## **2.1. Hazard Resources**

PT. Petrokimia Gresik is a large company which in its activities involve toxic and hazard chemicals, production process/equipment, a large man power, complicated methods of work, and a large area of workplace. Therefore, the company has hazards that basically consist of,

Major Effect Scale : Explosion, big fire and toxic chemical spread.

Minor Effect Scale : Noise, leaks, small fire, car crash, equipment damage, etc

Hazard potential resources may consist of, man power/employee, process equipments, material/substances, work places and management.

Hazards may originate from man power when he or she or they do unsafe action which is careless or untrained/incapable or taking short cut or breaking rules/instructions or doing horse play.

Hazards may originate from equipment when unsafe conditions exist. A few examples of unsafe condition are: out of order or improper design of equipment put into operation, equipment without safety devices, lack of maintenance of equipment and facilities, etc.

Hazards may originate from work places when condition such as dirty, narrow, improper layout of equipment, lack of light and ventilation, etc., exist in the work places.

Management from low to high level may create hazards when wrong decision or policies are made and management as a leader has no commitment to safety.

## **2.2. Safety Objective**

The Safety Act and Regulation in Indonesia defines that any employee has the right to have full protection for his/her safety in doing his/her job. In complying to the Safety Act and Regulation, PT. Petrokimia Gresik stipulated safety objective which is,

Creating safety for and preventing any accident to employees and any person within the work places in order to attain zero accident environment.

Achieving health and prosperity for all employee and his/her family so they may get a maximum degree of health within a prosperous industrial community.

## **2.3. Safety Management**

The Safety management of PT. Petrokimia Gresik involves all levels of management and check at aspects of commitment, safety strategy, procedure and organization.

### **1. Commitment**

Commitment to perform safety at work starts from top management to basic level, including workers. In order to build such commitment, the Company stipulated and issued objectives as follows,

A. Company Culture: to put safety first in any activity.

B. Safety Policy.

Company Safety Policy contains,

Board of directors strives to enhance safety and health of any person at the workplace and prevent any incident which may result in the loss to the Company.

The Company applies Safety Act and other relevant Government Regulations.

Any manager and unit head has the responsibility for making any person at his unit obey the Occupational and Health Rules within the Company.

In an event of a plant emergency situation or disaster, all employees are obliged to work together in overcoming it.

C. There is a degree of responsibility and authority at any level of management to participate in safety and accident prevention.

D. Review on safety management system periodically.

## **2. Safety Strategy**

By taking into consideration the accident potential to employees and material losses, the Company has a safety strategy as follows:

Identifying, measuring and controlling any hazard potential which may be exist in the work places.

Using any resources to prevent any event that may create losses to the Company.

Involving safety as a part of activities.

Promoting safety to all employees.

Giving insurance policy to all employees.

## **3. Procedure**

In order to make employees and organization work safely and securely, the Company issued safety procedures and regulations. Those procedures and regulations consist of

Company Safety Code of Practice.

Code of Practice for Handling Toxic and Hazardous Substances.

System and Procedure for Operating Hazardous Potential Equipment and Process.

Disaster Plan.

Hazard Classification Map.

Man Power Regulation which inclusively contains aspects of employee duty, rights and penalty on safety.

Work Procedure and Instruction which inclusively contain safety condition.

These procedures and regulations that stipulate the right and duty of any employee to make condition and action safe in their work places.

#### 4. Safety Organization

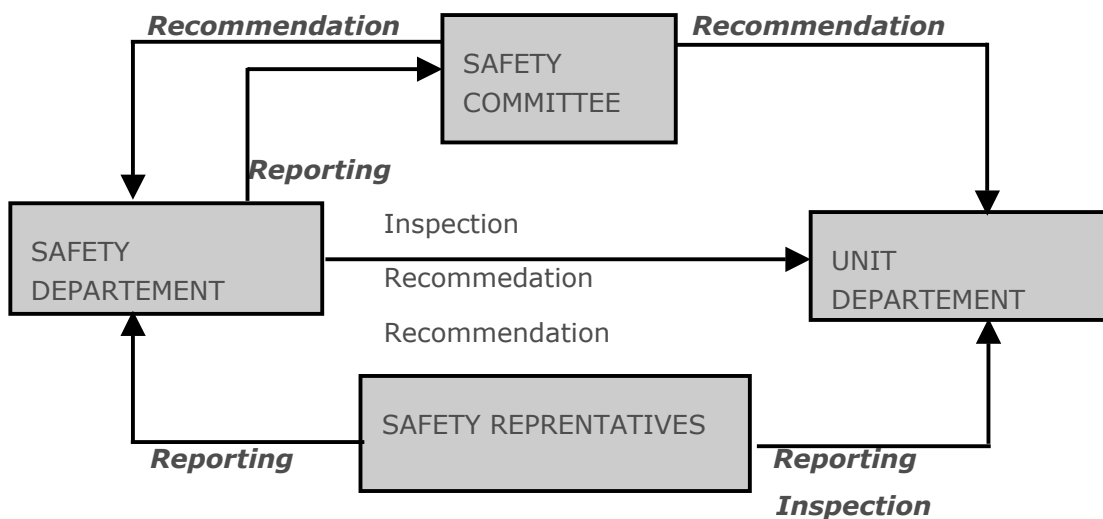
PT. Petrokimia Gresik has two types of safety organizations: structural and non-structural. Structural organization, so-called Safety Department has the duty to perform safety promotion, safety inspection, safety procedure and rules design, personal protection equipment distribution to all departments and employees, safety training to all employee, disaster plan drill, safety audit on all departments within the Company, issue recommendation for any action plan that should be done for complying safe condition in work places, accident investigation and maintaining safety records. This Department is directly responsible to the Production Director and has link to all departments within the Company. Performing safety at work as well as preventing accident in work places is the responsibility of the unit department heads or in other words, all unit department heads within the Company has the duty to make conditions and actions safe within his department. In cases or situation where he needs guidance to comply with safe condition/act, he has the right to ask Safety Department to assist him.

Non- structural organization consists of the Safety Committee and Safety representatives.

The Safety Committee is a forum for evaluating any needs for correcting any deficiency in safety requirements and reviewing safety system periodically. All Unit Department heads are members of this committee and the production director is the chief of the committee.

Safety representatives are persons selected from groups of employees. The duty of this person is to assist the department head in ensuring that all safety procedure/requirements are fulfilled.

The inter-relation among Safety Department, Safety Committee, Safety Representatives and Unit Department head is shown as Figure 2.2

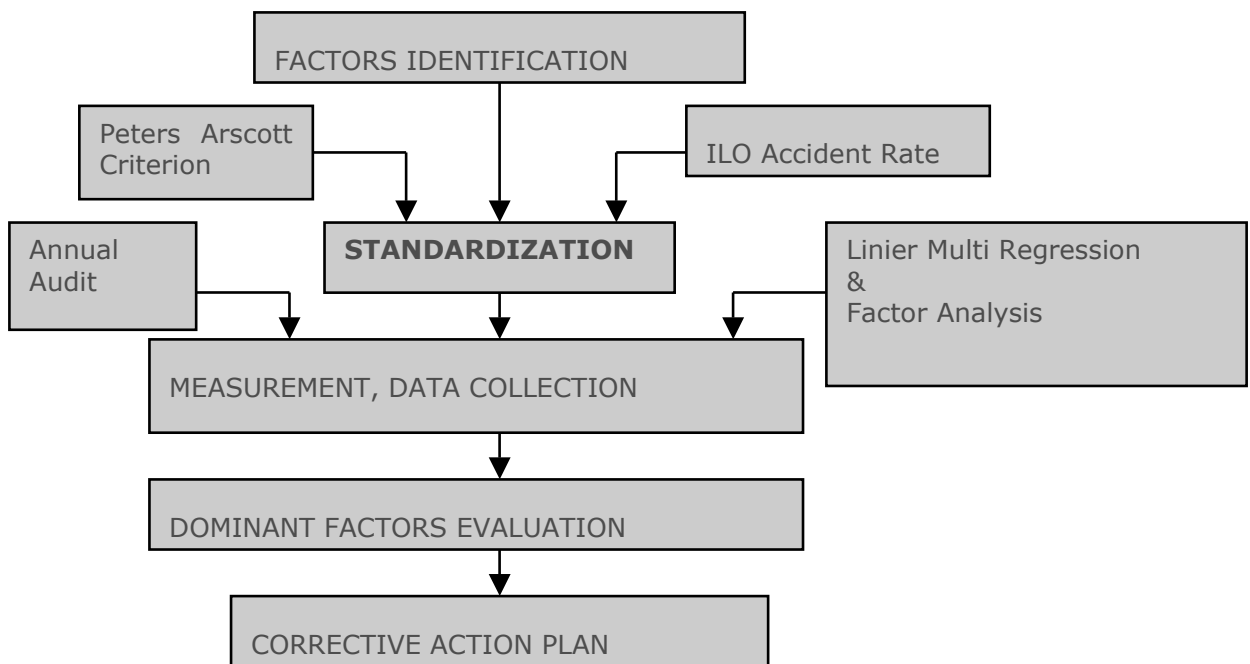


**Figure 2.2. Inter-relation among Safety Committee, Safety Department, Unit Department and Safety Representatives.**

**3. STUDY ON FACTORS THAT AFFECT ACCIDENT RATE.**

**3.1. Methodology**

Occupational Safety is basically the effort of management and employees of company to create safe condition and act at work in order to prevent work accident. Thus the effort needs a safety management system which includes planning, organizing, resources, procedure, responsibility, program, and continuous control. When a company has a bad accident record or even periodic accidents, it indicates that the company has failed to implement safety management system or has deficiencies in the safety management system. These deficiencies can be observed using ISMEC (Identification, Standardization, Measurement, Evaluation and Correction) on factors that affect accident rate. Firstly, to do ISMEC, it requires a model study. A model study used by PT. Petrokimia Gresik for finding the dominant factors that affect accident rate and then used to make correction on safety management system , is as follows,



**Figure 3.1. Model Study for implementing**



### 3.2. Identification, standardization and measurement

There are many variables or factors that may affect accident rate. It has been identified that there are 27 factors influencing accident rate in the Safety Management System of PT. Petrokimia Gresik, e.g. :

Factor	Description	Factor	Description
1	Safety Standards / Code of Practices	15	Safety Procedure.
2	Audit System.	16	Employee Competency.
3	Toxic and Hazards Definition.	17	Equipment Modification.
4	Disaster Plan Drill.	18	Safety Training.
5	Management Commitment and Involvement.	19	Personal duty Identification.
6	Safety Inspection.	20	License and qualification.
7	Product Using Instruction.	21	Job Risk Level.
8	Document Control.	22	Visitor Briefing.
9	Equipment Maintenance.	23	Work Planning and Control.
10	Work Environment.	24	Safety Records.
11	Communication & Information.	25	Safety Monitoring.
12	Personal Protection.	26	Responsibilities and Performance.
13	Working Contract.	27	Training Body and Instructor.
14	Operational Guard System		

**Table 2.1. Identified Factors that Influence to Accident Rate**

These factors determine how the far deficiency of safety management system is, after measurement has been taken by a standard measurement.

Standard applied to determine deficiency of system management system of PT. Petrokimia Gresik or to measure factors that affect accident rate is taken from Peters Arcscott Criteria, e.g. :

Degree	Point Scale	Remarks
Excellent	5	Fully implemented and effective: Exceed, where applicable, legal standards. Employee involvement, formal system and procedure issued.
Good	4	Satisfactorily implemented and effective: Meets, where applicable, legal standards. Employee involvement, formal system and procedure issued.
Fair	3	Implemented, but not satisfactorily.
Poor	2	Only partially effective, plenty of room for improvement.
Unsatisfactory	1	Some items made, but not effective

**Table 2.2. Criterion for Measuring Factors that Affect Accident Rate.**

Measurement shall be carried out periodically, at least once a year, by the competent safety officer.

Standard measured for determining accident rate is taken ILO, e.g.

$$F = N \times 1000,000/M \quad \text{and} \quad S = K \times 1000,000/M$$

F = Accident Frequency Rate.                      S = Accident Severity Rate.

N = Number of accidents per year.      K = Number of lost working time.

M = Number of effective man-hours.

Identified factors in safety management system and accident rate are measured yearly through annual safety audit. The data obtained is then recorded. Accident rate and severity rate data from 1996 to 2000 is tabulated in Table 2.3. Accident frequency rate and result of factors measurement from 1996 to 2000 is then calculated statistically by method of Factor Analysis and Multi-Regression. Surprisingly, it found the coefficient of regression as shown in Table 2.4. Those results are then tested by Stimulant test and individually by the regression coefficient test. It is found that only 8 factors are classified as dominant factors, e.g.

Factor	Coefficient of regression
Management Commitment and Involvement	1.8889
Communication& Information	6.3524
Operational Guard system.	3.9019
Employee Competency.	4.3550
Safety Procedure.	1.8413
Safety Training	3.1207
Work Planning and Control.	2.3315
Safety Monitoring.	3.0094

**Table 2.3. Dominant Factors that effect accident rate**

These factors simultaneously accounted for 88,4 % of the Accident Frequency Rate with Standard error 0.05 or 5 %.

NO	DESCRIPTION	YEAR				
		1996	1997	1998	1999	2000
1	Number of Man Power	3986	3927	3871	3810	3755
2	Man hours	915810	935145	911774	885495	8724034
3	Number of Accidents	84	92	78	77	71
4	Man Hours lost	58480	145448	49296	40920	48560
5	Accident Frequency Rate	923115	999347	860124	874437	8,180
6	Accident Severity Rate	6426	16451	5436	5598	5597

**Table 2.3. Accident Record from year of 1996 to 2000.**

Factor	Description	Unstandardized coefficient	Std. Error	t
	(Constant)	8.9508	0.0512	174.8849
1	Safety Standards / Code of Practices	0.1029	0.0518	1.9874
2	Audit System.	0.1116	0.0518	2.1553
3	Toxic and Hazards Definition.	0.1020	0.0518	1.9698
4	Disaster Plan Drill.	-0.0060	0.0518	-0.1151
5	Management Commitment and Involvement.	-0.0978	0.0518	-1.8889
6	Safety Inspection.	0.0413	0.0518	0.7986
7	Product Using Instruction.	0.0123	0.0518	0.2380
8	Document Control.	0.0026	0.0518	0.0512
9	Equipment Maintenance.	-0.0208	0.0518	-0.4017
10	Work Environment.	-0.0119	0.0518	-0.2304
11	Communication& Information.	-0.3288	0.0518	-6.3524
12	Personal Protection.	0.0366	0.0518	0.7066
13	Working Contract.	0.0669	0.0518	1.2930
14	Operational Guard System	-0.2020	0.0518	-3.9019
15	Safety Procedure.	-0.2254	0.0518	-4.3550
16	Employee Competency.	-0.0953	0.0518	-1.8413
17	Equipment Modification.	-0.0763	0.0518	-1.4743
18	Safety Training.	-0.1615	0.0518	-3.1207
18	Personal duty Identification.	-0.0323	0.0518	-0.6233
20	License and qualification.	-0.0862	0.0518	-1.6660
21	Job Risk Level.	-0.0609	0.0518	-1.1771
22	Visitor Briefing.	0.0251	0.0518	0.4845
23	Work Planning and Control.	-0.1207	0.0518	-2.3315
24	Safety Records.	-0.0495	0.0518	-0.9561
25	Safety Monitoring.	-0.1558	0.0518	-3.0094
26	Responsibilities and Performance.	-0.0277	0.0518	-0.5344
27	Training Body and Instructor.	0.0072	0.0518	0.1391

**Table 2.4. Coefficient of regression of identified factors.**

### **3.3. Evaluation and correction**

From the result of multi-regression and factor analysis on 27 factors, it was shown that if all factors are neglected or safety management system was not effective, the number of accidents would theoretically be 175 per year. In fact, only 71 to 92 accidents had been occurred from 1996 to 2000. This spread indicating that system is implemented but not fully effective. During 5 years of running the system, many corrective actions had actually been taken, but only instituted when there was an accident. Therefore the root causes that were likely to reveal the nature of the accident or accident potential were never fully explored, reduced or eliminated.

Eight dominant factors that affect accident rate had been found after running the safety management system for 5 years. Those factors are basically the area for taking corrective action on safety management system. It started from year of 2001, when a corrective action plan was made and implemented systematically focussing on dominant factors. Some examples of corrective actions taken are described as follows,

Factor : Management Commitment and Involvement.

Management from the low to high level were fully committed and involved in safety matter. Each department in the organization has fully been responsible to fulfill all safety requirements within its area. Prize and punishment system are applied to all employees with no exception. The higher the level of management, the higher its responsibility, and so is the risk to get punished and the greater opportunity to get the prize. Management were given sufficient budget for making safety system running. There is without a day for management to neglect safety. Management makes schedule for periodic safety tour. Total loss control management is applied with the objective of making any loss caused by accident intolerable.

Factor : Communication and Information.

Communication and information system was improved by means of safety campaign, safety meeting, safety road show, safety talk, etc.

Factor : Operational Guard System.

Operational Guard System is reviewed and improved. It is a must for any machine, tool and equipment to provided with guard.

Factor : Employee Competency.

All employee competency is reviewed and re-arranged. All employees must have know-what, know-how, about hazard within their work places and they have to be able to make job safety observation and analysis.

Factor : Safety Procedure.

Safety Procedures are reviewed and shall be totally implemented. All safety procedure shall be written in the Indonesian language. Procedure document shall be kept by appropriate person.

Factor : Safety Training.

Besides safety training which has been conducting before, some particular training has been added to the training program. The problem in safety training is that participant often get bored and paid a little attention to training material. The method of training is changed in such way to make training enjoyable.

Factor : Work Planning and Control.

Work Planning is renewed and up-dated. Work control as carried out beside by unit head concern, also by other units related to the work being done.

Factor : Safety Monitoring.

Safety Monitoring which is performed by safety inspector/department before, was changed to autonomous safety monitoring, meaning that safety monitoring must be carried out not only by safety inspector/department, but also by other units concerned which has a responsibility to do it.

Evaluation and correction on safety system particularly on dominant factor that affect accident rate are performed continually. As a result, the number of accidents was reduced drastically to maximum 7 and only minor accidents had occurred from 2001 to 2003.

Data of accident occurrence for 2001 until 2003 is as follows,

Month	2001		2002		2003	
	No of Accidents	Man Hours Lost	No of Accidents	Man Hours Lost	No of Accidents	Man Hours Lost
January	0	0	1	0	0	
February	0	0	1	0	0	
March	0	0	0	0	0	
April	0	0	0	0	0	
May	0	0	0	0	1	
June	0	0	0	0	1	3
					1	4
July	0	0	2	0	1	4
August	0	0	0	0	1	6
September	1	5	1	5	1	5
	1	4				
	1	7				
October	0	0	0	0	0	
November	1	7	0	0	0	
	1	5				
December	1	5	0	0	0	
Total	6		5	0*	7	

LTI = Lost Time Injury. \*None of employee absent from work after 24 hours. It therefore LTI = Zero and LTI Rate = Zero.