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DESIGN OF AN ACCIDENT PREVENTION PROGRAM
FOR THE MIDDLE INDUSTRY IN CHILE UNDER
THE NATIONAL HEALTH SERVICE

A THESIS

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SUMMARY

The purpose of this thesis was to design a practical accident prevention program for use throughout the middle industry in Chile, which would include all safety activities necessary to reduce the accident toll to an acceptable level. The program here designed specifies the assignment of responsibilities among the employers, labor unions and the government agency. This study considers the accident prevention program from the points of view of the National Health Service, a state agency, and the private enterprises.

As a government activity, this safety program includes the different stages to be performed by the state agency. As a program for the private middle industry, this accident prevention program presents the safety activities that can be realistically done in these enterprises.

The content of this program is based in the study of accident prevention experience among similar industrial enterprises in the United States of America, the recognition of the actual work accident situation through statistical data for Chile, and the legal requirements on this subject existing in Chile.

CHAPTER I

INTRODUCTION

In times before the Industrial Revolution no serious problem of work injuries was apparent. Since there was no organized collection of injury data or means of bringing them to public attention, there is little evidence of the problem (1).

The Industrial Revolution which marked the transition from the man power to machine power, brought with the introduction of machinery new types of hazards and a large number of work injuries.

It was only in the beginning of this twentieth century when the first efforts began toward compensation of employees who were injured at work. Such compensation was based on the concept that the employer is held liable not on the basis of his fault or negligence but on the basis of social policy.

The workmen compensation laws have provided some motivation for employers to reduce accident hazards and to assure safe practices in their establishments.

In modern industry with its increasing mechanization and automation and its increasingly complex machinery, materials and methods; the relationship of the worker to the environment produces various problems including those of adaptation, safety and health. Many of these problems are beyond the appropriate sphere of activity of the engineer,

or any other single type of professional person. Solutions require the combination of various professional persons such as engineers, physicians, and psychologists.

In Chile, the safety and health problems are additionally complicated by combinations of modern and obsolete equipment and methods, combinations of manufacturing and mining operations, and a general lack of skills among the workers (2).

The Chilean Government established the legal responsibility of the employer for work accidents in 1916. The work accident insurance law was issued in 1925, and in February, 1968 a new law was issued stating a variable rate for work accident premiums, according to the hazard and safety performance of the industry. This new law includes the prevention and compensation of the occupational diseases (3).

At the present time, the accident prevention activities in Chile, are restricted to companies in the large industry and a small number of companies in middle industry that have maintained insurance policies with a Governmental Insurance Agency. The major part of the middle industry and the small industry have no organized activity in accident prevention.

According to the latest accident statistics available (4), the frequency and severity rates for all the Chilean industry in 1965, were 105 and 4600, respectively. These rates may be compared with the corresponding rates for U.S.A. in the same year which were 6 and 700, respectively (5).

Though these statistics are incomplete, because they do not cover the entire industrial activity of the country, they are the basis for

the estimate that the accident rates of the middle industry are much higher than the average figures just given, because the large industry with its safety programs has achieved accident rates far below the average, and the small industry is only partially included.

The National Health Service in Chile, which has already made considerable progress in the study and control of occupational diseases and has begun a minor activity in industrial safety, has received the assignment of the responsibility of the prevention and control of work accidents and occupational diseases.

Accordingly, it will be apparent that there exists a big problem of work accidents in Chile, that there is an urgent need for beginning the attack of it, and that there exists a legal basis and a specialized agency to undertake the necessary preventive action.

To make possible an efficient preventive action against work accidents, it is necessary to plan a definite program for this activity under the National Health Service and to establish a model safety program for the middle industry to be performed substantially by the industry itself.

The purpose of this work is to design a practical accident prevention program for use throughout the middle industry in Chile, which will include all safety activities necessary to reduce the accident toll to an acceptable level. The program will specify the assignment of responsibilities among employers, labor unions, government agencies, etc., and will suggest a time schedule for its development and installation.

In the literature survey, little specific information has been found on safety programs for Chilean industry. Two papers were published in a specialized journal, in one of which there is a general description of the safety action in a large copper mine in Chile which is an American owned (6). The other article makes references to a first movement in safety education in Chile (7). There exists a report about the safety conditions in the Chilean industry issued by an American consulting engineer, but this report has not been published and it was not available (8).

Extensive information on accident control activities which have proven effective in industries in the United States, is available in handbooks, textbooks, and journals pertaining to this field.

CHAPTER II

GENERAL CONSIDERATIONS ABOUT ACCIDENTS

1. Nature and Extent of Work Accidents

Among the accidents that affect the human being, the work accidents are placed in a prominent rank in many countries. The toll that U.S.A. pays for the work accidents remains high, in spite of the progress that has been made over the past fifty years in organized accident prevention. Accident statistics report for this country a total of 14,500 deaths and 2,200,000 disabling injuries during 1967 with a total cost of \$6,800,000,000. These figures do not include accidents with no time lost or non-disabling injuries (9).

Within the industrial community, there are very large variations in accident rates from industry to industry and from company to company.

Trade, service, and manufacturing are, on the average, low-accident types of activities. Transportation, agriculture, construction and the extractive industries are high-accident types. The communication industry has accidental death rates substantially below the National average, and the lowest injury rates.

Manufacturing with more than a fourth of all workers, produced only about one eighth of all fatal work accidents and more than a fifth of all disabling injuries.

As with U.S.A., many countries are trying to expand their efforts in preventive action against accidents, avoiding the waste of lives;

skilled manpower, work-hours and money.

Among the humanitarian, social and economic reasons for preventive action against accidents (11) are:

- (1) Needless destruction of life and health is a moral evil.
- (2) Failure to take necessary precautions against predictable accidents involves moral responsibility for those accidents.
- (3) Accidents severely limit efficiency and productivity.
- (4) Accidents produce far-reaching social harm.
- (5) The industrial safety movement has already demonstrated that its techniques are effective in reducing accident rates and promoting efficiency.

The accident prevention activity has a significant constructive action in industry; it involves consequences of great importance, and it is something over which it is possible and practical for man to exercise control.

As an example, the rates of accidents of those industries that report to the U.S.A. National Safety Council, show through the years a large drop in their values (12).

2. Accident Definition and Classification of Injuries

There are two different criteria to define the work accident, according to its implications:

- a) The compensation-law criterion, and
- b) The safety engineering criterion.

According to the first, the accident is directly related with the kind of injury that a man suffers in his work.

The second criterion defines the accident as an unintended occurrence arising out of employment in any kind of business or industry that either causes personal injury or causes property damage or interference with production or other business activity under such circumstances that personnel injury might have resulted. This definition requires the element of personal danger, and it is wider in scope than the first one.

The terms "accidents" and "injuries" are often used interchangeably. Statistically, one accident might give rise to one or several injuries or none.

Personal injuries have been divided into a few major types, and are referred to as "lost-time," "doctors'," and "first-aid" cases. The lost-time cases are called, too, "disabling injuries," and "doctors'," and "first-aid" cases are called "medical treatment injuries." A lost-time injury is one that either makes a worker unable to perform a regularly established job on any one or more days following the injury or results in some permanent impairment or death.

Injuries are classified, too, according to the degree of disability, in the following types:

- a) Permanent total disability, fatality
- b) Permanent partial disability
- c) Temporary total disability
- d) Nondisabling injuries.

3. Causal Factors

It is true that safety work attempts to prevent all hazardous occurrences and eliminate unsafe conditions, but no harm has actually

come until costs have been incurred or injuries suffered. The way to prevent personal injuries is to prevent those unintended occurrences that might result in personal injury.

When attempting to isolate the causes of an accident, it is possible to establish the six elements of accident causation by the standard procedure (13), as follows:

- (1) The agency
- (2) The agency part
- (3) The accident type
- (4) The unsafe mechanical or physical condition
- (5) The unsafe act
- (6) The unsafe personal factor.

In most industrial accidents, both an unsafe condition and an unsafe act are contributing factors. In almost 80,000 work injuries reported in Pennsylvania in 1960, an unsafe condition was identified as a contributing factor in 98.4 per cent of the non-fatal manufacturing cases. In the same study, an unsafe act was identified as a contributing factor in 98.2 per cent of the non-fatal cases. Thus, both an unsafe act and an unsafe condition contributed to about 97 per cent of the non-fatal manufacturing injuries reported (14).

An unsafe condition, in addition to being a direct cause of accidents in itself, often can lead people to perform unsafe acts. Many times, an unsafe act is the result of poor machine design, inadequately planned methods, and other engineering deficiencies. Thus, elimination of a hazard caused by an unsafe condition may also reduce the likelihood of injury from an unsafe act.

When an injury occurs, the unsafe condition is often not as glaringly evident as the unsafe act. Unless a careful analysis is made of the accident, the correctible physical hazard may escape notice.

In summary, Safety Engineering, therefore should have as its objectives both the elimination of hazardous conditions and the reduction of unsafe acts.

4. Accident Rates

A record of injuries is an essential part of an efficient and successful safety program. In the absence of a uniform definition of accident rates, all comparisons between the injury data of different establishments become almost worthless.

There are two principal rates, widely used in accident prevention to measure the actual injury experience showing how often injuries occur and to indicate the rate at which time is being lost. Only disabling injuries are used in computing these rates which enable a company to determine the effectiveness with which its employee injury problem is being met, and what progress is being made. Of these two injury rates, frequency is a much more valuable indicator of safety performance than severity, because chance plays a greater part in determining the seriousness of an injury than it does in determining how frequently accidental injuries occur.

The disabling injury frequency rate is determined by the total number of disabling injuries which occur during a given period, related to the hours worked during the period and expressed in terms of a million-hour unit, according to the following formula:

$$\text{Frequency rate} = \frac{\text{No. of disabling injuries} \times 1,000,000}{\text{man-hours of exposure}}$$

The American Standard Method of Recording Work Injury Experience (15) specifies that the hours be calculated from the payroll time clock records, or in some instances estimated by multiplying the total employee-days worked by the number of hours worked per day. When an estimate of exposure is to be made, a satisfactory yearly estimate is obtained by multiplying the number of employees by 2,000 in the case of a 40-hour week, for most types of industrial operations.

The disabling injury severity rate is determined by the total number of days charged and actual days of disability from disabling injuries which occurred during the period covered, related to the hours worked during the period and expressed in terms of a million-hour unit, according to the following formula:

$$\text{Severity rate} = \frac{\text{Total days lost or charged} \times 1,000,000}{\text{Man-hours of exposure}} \quad (8)$$

Included in the injury severity rate are the actual days lost and scheduled time charges. In a majority of cases in which scheduled charges are assessed, these charges exceed the actual days lost, because they represent potential losses of productive working capacity by the injured employee.

5. Accidents' Costs

Besides the humanitarian purpose of accident prevention, and as a main driving force behind the industrial safety movement is the fact that accidents are expensive. Substantial savings can be had by preventing them.

There are two major classes of costs resulting from accidents:

- a) insured costs
- b) uninsured costs.

The insured cost including medical treatments, disability benefits, etc., is ordinarily readily available in the company records.

The elements of uninsured cost are:

- a) Cost of wages paid for working time lost by workers who were not injured.
- b) The net cost to repair, replace, or straighten up material or equipment that was damaged in an accident.
- c) Cost of wages paid for working time lost by injured workers, other than workmen's compensation payments.
- d) Extra-cost due to overtime work necessitated by an accident.
- e) Cost of wages paid to supervisors while their time is required for activities necessitated by the accident.
- f) Wage cost due to decreased output of injured worker after return to work.
- g) Cost of learning period of new worker.
- h) Uninsured medical cost borne by the company.
- i) Cost of time spent by higher supervision and clerical workers on investigations or in the processing of compensation application forms.
- j) Miscellaneous unusual costs.

Some of these items are not apparent in the individual accident, but they appear as general cost in the plant (17).

Various studies have indicated that the ratio of uninsured costs to insured costs ranges from 1 to 1 to as high as 20 to 1, and some

authorities assume an average ratio of 4 to 1 (18). The validity of this average ratio has frequently been questioned, and a good case can be made for a considerably higher ratio, because there is much more likelihood of damage to expensive equipment or material in some industries than there is in others.

A straightforward method for approximating uninsured cost is to determine the approximate company or plant averages of such costs for:

- (1) death and permanent total disabilities;
- (2) permanent partial and temporary total disabilities;
- (3) medical treatment cases referred to a physician;
- (4) first-aid cases; and
- (5) accidents which resulted only in property damage.

Once average costs have been established for each accident class, they may be used as multipliers to obtain total uninsured costs in subsequent periods. These costs then may be added to known insured costs to determine the total cost of injuries. It should not be inferred that so-called average costs are the ultimate answer. This procedure, which has definite limitations, is merely suggested as a better overall approach than to assume an arbitrary ratio of uninsured costs to insured costs. A catastrophic occurrence would unbalance the average, moreover the number of cases reported by any one company would often be insufficient to establish a legitimate average.

6. Control of Accident Hazards

The basic measures for preventing accidental injury, in order of effectiveness, are:

(1) Eliminate the hazard from the machine, method, material or plant structure.

(2) Control the hazard by enclosing or guarding it at its source.

(3) Train personnel to be aware of the hazard and to follow safe job procedures to avoid it.

(4) Prescribe personal protective equipment for personnel to shield them against the hazard.

If the hazard can be eliminated, none of the other steps need be taken. If all possibilities have been exhausted and the hazard is still not removed, then every effort should be made to enclose, or guard the hazard as its source so that exposure to injury is controlled. In some cases, this measure can be just as effective as elimination of the hazard, but it is usually second best.

If either of the first two measures can be successfully employed, the need for one-the-job training to protect personnel against hazards is either eliminated or greatly reduced, and use of personal protective equipment may be found unnecessary.

The control of mechanical and physical hazards cover these four engineering aspects: design, construction, operation and maintenance. However, these functions are interdependent. Good design can reduce the hazards of construction and operation and will minimize maintenance. Maintenance, in turn, is necessary in order to continue the original optimum quality of safety operation.

The reduction of mechanical or physical hazards include areas of consideration like the following:

- a) Plant layout and design
- b) Machinery and mechanical equipment
- c) Point-of-operation guarding
- d) Material handling
- e) Hand tools
- f) Electrical equipment and installations
- g) Maintenance
- h) Housekeeping

Efficiency and safety in industrial operations can be greatly increased by careful planning of the location, design, and layout of a new plant or of an existing one in which major alterations are to be made. Numerous accidents, occupational diseases, explosions, and fires are preventable if suitable measures are taken right from the earliest planning stages.

Machinery ranks fourth as a source of disabling work injuries, accounting for about 10 per cent of all such injuries. Further pointing to the need for safe design of machines is the fact that this type ranks second as a source of permanent partial injuries (19). The design of machinery must be further improved if the number of injuries caused by machines is to be reached.

The main considerations in guarding of machinery are concerned with the following parts of machines:

- a) Point of operation
- b) Power transmissions

Material handling is another important source of accidents and it is responsible for about a fourth of them. Manual handling of objects

reached 22.6 per cent of the accident total in 1967 in USA. Manual handling is practically always present in all industry. It is necessary, therefore, that all workers who handle materials be taught the proper method of lifting so as to reduce the possibility of the occurrence of lifting-associated injuries.

The use of powered handling equipment involves certain risks that must be considered. Special guarding devices may be required for certain works, as well as special training for the operation of the equipment and the safe practice principles to be followed.

One method of preventing unsafe acts is to train employees in the proper use of tools and equipment. Similarly, the way to eliminate unsafe conditions is to train supervisors to establish and maintain a safe working environment. Training of employees must include safety. This training may be performed by training specialist or supervisor or foreman, and the procedures to be imparted may be some of these:

- (1) Lectures
- (2) Shop training
- (3) Discussion group.

There are two general methods for providing shop training within the company itself:

a) Vestibule instruction, to be done under the company's direction but in a place outside the production workshop. Usually it is conducted by instructors who are not actually workers in the shop. This method is only practical for the large company.

b) On-the-job training, is the more common method for acquainting the employee with a new job or teaching him additional skills. The

training is given ordinarily by the supervisor or someone in the department designated as instructor.

As the immediate job of preventing accidents falls upon the supervisor, because accident prevention and production control are closely associated supervisory functions, the safety training for supervisors must be given first of all. This training may be accomplished by providing a course of instruction for supervisors.

7. Occupational Health Hazards

The use of different substances and processes in the industry is creating special hazards by releasing toxic contaminants to the working environment. The contact, absorption or inhalation of certain contaminants may produce a temporary or permanent harm to the workers. Some of these effects of contamination in the human organism are called "occupational diseases."

Occupational health hazards which may adversely affect an employee are usually classified according to exposure as follows:

- (1) Toxic chemical agents
- (2) Biological agents
- (3) Physical agents.

The chemical agents consists of dusts, fumes, mists, vapors, and gases.

Among the biological agents are bacteria, fungi and parasites of occupational origin.

The physical agents and conditions include:

- a) Extremes of temperature and humidity

- b) Abnormal air pressure
- c) repeated motion, shock or vibration
- d) noise
- e) ionizing radiations.

Both chemical and biological agents reach the body by inhalation, skin contact, or ingestion. Inhalation and skin contact are the most important because the majority of occupational diseases result from breathing dusts, fumes, vapors, gases, and mists from skin contact with chemical or biological materials.

The evaluation of occupational health hazards usually proceeds in two states:

- (a) a preliminary survey to determine which operations and environmental physical agents may be hazardous; and
- (b) a detailed study including the use of air sampling and direct reading instruments to determine the amount of air contaminants present and the extent of exposure to physical agents.

The control of occupational exposures to injurious materials or conditions may be accomplished by one or more of the following methods:

- (1) Substitution of less toxic materials, or change of process.
- (2) Isolation or enclosure of operations or machinery.
- (3) Control at point of generation or dissemination.
- (4) Dilution with uncontaminated air.
- (5) Personal protective devices.
- (6) Maintenance, housekeeping and education.

These general principles of control apply not only to toxic materials such as chemicals and dusts, but also to many of the physical

agents. In addition to the above general methods of control, specific measures are usually employed for control of physical agents.

In the control of occupational diseases, the engineer and the physician have equally important roles.

The physician has the responsibility of the proper diagnosis of the occupational disease and the physical control of the workers.

8. Standards, Codes and Rules

Safety standards establish the safe procedure, practice or design for some industrial operations or products.

Some codes have been developed by some professional societies and contain specific rules upon a specific subject. Some codes of recommended practices, made by a group of industries, are used widely as internal rules for safe procedure and practice.

In a certain sense, the safety standard is a model which is the most desirable. In other cases, a safety standard might be determined on the basis of what is economically feasible at a given time under the present state of knowledge in the particular subject area.

Some of the standards are of the types of mandatory codes and are issued by the regulatory authorities, such as Federal, State, and municipal authorities. Other standards are issued as advisory standards and they may be widely adopted by the industry on a voluntary basis.

Although the original purpose of safety standards may have been to provide a uniform set of rules which could be adopted by governmental agencies as regulatory codes, should be considered acceptable at a given time, but recognized as a "minimum" rather than the most desirable

standard (20).

Safety standards, whether used as regulatory codes or as voluntary standards, provide the safety specialist with certain criteria upon which to base his recommendations and judgments for the elimination of hazards and the preservation of life and property. At the same time, because of the many variations of the same equipment or process that may be in use, it is frequently necessary to extrapolate from an existing standard to make it apply to specific situations not covered by the standard.

In either event, the safety specialist should have a thorough knowledge of all safety standards applicable to his operation, so that he may benefit from the collective experience and knowledge of others, as well as provide support for his recommendations to control environmental hazards.

CHAPTER III

THE WORK ACCIDENTS AND THE OCCUPATIONAL
DISEASES IN CHILE1. Industrial Population

In Chile as in other undeveloped countries, the problem of industrial accidents is becoming greater and greater. The causes of this are in the increasing industrial activity with new machinery, equipment and methods, the lack of skillness among the workers, and lack of knowledge about accident prevention among industry managements.

The estimate of the Chilean population at June 30, 1968, is 9,191,000 persons (21). This estimate is based on the last census in 1960.

According the same census figures, the economically active population and rates of activity is given in Table 1.

Table 1 shows that for a population of 7,627,000 persons (census 1960), the total economically active population was 2,356,000 persons, that is to say, the 30.8 per cent of the total.

Tables 2 and 3 give the distribution of the economically active population by occupational group and economic activity.

From the above tables, and correlating these data to 1968, there is an estimate population of 2,935,000 persons exposed to work accidents hazards, in Chile, as a first approximation.

Table 1. Economically Active Population and Rates of Activity by Sex and Age According to Recent Censuses, Chile (29-IX-1960)*

Sex/Age	(Thousands)		
	Males	Females	Both Sexes
10-14			
15-19	229.4	86.8	316.2
20-29	508.4	177.7	686.1
30-44	596.8	147.5	744.3
45-64	430.3	93.9	524.2
65 and over	<u>72.9</u>	<u>12.3</u>	<u>85.2</u>
Total	1,837.8	518.2	2,356.0

* United Nations: "Statistical Bulletin for Latin America," Vol. I, No. 1, page 23.

a) Data based on a sample

b) By definition all persons under 15 years are excluded.

Table 2. Economically Active Population by Sex and Occupational Group, According to Recent Censuses, Chile (Sept. 29, 1960)*

Occupational Group	(Thousands)		
	Both Sexes	Males	Females
0. Professional, Technical and related workers	121.3	61.8	59.5
1. Administrative, executive and managerial workers	40.9	35.2	5.7
2. Clerical workers	161.9	112.6	49.3
3. Sales workers	164.4	121.4	43.0
4. Farmers, fishermen and related	632.1	610.3	21.8
5. Miners, quarrymen and related	57.3	57.2	0.1
6. Workers in transport and communications	77.7	77.6	0.1
7,8. Craftsmen and Process Workers	643.8	541.9	101.9
9. Service workers	301.8	82.7	219.1
10. Not classifiable	<u>154.8</u>	<u>137.1</u>	<u>17.7</u>
Total	2,356.0	1,837.8	518.2

* United Nations: "Statistical Bulletin for Latin-America," Vol. I, No. 1, page 22.

a) Data based on a sample.

Table 3. Economically Active Population by Sex and Sector of Economic Activity According to Recent Censuses, Chile (Sept. 29, 1960)*

Sector of Activity	(Thousands)		
	Both Sexes	Males	Females
0. Agriculture, Forestry	648.0	625.9	22.1
1. Mining and Quarrying	97.3	95.1	2.2
2,3. Manufacturing	406.0	303.7	102.3
4. Construction	164.5	163.2	1.3
5. Electricity, Gas, and Water	6.0	6.0	6.0
6. Trade	225.3	171.4	53.9
7. Transport and Communications	120.2	114.2	6.0
8. Services	568.4	258.7	309.7
9. Not specified	<u>126.3</u>	<u>105.6</u>	<u>20.7</u>
Total	2,356.0	1,837.8	518.2

* United Nations: "Statistical Bulletin for Latin America," Vol. I, No. 1, page 21.

a) Data based on a sample

b) Included under "Services."

From the above tables, and correlating these data to 1968, there is an estimate population of 2,935,000 persons exposed to work accidents hazards, in Chile, as a first approximation.

2. Work Accidents Statistics

The only statistics of work accidents and occupational diseases available (2) is incomplete and the data there presented, corresponding to 1963 give an approximation to the actual problem:

Table 4. Number of Work Accidents and Days of Incapacity, by Insurance Company and Self-Insurance Institution, Chile - 1963*

Institutions	No. of Insured persons	No. of Work Accidents(a)	Days of Incapacity(b)
Insurance Companies	367,489	86,969	657,438
Insurance Mutuals	23,380	2,854	42,013
Self-Insurances Enterprises	<u>80,586</u>	<u>7,789</u>	<u>382,039</u>
Total	471,455	97,612	1,081,490

* Ministerio del Trabajo, Chile: "Boletín de Estadísticas de Seguridad Social," No. 24, 1965.

a) It includes only lost-time accidents.

b) It doesn't include scheduled charges.

Considering the same source of information it is possible to determine the frequency rate for several years in the country. The corresponding values are presented in the next table:

Table 5. Frequency Rates, Chile

Year	Frequency
1959	93.4
1960	88.4
1961	101.0
1962	99.5
1963	103.8

According to the tendency of these data it is possible to estimate the frequency rate for 1968. This value is 132.

From the comparison of the total of the active population, given in Tables 1, 2, and 3, and the total of the number of insured persons it is shown that the workers with accident insurance reach only 20 per cent of the economically active population.

The relation between the economic activity and the number of accidents is illustrated in this table taken from the main Insurance Company of Chile (23).

From this table it is shown that the economic activity that carries the high percentage of accidents is: Mining and Quarrying, with 43.1 per cent, followed by Wood Manufacturing with 41.8 per cent, and in third place is Construction and Public Works with 36.9 per cent of the insured people.

Grouping some industries, like Foods, Chemical, Mechanical, Textiles, and Wood Industries it can be seen that the relationship

Table 6. No. of Work Accidents and Insured People, by Economic Activity (Caja de Accidentes del Trabajo), Chile - 1963

	Workers with Insurance	Accidents
0. Agriculture	41,034	10,809
1. Mining and Quarrying	14,390	6,193
2. Food Industries	18,678	2,851
3. Chemical Industries	10,879	1,422
4. Mechanical Industries and Foundries	21,753	6,069
5. Textiles, Leather, and other industries	14,202	2,030
6. Wood Manufacturing	4,102	1,713
7. Construction and Public Works	28,652	10,558
8. Transport, and Communications	33,018	4,912
9. Other not classified	<u>2,062</u>	<u>469</u>
Total	188,770	47,026

between accidents and insured personnel is 20.3 per cent.

The relationship between the Agent that produces the accident and the number of accidents is given in Table 7, from the same Insurance Company (24).

The main type of accidents is found in falls of persons, followed by falls of objects and manual handling.

These data are taken from statistics of some years ago, but there is no reason for a substantial change other than the growth of population. So the problem must have risen or at least remained unaltered in the average.

It has been shown that the rates of frequency are high, compared with similar industry with some safety action.

Other points to consider are that the large industry present rate of frequency (48.4) is below the average for the country (103.8 in 1963). So the Middle Industry is responsible for the high rate. The Small Industry is included in a little proportion in this statistics.

3. Occupational Diseases

In this subject there are no statistics up-to-date, and there are some general estimates for 1958, where the National Health Service has reported that the 12 per cent of a population of 41,200 miners exposed to the silicosis hazards presents this disease. Silicosis is the most prevalent occupational disease found in the Chilean workers. The number of total cases that present some occupational disease, according to the report of the National Health Service (5) in 1958 reached to 7,256 cases. Among this group there is an estimate of 6,000 silicotics.

Table 7. Accidents by Agents, Sources and Types,
Chile - 1962

	<u>No. of Accidents</u>
1. Machines	2,658
2. Transportation	1,004
3. Explosions and Fires	140
4. Loading	810
5. Toxic Substances (no-disease)	1,091
6. Electricity	220
7. Falls	9,410
8. Steps on objects and collisions	2,486
9. Falls of objects	8,485
10. Landslide	155
11. Manual Handling	8,482
12. Hand Tools	2,482
13. Animals	918
14. Other Causes	<u>8,685</u>
Total	47,026

Other occupational diseases with some importance in the country are: lead poisoning, with 830 cases in 1957; manganese poisoning, with 148 cases in 1958 (26). There has been described some cases of solvent intoxication, by benzene, mercury poisoning, cromates and arsenic poisoning.

The true incidence of the occupational diseases in Chile must be higher than that just described. An important part of these diseases remains without diagnosis or is confused with common diseases and is computed as "common disease."

Other diseases, like dermatoses, do not have a diagnosis as an occupational disease, and others that are computed like "accident."

The economical effect of work accidents and occupational diseases over the country cannot be established clearly, because there is no available data on total accident costs, or occupational diseases.

The only relationship available is an estimate of disability for accidents, according to data from the same source, for 1963, as shown in Table 8.

This table shows an average of 9 days of lost-time for disability by each worker, and a 0.25 per cent approximately of deaths of all injured workers.

Making some estimates of costs for work accidents and occupational diseases, the National Health Service of Chile reported that for a population of 500,000 workers for which there were information, the cost was as much as the 2 per cent of National Gross Income and 70 per cent of the budget of the National Health Service (27).

Table 8. Disabilities by Work-Accidents,
Chile - 1963*

Disability	No. of Injuries	Lost-Days
Temporary Total Disability	95,903	1,081,490
Permanent Partial Disability	1,398	1,400,000
Permanent Total Disability	64	384,000
Deaths	<u>247</u>	<u>1,482,000</u>
Total	97,612	4,347,490

4. The National Health Service and the Work Accidents

The formation in 1952 of the National Health Service in Chile (Servicio Nacional de Salud), has given a great impetus to vastly improved domestic health and industrial health.

The new agency consolidated into one department several federal bureaus that operated independently of each other, although all performed services in the areas of public health, industrial safety, compulsory workers insurance, illness and old age pensions, working conditions, and other phases of social and industrial health and welfare.

Prior to 1952, industrial hygiene and industrial safety were left mainly in the hands of individual companies. Liaison between clinical experts and industrial hygiene engineers was non-existent. In addition, there was no full-time government staff of any consequence, nor a staff with technical training to analyze problems and evaluate methods for

avoiding accidents and illnesses.

In 1951, the Rockefeller Foundation, the Institute of Inter-American Affairs, and other international organizations, made recommendations to the government of Chile, and an industrial hygiene program was initiated.

With the establishment of the National Health Service, many health and safety benefits were expanded. The program was motivated by the need of more and better qualified technicians and by a desire to elevate the living and working standards of the people of Chile. Using scholarships made available through such international organizations, engineers and doctors came to the United States to study industrial hygiene and occupational medicine.

The contribution of the Institute of Inter-American Affairs (Technical Assistance Program) proved exceptionally beneficial with experts on the working scene in Chile, apart from grants of equipment, transportation units, laboratory materials, etc. (28).

Currently, occupational health efforts are carried out as an integral part of the National Health Service as a subdepartment dealing with hygiene, safety and industrial medicine. Depending upon this section there is an Institute of Labor Hygiene and Air Pollution. The purposes of this Institute are the research, education and services in the field of industrial hygiene, safety, industrial medicine and air pollution.

The action in industrial hygiene and safety is performed through the organization of the National Health Service about the country and includes the principal industrial towns. The personnel in this activity

in the National Health Service amount to 18 engineers, 13 physicians and 30 technicians.

The specific activity in accident prevention has been restricted to the partial control of industries in some general unsafe conditions and the partial control of boilers, according to a compulsory code that delivered the responsibility of its application to this section of the National Health Service.

5. Some Legal Aspects to be Considered

Besides the general functions of the National Health Service in the industrial field, that is to say, to keep vigil about the conditions of hygiene, safety, and sanitation of every work place, the specific functions of the section of industrial hygiene, safety and occupational medicine are given by some codes concerning to safety and hygiene. Besides these aspects, a new law on work accidents and occupational diseases, issued on February 1, 1968 (29) gives other duties to the National Health Service, establishing that:

a) The control of the preventive action, the safety and sanitation of all work places shall be responsibility of the National Health Service.

b) The enterprises will accomplish all the measures that the National Health Service requires.

c) Every industry with more than 25 workers must have a Safety Committee, with representatives of the employer and workers.

d) All enterprises with more than 100 workers must have a Department of Prevention of Occupational Hazards. This Department will be

directed by an expert in accident prevention, who will be a part of the safety committee.

e) All the enterprises will have an up-to-date internal safety code.

f) All the enterprises with more than 2,000 workers may be self-insured companies, and they must comply with the requirements of the National Health Service.

There are many other statements in this law, other than these above presented, but these are the main general ones.

CHAPTER IV

THE MIDDLE INDUSTRY IN CHILE

1. Definition and Characteristics

There is no precise definition of what is called the Middle Industry. There is not a definite set of limits within which to place each kind of plant, because there are several factors that determine whether a plant may be considered large, middle or small. Only in mining are there precise limits within which it is possible to classify a mine. These limits involve the tonnage of ore in a year. In the manufacturing industry, the general criterion of classification is the number of employees.

From the safety viewpoint, too, it is better to use, as a definition limit, the number of workers. In Chile, the general classification, according to this criterion is:

- (a) Small Plants, those plants with less than 25 workers;
- (b) Middle Plants, with more than 25 workers and fewer than 500 workers; and
- (c) Large Plants, over 500 workers.

According to the new law about work accidents just mentioned, a new classification will be necessary, because this law distinguishes classes of enterprises as:

- (a) less than 25 workers;
- (b) more than 25 workers and fewer than 100;
- (c) more than 100 workers and fewer than 2,000; and

(d) more than 2,000 workers.

Though this classification is made from the viewpoint of the safety organization, this is not a general accepted classification in this work, as middle industry will be understood to be those plants with more than 25 workers and less than 500.

One of the main characteristics of the plants of the Chilean middle industry is that, in a great number, they are owned by a person or a few partners. Other characteristics are:

(a) They are managed, in many cases, by the owner himself, or other partner. Many times, this person acts like manager, supervisor, and foreman.

(b) Normally the manager has no time to expend in safety activities, because he has no knowledge of this subject and is convinced that the small number of accidents in a plant do not require his special attention.

(c) A great number of plants do not have resources for employing safety personnel, and so, the problem of accidents cannot be attacked.

(d) A gross part of these industries are doing nothing in accident prevention, because the general feeling is that the insurance coverage protects them from economic loss.

(e) The consequence of accidents in some of the middle plants may have serious effects or even disastrous effects, because the damage to an equipment unit or a machine can stop the production of the whole plant.

(f) the financial situation of many plants is difficult, and it is not easy to convince management that safety savings repay the investment.

There are no specific statistics in Chile about the accidents in industry, or the distribution of people working in these plants.

2. Geographical Distribution of the Industry

There are no precise data about the middle industry and its distribution in Chile. A manufacturing census is being undertaken, in September 1968, by the Bureau of Statistics and Census (30). A 1967 pre-census revealed that there are 37,000 industries in the country, including large, middle and small industries. The 1968 Census will eliminate the smallest line of production, repair and artisanry.

An estimation of the number of large and middle industries for Santiago, the Capital of the Country, gave 6,500, according to the Chilean Development Corporation (31), and from this figure the middle industry was estimated in 5,500 plants.

The estimation of the industrial manufacturing population, number of industries and its distribution by industrial towns is presented in the next table.

Table 9. Estimated Distribution of Industries and Manufacturing Population, by Towns, Chile - 1968*(a)

Towns	Manufacturing Population	No. of Industries	No. of Middle Industries
Santiago	250,000	15,000	5,500
Concepcion	130,000	6,000	1,500
Valparaiso	100,000	10,000	2,000
Antofagasta	20,000	1,500	400
Talca	20,000	1,000	200
Valdivia	30,000	2,000	600
Other Towns	<u>12,000</u>	<u>1,500</u>	<u>400</u>
Total	562,000	37,000	10,600

* Table based on information of the Chilean Development Corporation.

^a Figures rounded by the imprecision of the estimate.

From the above table it may be seen that the Town of Santiago has, approximately, 50 per cent of all the manufacturing industry.

The accident prevention efforts must be related to the distribution of the industrial population, and the personnel that the National Health Service have for working in this activity must be distributed by zones, according to the population shown in the last table.

3. Some Comparisons of the Middle Industry in Chile with the Small Industry in U.S.A.

The United States Department of Commerce, in 1941, suggested that a small manufacturer might be defined as one with 100 or fewer employees. More recently, according to the same Department, there has been a tendency to say that any manufacturer having 500 or less employees is small, but almost everyone admits that any single standard of size is in error. Small size is a relative term; what is large to one industry may be comparatively small in another.

A report about an Occupational Health Program for Small Plants (32) considers as small plants those with less than 500 employees. Another work about safety program in small plants (33) considers as small plants those with fewer than 100 employees. The Accident Prevention Manual for Industrial Operations (34) classify also the plants in small, medium, or large size, according to the number of workers in them. Small plants are defined there as those with less than 100 workers.

The Chilean middle industry falls partially inside the American classification of small industry.

Some characteristics of the small plants in the U.S.A. are:

(a) A business which is operating with its own capital, either

individually owned or a partnership.

(b) A business whose management is essentially a matter of one-man control.

(c) The small plants cannot employ specialized safety personnel to deal with the accident problem.

(d) The financial position of many small concerns make it difficult to convince them that spending the money necessary for proper equipment, layout, guarding, and other elements is important.

(e) Small-plant management, harried by a host of problems in all fields, seldom will find time for proper study of accidents and their causes.

(f) In small units, statistical measures of performance are unreliable, so that it is difficult to produce clear-cut evidence as to the effectiveness of accident prevention (35).

All these characteristics are true for a great part of the middle industry in Chile.

The small industry in the U.S.A. presents the high frequency rates of the U.S.A. industry, and the Chilean middle industry, though there are not statistics available, may be considered responsible for similar situations, considering that the average frequency rate for the Chilean industry was 103 and that for large industry was only 48.4 as was said in Chapter III.

The safety considerations made for the American small industry serve the same for the Chilean middle industry and they may be applied to this effect.

CHAPTER V

PLANNED ACTIVITIES IN ACCIDENT PREVENTION

Stages of a Safety Program

In all planned activity there are some steps to accomplish, corresponding to some general stages in the human behavior. These steps correspond to: thinking, acting, measuring, and progressing. These steps are summarized in the stages of a program that are called:

- A. Informative Stage
- B. Determinative Stage
- C. Active Stage
- D. Evaluative Stage

The informative stage corresponds to the collection of information about a problem in order to see the magnitude of it, the need, and the possibility of the attack of the problem.

The determinative stage corresponds to the decision making involved in the solution of the problem. In this stage, it is necessary to fix the objectives, the method of attack, the content of the program; that is to say, the activities to be performed in this program, the resources of materials and personnel, the time schedule of the program, the evaluation indexes, and the priorities of the activities.

The active stage corresponds to the start, development of the program, and the fitness of the action to the available resources, and the control of the method of procedure.

Activities to be Considered in a Safety Program

Practically all the things we do to prevent accidents can be grouped into distinct areas of activities. Unless we are doing some things in each area, the program lacks balance as we are neglecting some avenues of approach to safe operations. If all the efforts are concentrated in one or two areas and others are neglected, the program will be unbalanced and the results will show the effects.

The activities concerned with a safety program may be grouped in these four groups:

- (a) Safety Information
- (b) Safety Organization
- (c) Solution of Safety Problems
- (d) Miscellaneous

Every one of these includes some parts to be considered in a complete program. Many of them are not completely accomplished by the specific program, and others are in some cases more important than another; but, theoretically, all of them might be included in a complete program.

Safety Information

Safety information must include nine areas.

Establishment of a Safety Information System. The need of knowing what is happening in accident matters is fundamental for those who are related to the preventive action, for management, for the production branch of an industry, and for government agencies concerned with the problem. So the information on accidents must be collected and communicated to all interested in it. The first problem that arises is what information about

accidents to collect. Here the American Standard Z16.2 (American Standard Method of Recording Basic Facts Relating to the Nature and Occurrence of Work Injuries) is useful. This Standard permits identification of certain key facts about each injury and the accident that produced it and records those facts in a form which will permit summarization to show general patterns of injury and accident occurrence in as great analytical detail as possible. These patterns are intended to serve as guides to the areas, conditions and circumstances to which accident prevention efforts may be directed most profitably (36). Items to be included in the information, besides the general information of the accident and injured person, are:

- (a) nature of injury, the type of physical injury incurred;
- (b) part of body, the part of the injured person's body directly affected by the injury;
- (c) source of injury, the object, substance, exposure, or bodily motion which directly produced or inflicted the injury;
- (d) accident type, the event which directly resulted in the injury;
- (e) hazardous condition, the physical condition or circumstance which permitted or occasioned the occurrence of the accident type;
- (f) agency of accident, the object, substance, or part of the premises in which the hazardous condition existed;
- (g) agency of accident part, the specific part of the agency of accident that was hazardous;
- (h) unsafe act, the violation of a commonly accepted safe procedure which directly permitted or occasioned the occurrence of the accident event.

With this information it is possible to make an analysis of the accident.

The second question about accident information is where to collect it. The collection of injury data generally begins in the first aid department. The first aid attendant or nurse fills out a first aid report for each new case. The line supervisor or the investigator of an accident must make a detailed report about each injury severe enough to require a doctor's attention or one needing more than two treatments (37). This report should be completed as soon as possible after an accident occurs.

Now, the way in which this information is collected is through the use of standardized forms. One form is used for first aid reports and another one is used for the supervisor's report. All the safety information must be located in a centralized place in the company where it will be recorded, after being classified.

Accident Reports. The report of accident issued by the central office (Safety Department or others) and sent to other sections must be done on a standard form, preferably the same as the one used for the Official Agency. This will avoid loss of time of the personnel involved. The accident report will contain a classification of accidents in "disabling" or "lost-time accident" and "non-disabling injury". This permits having a special record of the last type, which is needed because such cases may develop complications, and the causes of non-disabling injuries should be found and eliminated because they might lead to serious injuries.

Non-Injury Accidents. In some cases it is possible to carry on a record of non-injury accidents in order to determine and correct their causes, because any accident may give place to an injury.

Computations of Accident Rates. From the reports of injuries

(disabling injuries), it is possible to compute the frequency rate and the severity rate, according to the USASI Z.16.1. For the severity rate, it is necessary to know the number of days of disability, the actual days and charged days. In the Supervisor Report Form, information is given about the classification of the injury and the time charge. These rates may be computed for sections or departments of the plant.

Accident Investigation. The accident investigation is of great importance in the safety program. Therefore, the persons running the safety program must protect its integrity as a device for preventing accidents. Investigations must be fact finding, not fault finding. Otherwise, they may do more harm than good (38). The principal purposes of an accident investigation are:

(a) to know the accident causes so that similar accidents may be prevented by mechanical improvements, better supervision, or employee instruction;

(b) to publicize the particular hazard among employees and their supervisors, and to direct attention to accident prevention in general;

(c) to determine facts bearing on legal liability.

The investigation should be made as soon after the accident as possible. A delay may permit the destruction or removal of important evidence, intentionally or unintentionally. The result of the investigation should be made known quickly, inasmuch as the publicity value in the safety education of employees and supervisors is greatly increased by promptness.

Accident Analysis. Accident prevention must be based on facts which clearly identify the problem. An approach to the accident prevention problem on this basis not only will result in more effective control

over accidents, but will permit this objective to be accomplished with savings in time, effort, and money.

After injury frequency rates have been used to identify the plants or departments in which injuries occur most frequently, analysis of individual cases will provide the information necessary to reduce accidents in these locations.

Analysis of the circumstances of accidents according to USASI Z 16.2 can serve for these purposes (39):

- (a) Identify and locate the principal sources of accidents;
- (b) Disclose the nature and size of the accident problem in departments and among occupations;
- (c) Indicate the need for engineering revision correcting the unsafe condition;
- (d) Disclose inefficiencies in operating processes and procedures where poor layout, outdated methods, or procedures which overtax the physical capacities of the workers can be avoided;
- (e) Disclose the unsafe practices which need special attention in the training of employees;
- (f) Disclose improper placement of personnel in instances in which inabilities or physical handicaps contribute to accidents;
- (g) Enable supervisors to use the time available for safety work to the greatest advantage by providing them with information about the principal hazards and unsafe practices in their departments; and
- (h) Permit an objective evaluation of the progress of a safety program by noting in continuing analyses the effect of different safety measures, education techniques, and other methods adopted to prevent injuries.

The accident analysis is based on the information supplied by the accident reports, the first aid and supervisor's reports, and through the study of the nature of injury, the part of the body affected, the source of injury, the accident type, the hazardous condition, the agency of accident, and the unsafe act.

After an accident analysis, the conditions which contributed to the accidents must be corrected.

In summary, the steps to follow in developing adequate information about accident experience are:

- A. Obtain reports on every injury, including medical treatment cases.
- B. Classify and record each injury according to the corresponding USASI provisions.
- C. Prepare a periodic summary report showing injury rates and the circumstances and causes of the accidents which resulted in the injuries.
- D. Analyze periodically the circumstances and causes of accidents.
- E. Make the reports of accidents for the State Agency, according to the legal requirements.

Other activities that contribute some information about accidents are exposed next.

Safety Inspections. Inspections are one of the principal means of locating accident causes. They assist in determining what safeguards are necessary to protect against hazards before accidents and personal injuries occur. Four questions about inspections must be answered.

- (1) Who will inspect?
- (2) Where to inspect?

(3) What to look for?

(4) When to inspect?

Who will inspect will depend largely on the size of the organization and the amount of time required to inspect all areas where hazards could exist.

Inspectors will come from the following:

- (a) Managers, Supervisors, Foremen
- (b) Workmen
- (c) Safety Supervisors, Safety Engineers
- (d) Specialists -- industrial hygienists, boiler inspectors, elevator inspectors, etc. They may be full-time employees or engaged on contract for specific inspections.

To assure the inspection of all items that need attention by employee-inspectors, it is general practice to use safety checklists. Such lists should be tailored to the specific needs of plants or departments.

The safety inspection should be performed at regular intervals, depending on the degree of hazard of the plant. Some equipment such as boilers, elevators, hoists, and others requiring highly specialized knowledge are usually required by law to be inspected at least annually by licensed inspectors.

In small plants, the manager or superintendent will usually inspect every point of operation, every machine, and all building areas on his frequent tours through the plant. He will detect such things as poor housekeeping, unsafe piles of materials, the condition of floors and stairways, unsafe tools, and many other potential accident-causing factors.

In large plants, the manager usually delegates the safety inspection job to the safety committee, where there is no safety department, and

requires reports of the unsafe items discovered and what was done to correct them.

In the safety inspections, the items to be inspected are, in general, the physical conditions and the personal acts. Among the first are: electrical equipment, machinery, walkways and aisles, elevators and hoists, material handling equipment, tools, health hazards, fire protection, personal protective equipment, storage areas, working conditions as light, temperature, crowded work spaces.

Among the personal acts are: authorized use of tools and machines, safe use of tools and machines, safe working speeds, replacements of guards, working or standing under suspended load, etc.

Safety inspections records are usually handled by the managers of small plants. In large plants, they may be sent to the chairman of the safety committee, to the safety engineer, or to the safety department for disposition (40).

Determination of Accident Costs. Although most executives want to make their companies safe places in which to work, they also feel a responsibility for running their business profitably. Consequently, they may be reluctant to spend money for accident prevention unless they can see a prospect for saving at least as much as they spend. Without information on the cost of accidents, it is practically impossible to estimate the savings which are affected through expenditures for accident prevention. Facts about the cost of accidents may be used effectively in securing the active cooperation of foremen, who are cost conscious because they are expected to run their departments profitably. To be of maximum usefulness, cost figures should represent as accurately as possible the specific

experience of the company itself.

For many years, the relationship between direct and indirect costs has been used to estimate the total cost of accidents, but this does not provide the maximum accuracy possible. Using the data obtained for the insured and uninsured costs of a plant makes it possible to estimate its accident cost with reasonable accuracy.

The insured costs can be determined easily from accounting records. The difficult part is determining uninsured costs. A procedure for determining uninsured costs follows these steps.

(1) To make a pilot study to ascertain approximate averages of uninsured costs for each of the following four classes of accidents.

Class 1 -- Permanent partial disabilities and temporary total disabilities

Class 2 -- Medical treatment cases requiring the attention of of a physician outside the plant

Class 3 -- Medical treatment cases requiring only first aid or local dispensary treatment and resulting in property damage of less than \$20.00 or loss of less than 8 hoursj working time

Class 4 -- Accidents which either cause no injury or cause minor injury not requiring the attention of a physician and which result in property damage of \$20.00 or more, or loss of 8 or more man-hours.

(2) Once the average costs have been established for each accident class, they may be used as multipliers to obtain total uninsured costs.

(3) Classify the total number of accidents according to the preceding classes.

(4) Multiply the number of accidents of each class by the multiplier just obtained, add for getting the total uninsured cost.

(5) Add to the total uninsured cost the known direct costs. This total will approximate the total accident cost for the period.

The average costs determined in this pilot study represent the actual experience of this particular company. Until important changes take place in this company's safety program, in the kind of machinery used or persons employed, or in other aspects which affect costs, the same average costs may continue to be used, subject to periodic checks.

Information on some items of accident cost is derived from the Department Supervisor's Accident Cost Report, for which a standard form is used.

Care must be taken before using these costs to apply to other industries or plants because there are differences in the size of the plant, wage factors, cost of materials, supplies and equipment. There is not an easy way to determine cost, and if it is expected that management will put any credence in the figures supplied, it is necessary to substantiate their reliability. The advantages of using accident costs as a tool for motivation lie in the fact that money is a critical factor in most management decisions (41).

Safety Rules and Codes. Before starting any safety program, it is necessary to know what has been done by trade or industry associations related to the kind of industry involved, and in the industrial safety field. Normally, some information about safety devices available, safety practices, and procedures is published under a procedure of long study, discussion and consultations. Some of this information may be gotten from the United States of America Standard Institute, from the National Fire Protection Association, the American Society for Testing and

Materials, and some industrial associations, such as the American Foundrymen's Society, Manufacturing Chemists' Association, Portland Cement Association, American Iron and Steel Institute, and American Petroleum Association.

Based on these standards and on the rules and laws on accident prevention, it is possible to develop a group of internal safety rules for the individual plant. These rules must consider the specific characteristics of the production and personnel.

Safety Organization

It may be defined as a method employed by management to assign responsibility for accident prevention and to ensure performance under that responsibility (42). In the industrial safety programs, it has come to realize that there is a close relationship between good safety and good management. With proper and adequate managerial direction, teaching, motivation, and enforcement, employees can work in environments filled with hazards without having accidents. The same management principles that are applied to quality, cost, and production also must be applied to safety (43).

The safety organization to be adopted by an industry depends upon the size of the industry or the hazards involved in it. The safety organization for a governmental agency will have a very different structure.

Systems of Safety Organization. As it was stated, the system of organization depends upon the kind of enterprise, size, hazards present, etc. The small industry in the U.S.A. or the middle industry in Chile must adopt organizations that vary according to the number of workers in the plant. In Chile, the law established that all the industries with

more than 25 workers and less than 100, must have a safety committee, and the industry with more than 100 workers and less than 2,000 must have a Safety Department managed by a Safety Specialist. This is the minimum organization required by the law (44).

In the case of some plants, the safety organization will consist of the owner and the safety committee, or the manager, or supervisor and safety committee, and in other plants there may exist a complete staff of safety personnel. In any case, the program should be individually designed for the specific plant in which it is to be used. The first step in organizing a safety program for any plant is to assign the responsibility for the program to one specific person. This person may be known as the safety director, the safety engineer, the safety supervisor, or he may be the owner, the manager, the supervisor, or a foreman.

The first characteristic of any safety organization is the assignment of responsibility of the program to a suitable qualified person. The second important step is to delegate responsibilities to other members of the plant, including in the first place to the manager or owner.

A controversial subject has been whether the safety organization should report to a line or staff executive. To make clear the difference, it is necessary to say that there are two basic forms of organization structure, namely, line structure and staff structure. However, nearly all practical organizations are a combination of both types (45). Pure line structure is rare, although it is likely to be characteristic of very small businesses. As the business expands, the development of a staff organization becomes a necessity. The line organization is the hierarchy of executive and operative personnel which extends from the executive head

head of the entire organization to the groups of primary operatives. In a factory, this is the organization that is directly concerned with the production.

Staff, on the other hand, is concerned with the service of providing information and advice to line men and may be found at any level of the line organization. It aids the line men by taking care of those activities which are generally not directly connected with production but are still necessary to the operation of the business.

Line and staff are not opposite in meaning but refer to a relationship between functions.

It has been shown that the safety function is definitely a staff function (46), except in small plants where this function is accomplished by line personnel.

Among the activities included under safety organization are:

- (a) The role of management,
- (b) The role of supervision,
- (c) The role of individual employee,
- (d) The role of safety committee,
- (e) The role of employee union, and
- (f) The role of staff personnel.

Safety Training. In American industry, those safety programs which are most successful are the ones where all levels of management not only support but actively participate in their conduct (47). Safety rests, to a high degree, with the foreman, because it is his responsibility to train workers, to maintain standards of quality, and the quantity of production as programmed. These supervisors represent all of management to the workers

and their efforts have much to do with whether or not good employee morale is maintained. Training is also necessary at the workers' level. This training is sometimes performed by the foremen and at other times by training personnel.

The steps that are the real foundation of any training program are:

- (1) Identifying training needs,
- (2) Formulating training objectives,
- (3) Gathering materials and developing course outlines,
- (4) Selecting training methods and techniques,
- (5) Conducting training programs, and
- (6) Evaluating training programs.

How these steps are used determines, to a large degree, how successful the program is going to be (48).

Solution of Safety Problems

In attacking the solution of safety problems, the first step is to determine the top-priority problems. The criterion to follow in this procedure will be the high frequency rate determined for the section or department. The analysis of accidents will give the information about the factors affecting the accident production. From this same analysis is derived the need of correction. The other steps follow.

Correction of Unsafe Conditions. The accident analysis, the safety inspection report will show the exact unsafe condition, and correction of it must be made as soon as possible. This activity must be oriented to the check of

- (a) General conditions of building, including floors, ladders, stairs, exists, lighting, ventilation, temperature, etc.;

- (b) Machinery;
- (c) Electrical installation;
- (d) Hand-tools; and
- (e) Pressure equipment.

Methods of Improvements. In order to improve the productivity and to avoid accident, it is necessary to study each industrial operation in the plant. Many hazards that may have been overlooked in the design of the plant and in the design of machinery, equipment and processes, or that may have developed after production has begun demand that a continuing programmed activity must be carried on to uncover them. This activity is job safety analysis. A job safety analysis is a procedure to make a job safe by:

(1) Identifying the hazards or potential accidents associated with each step of the job.

(2) Developing a solution for each hazard that will either eliminate or control the exposure.

Once the hazards are known, the proper solutions can be developed.

The four basic steps in making a job safety analysis are (49):

- (1) Select the job to be analyzed,
- (2) Break the job down into successive steps,
- (3) Identify the hazards and potential accidents, and
- (4) Develop ways to eliminate the hazards and prevent the potential hazards.

The last step involves the following solutions:

- (a) Find an entirely different way to do the job;
- (b) Change the physical conditions that create the hazards;

(c) If changing the physical conditions does not eliminate all the hazards, revise the job procedure; and

(d) Reduce the frequency of the job by correcting the conditions that make it necessary.

This job safety analysis affords a study of the methods of performing some jobs and gives the possibility of changing or improving them.

Particular Attention Paid to Some Events that are Sources of Accidents. Some operations, activities, and types of accidents require special attention because the frequency and severity of accidents makes them very hazardous. These operations and types of accidents vary from one plant to another, but some of them may be mentioned here.

(a) Falls of persons. Falls must be considered from the same level and from different levels.

(b) Falls of objects.

(c) Material Handling. Includes mechanical and manual handling, the latter after being a source of high frequency of accidents.

(d) Machinery. Special consideration must be given to the point-of-operation, transmissions, and moving parts.

(e) Hand tools.

Miscellaneous Activities

There are some fundamental activities of a safety program that cannot be included in the previous classifications and they are considered here as miscellaneous.

Medical and First Aid Facilities. In the small and middle industry, it is not practical nor justifiable to have qualified professional medical personnel available. In this case the best arrangement is a suitable first

aid kit or a station administered by trained lay first aid attendants who follow procedures and treatments outlined by a doctor. The doctor should be available on an on-call or referral basis to take care of injuries not of a minor nature.

There are two kinds of first aid. One is emergency treatment, given in the case of accident or sudden illness before the services of a physician can be secured. The other kind of first aid is the prompt attention given to injuries, such as cuts, scratches, bruises, and burns, which are usually so minor that the injured person does not ordinarily seek medical attention.

A first aid program should include the following (50):

- (1) Properly trained and designated first aiders on every shift.
- (2) A first aid unit and supplies, or first aid kit.
- (3) A first aid manual.
- (4) Posted instructions for calling a physician and notifying the hospital that the patient is enroute.
- (5) Posted method for transporting ill or injured employees and instructions for calling an ambulance or rescue squad.
- (6) An adequate first aid record system.

Other medical facilities that are provided in some plants are:

- (a) The dispensary, the capacity of which depends upon the number of employees of the plant;
- (b) The first aid room; and
- (c) First aid kits.

The industrial physicians may be employed on different bases, depending upon such considerations as the number of employees, hazards in the

operation, etc. Arrangements may be made for full-time, part-time, on-call, or consulting services. The various kinds of examinations may be classified as follows: preplacement, periodic, special, and exit.

Selective Placement. A safety activity is found in the placement, reassignment, and transfer of all workers -- male or female, young or old, able-bodied or handicapped. To use manpower most efficiently, the job should be evaluated for the physical demands it imposes and the working conditions under which it is performed; moreover, in parallel with this, the person should be evaluated for his abilities and limitations. These job analyses are applicable to all workers and all jobs; however, they are particularly helpful in the selective placement of women and anyone with physical or mental limitations.

Emergency Plans. Emergencies can arise at any time and injuries and property damages result from six basic causes: work accident, fires and explosions, flood, earthquakes, hurricanes, and tornados, and warfare or civil strife. Regardless of the size or type of organization, management is responsible for developing and operating an emergency action program.

Emergency action plans include the organizing and training of small groups of people to perform specialized services, such as fire fighting or first aid, and restore the organization to a productive unit. Small, well-trained groups can serve as a nucleus to be expanded to any size needed to meet any kind of emergency. Even with outside help available, a self-help plan is the best assurance that losses will be kept to a minimum. This precaution is particularly true in the case of warfare or civil strife because outside help may not be immediately available and the survival of the company depends on its own ability to cope with its problems.

Off-the-Job-Safety. Many industrial firms do a direct off-the-job educational service among the employees and their families. Part of this action is directed against the motor vehicle accidents and recreational activity accidents. These actions are performed by some enterprises and labor unions, too.

Maintaining Interest in Safety. Accident prevention basically depends upon the motivation of employees to work safely. Therefore, it becomes necessary to create and maintain their interest in the importance of safety. A well-planned program must consider maintaining interest in safety as an important activity to perform. In this activity, the entire plant -- staff, workers, labor union -- must participate. To be effective, a program for maintaining interest in safety must be based on needs. This program must try to touch the basic interest factors as:

(a) Fear of painful injury, death, loss on income, group disapproval or ridicule, etc.;

(b) Pride, in safe workmanship, in good records;

(c) Recognition, desire for approval of others in group and family, for praise from supervisors;

(d) Participation, desire "to get in the act";

(e) Competition, desire to win over others, such as shown in sports,
and

(f) Financial gain through increased departmental or company profits.

All of these factors may be used in this program through means such as:

A. Visual materials, like posters, films, pictures, and reports on bulletin boards.

B. Awards, for individual and group achievement, trophies, personal awards.

C. Publicity, photos and stories in company and community papers, on bulletin boards.

D. Group and individual activities, safety committees, suggestion plans, safety stunts, campaigns.

E. Contests, with attractive awards.

F. Monetary awards through suggestion systems, profit-sharing plans, promotions, increased responsibility (51).

Public Relations. These are the result of how the public regards all of an organization's policies and actions. A good public relations program utilizes every employee and every activity and facility of the entire organization to create a collective, continuing and unflinching impression that the organization is strictly fair and reliable in every way. In any genuine, effective public relations program, emphasizing safety can be a big help. Public relations utilizes the technique of publicity to acquaint the public with the quality of an organization. Anyone concerned with accidents in any way should let himself go and not only welcome publicity for his safety efforts, but go out and fight for it (52).

CHAPTER VI

A SAFETY PROGRAM UNDER THE NATIONAL HEALTH SERVICE

Introduction

As the National Health Service is the Government Agency in charge of the accident prevention in Chile, and its responsibility has been given by law, the action to be performed will be preferentially compulsory. This safety program will differ from the safety program for the private enterprise, although a great part of this program will be directed to the cooperation with the private enterprise, especially in those aspects related to safety training and safety information.

The safety program under the National Health Service will reach its purposes and objectives in succeeding phases so it may be divided into a short-term and a long-term program.

The method of attack to reach the objectives will be different from that for the private industry.

As the average work accident rates for the country are high and for the middle industry even greater, the preventive action must be performed preferentially among the middle industry companies.

Objectives and Purposes

The objectives and purposes are:

- (1) Lowering of the accident rates of the middle industry to levels similar to those of other countries which are highly industrialized;
- (2) Decreasing the toll of death and disability among the Chilean workers.

- (3) Reducing the losses of materials or equipments in the Chilean middle industry;
- (4) Reducing the damage to property by accidents, fire, and catastrophies; and
- (5) Increasing productitivity through the reduction of accidents in the Chilean middle industry.

Method

The National Health Service will control the accident prevention activity in the middle industry, through periodic inspections of the plants, the accident reports of the industry sent to the National Health Service, and the periodic reports of the safety committees of the industry. Other contacts with the middle industry will be through the safety educational and training program, for management, supervision, and labor unions, developed by the Service and others promoted by the National Health Service in other institutions.

Safety Activities to be Included in This Program

Safety Information

In order to secure information about accidents in the middle industry it will be necessary to standardize some forms to be used by the industry and to be sent to this service. These forms are:

- (a) First-aid report,
- (b) Supervisor's accident report,
- (c) Injury record of employee,
- (d) Monthly summary of injuries,
- (e) Accident report for the National Health Service,

(f) Inspection check lists for unsafe work practices.

The forms from (a) through (d) will be similar to those given in the "Accident Prevention Manual for Industrial Operations" (53).

The form (e) will be an adaptation from the legal requirements and technical information gotten from the forms before it.

The form (f) will be for being used by the state inspectors.

Another part of the safety information activity is to establish the procedure to be followed in processing the information sent to the National Health Service, the collection of it by the Bio-Statistics Department, and delivery of it to the Department of Industrial Hygiene and Safety.

Safety Organization

In the principal industrial towns, there will be a team composed of engineers, technicians, and inspectors. The number of persons working in each town will depend upon the number of middle industries in the town. This section of the Industrial Safety Program will be a part of the general organization of the National Health Service for that town, and technical dependence of the Central Department of Industrial Hygiene and Safety.

The minimum organization of this section includes:

- (a) A senior engineer
- (b) Technicians
- (c) Inspectors

The senior engineer will represent this section before the other sections of the National Health Service, and the private companies and will be responsible for the safety program and the coordination of it.

As a coordinator, he will relate the different activities to be

performed by the technicians and inspectors. He will make inspections for control of the accomplishments of the program and by request of technicians.

Technicians that are personnel with four years of technical or university education will make inspections according to the program and they will be responsible for the accomplishment of the safety program within an area of the town or the sector priorly assigned.

The inspectors will be graduates of high school and employed by the National Health Service, after a selection made by a specialized section of the Service, the Psycho-Technical Section. These inspectors will receive a safety training course in the Institute of Labor Hygiene and Air Pollution, and practical training on-the-job done by technicians.

When a problem is beyond the knowledge of an inspector, he will consult with the Technician, and if this is out of the scope of his competence, he will transfer the problem to the chief engineer who will try to discuss it in wide technical meetings to find the solution.

This minimum technical organization will be complete with the necessary clerical personnel.

The personnel located in a town will control all the industries corresponding to a geographical zone, according to the respective division of the National Health Service.

Safety Training. The first problem to solve for the National Health Service is the training of its own personnel. This has been done partially with the present personnel, but the new personnel required will need special safety training. This training will begin with safety courses to be performed in the Institute of Labor Hygiene and Air Pollution. In

Chile, engineers and technicians receive, in their academic background, some fundamentals of industrial safety. This is as part of program of safety engineering education begun in 1953.

In 1953 with the technical assistance of the U.S.A. government agencies, a program of safety engineering education started. An American safety consultant was sent to Chile to make an initial survey of need. As a consequence of this consultant action and the program developed later, some facts were established.

(a) Development of Disabling Injury Statistics. This has been continued in the main Insurance Company of the Country. This is a semi-fiscal insurance agency that now, according to the new law, is incorporated into the National Health Service.

(b) Safety Engineering Education and Training Courses. This included two types of education: (1) in the U. S. Department of Labor, universities, etc. and (2) the development of safety engineering courses within the foreign countries and universities, department of labor, national insurance organizations, industrial association and trade unions by the safety consultant. Such training was not only for the engineer, the supervisor, and the worker, but also for the professor of the university, for the teacher in the primary schools, and for instructors who in turn teach engineers, foremen, workmen, and labor leaders.

(c) Program Development in Plants. From these suggestions has begun the safety activity in the large industry.

(d) Development of a National Safety Council. This was organized and has been growing, with special advancement in the field of safety traffic and home (54).

Now, all universities include Safety Engineering in their curricula. Therefore, it is possible to get engineers and technicians with the fundamentals of safety engineering and instructors for developing courses for supervisors and workers.

The second step in safety training is the developing of courses for supervisors and foremen. The content of these courses may be similar to those given by the U. S. Department of Labor. These courses must be given as a first stage in all the towns where a safety team exists. At the same time, an action must be promoted through the universities for an extension of their programs of technical capability including safety engineering fundamentals. The promotional activity must reach to the National Safety Council of Chile for the development of Safety courses under its sponsorship and some industrial associations to make possible the training of a great part of supervisors and foremen as soon as possible. The courses for supervisors may be of 30 hours and duration of two months.

At the same time, the safety education must reach to the employers through conferences or seminars sponsored by the industrial associations and with the participation of the National Health Service.

Other groups to be considered will be the labor unions' memberships. A tentative training will be made with the representatives of some unions. The courses to be developed will be the fundamentals of safety engineering and inspections.

The training program must be the stronger part of the safety program of the National Health Service, though it is not going to be performed only by itself, it must promote the action of other institutions in this field.

Solution of Safety Problems

Priorities. The first priority in this program will have the training of the inspective personnel; then the promotion of training for supervisors the safety information system; and, finally, the safety inspections of the middle industries.

Correction of Unsafe Conditions. It will be to consider the inspections of plants, with a first inspection for determining the unsafe conditions and for making the requirements to the industry and the second inspection for checking the new conditions. These two inspections are made in a year. These inspections will be made considering the most hazardous activities and operations of the industry. The inspectors will utilize check-lists to make easy and sure the complete inspection. These personnel will make the necessary requirements to the industry for the elimination of unsafe conditions.

Miscellaneous Activities

Among the possible miscellaneous safety activities to be performed by the National Health Service are the check of first-aid facilities, the promotion of organization of emergency groups for acting in the cases of fires, earthquakes, and explosions of equipment units, and information about safety training programs for those industries that may be interested.

Resources of Personnel

In order to know the number of engineers, technicians, and inspectors necessary for this program, it is convenient to know the number of middle industries and their distribution in the country.

The computation of the number of technical inspectors is based on the fact that every plant of the middle industry will be inspected twice

a year and that the average number of inspections per year per government inspector is 200 (55).

An estimate of the number of technical inspectors is given in the following table. It is based on an estimate of the number of plants of the middle industry.

Table 10. Number of Technical Inspectors for the Safety Program Under the National Health Service

Towns	Middle Industries	No. of Technical People
Santiago	5,500	55
Valparaiso	2,000	20
Concepcion	1,500	15
Antofagasta	400	4
Talca	200	2
Valdivia	600	6
Other towns	<u>400</u>	<u>4</u>
Total	10,600	106

The personnel working now in the field of safety engineering and industrial hygiene number 48. It is believed that one-half of this number may be dedicated to safety engineering and that some trained persons will come from the main insurance company, a semi-fiscal agency, that now form part of the National Health Service, the total new personnel that is required

is approximately 70, being inspectors the great majority. These persons require basically a high school preparation and special training, equivalent to a supervisor training course, as a minimum.

Resources of Materials and Funds

The required material will be the administrative corresponding to the places and the minimum technical material, forms, books, standards, codes, and teaching materials.

The funds for this safety activity come from the income determined by the new law.

The new expenditure for this program will be estimated at about \$200,000 per year.

Time Schedule for the Program

As different activities to be performed by the National Health Service have different urgencies, the goals of the program may be reached in different periods of time.

A time-schedule for this program is as follows:

First Year

- (a) Organizational framework in the National Health Service
- (b) Training of inspective personnel of the National Health Service
- (c) Promotion of Training Courses for Supervisors and Labor Unions Representatives. This promotion will be among universities, technical schools, National Safety Council of Chile, Industrial associations.
- (d) Establishment of the Safety Information System
- (e) Programming Courses for Supervisors

Second Year

- (a) Training of supervisors. Some courses will be developed in the Institute of Labor Hygiene and Air Pollution and others under the responsibility of the universities, technical schools and National Safety Council of Chile.
- (b) Promotion of safety education for management. Some conferences may be sponsored by the National Safety Council and Industrial Associations for Managers and Top Executives.
- (c) Start of inspections and checking of the industry.

Third Year

- (a) Training of Supervisors.
- (b) Training for Labor Unions Representatives, made by the National Health Service and National Safety Council.
- (c) Inspections of industries.

Fourth Year

- (a) Training of Supervisors.
- (b) Training of Labor Unions Representatives.
- (c) Inspections of the industries.

Fifth Year

- (a) Training of Supervisors.
- (b) Training of Labor Unions Representatives.
- (c) Inspections of the industries.

After the fifth year, an evaluation of the total program will be made in terms of the accident frequency rate in the middle industry, and according to this it will be necessary to intensify some activities of this program. Besides this total evaluation of the program, every year

for each industry under control will be necessary to compute the accident frequency rate in order to determine the insurance premiums to be paid, according to the statement in the new law on work accidents (56).

Besides the normal activities included in this program, there are other special activities to be performed by the National Health Service for the middle industry, during these five years.

A. Promotional activity among the middle industry in order to group themselves for developing their own programs, with permanent contracted safety personnel.

B. Promotional activity before the Government authorities in order to get loans for some safety activities in the middle industry and for only special situations.

After this first period of five years and according to the results found in this program, it will be necessary to include new activities that complete the action of accident prevention in the middle industry.

These activities may be:

(a) To take a sample of industries for making a total study of accident prevention and to develop a complete program that includes all the activities necessary for a permanent low accident frequency rate.

(b) To extend some of these new activities to a greater number of industries, to be performed by the industry itself.

(c) Determine approximated accident costs.

(d) To promote the permanent activity of other institutions concerned with accident prevention for developing contests, awards and other methods of maintaining the interest of workers and public in safety.

(e) To promote the participation of management and union in off-the job safety campaigns.

CHAPTER VII

A SAFETY PROGRAM FOR THE MIDDLE INDUSTRY

The middle industry needs to diminish the number of accidents for humanitarian reasons, for increasing the productivity, and for paying lower premium rates according to the law.

The best method to reach these purposes is to develop a safety program. The content of this program is expressed in the safety activities to be performed.

It is necessary to make differences between two groups of plants pertaining to the middle industry.

- (a) Industries with more than 25 workers and less than 100.
- (b) Industries with more than 100 workers.

New legal requirements state that all the industries with more than 25 workers shall have a safety committee and those with more than 100 workers shall have a safety department directed by a safety specialist.

Safety Activities for an Industry Under 100 Workers

In a great number of these industries, the owner is production manager and supervisor. He works in the plant with one or more foremen. Some clerical people complete the administrative staff of these plants. Other plants have a more complex organization composed of production manager, supervisors, and foremen. The activities to be considered in these plants (under 100 workers) are listed below.

Safety Information

Injury Reporting. This safety information system will include the collection record and communication of the accident information. For this it will be used on the forms prepared by the National Health Service for the report of disabling injuries. A copy of this report may be used as a record for injuries in the plant.

The report of accidents will be done by the foreman or the supervisor and sent to the National Health Service, if this accident results as a lost-time one. A copy of this report will be filed in the industry.

Accident Investigation. When an accident occurs, the supervisor, the foreman and the members of the safety committee must investigate the accident as soon as possible to determine the causes of the accident and to correct the hazardous condition or the unsafe practices.

Safety Inspections. These inspections must be made by the supervisor every day, or by the foreman, in their trip by the plant. It is convenient to use once a month a check-list similar to that used by government inspectors. In these inspections the foreman must try to detect the unsafe conditions and practices of workers. The safety committee members must make inspections once a month.

Safety Organization

The responsibility of the accident prevention will be of the owner, and delegated in the supervisor of the plant.

Role of Top Management

Manager must have clear the purposes of the safety program, making it clear, too, to the supervisors, foremen, and transmitted to workers. He must make the plant a safe place to work. He must accomplish with

the safeguard of equipment and the supply of personal protective equipment.

Role of Supervision

The supervisor as the foreman must have some fundamental knowledge of safety and of the program and purpose of it, and they must accept their responsibility in it as representatives of management.

Role of Individual Employee

The workers must understand that the safety program is planned for protecting them from injuries, and that it requires their contribution. It will be necessary to give them general information about the accident problem. This will be done by foremen or supervisors.

Safety Training

The training will reach to supervisor and foremen, to workers, and to union representatives. Supervisors and foremen must attend to a safety course given by the National Health Service or other institution. Union representatives must make a similar action and attend to safety courses for labor unions. The training of workers will be made by foremen and supervisors and through the participation in the safety committee.

Safety Committee

This committee must be composed of representatives of the employer and representatives of the workers, according to the law (57). The minimum personnel that compose the Safety Committee will be three persons, but it may be constituted of the supervisor, the foremen, and an equal number of workers. The basic function of this committee is to create and maintain an active interest in safety and to reduce accidents. A Safety Committee should be set up to carry out the following basic functions (58).

- (a) Discuss and formulate safe policies and recommend their

adoption by management.

(b) Discover unsafe conditions and practices and determine their remedies.

(c) Work to obtain results by having its management-approved recommendations put into practice.

(d) Teach safety to the committee members, who in turn will teach safety to the entire personnel of the company.

(e) Arouse and maintain the interest of foremen and group leaders.

(f) Arouse and maintain the interest of workmen and convince them that they are largely responsible for accidents and that their cooperation is needed to prevent them.

(g) Make safety activities an integral part of operating policies and methods and a function of operation.

(h) Provide an opportunity for free discussion of accident problems and preventive measures.

(i) Improve the spirit of cooperation between management and employees.

The committee should comprise workers well known to and respected by fellow workmen.

In some cases, if there are several foremen in the plant, they should rotate as members of the committee. The workers are rotated, too, after a period of three months.

When a committee is formed, certain policies and procedures should be set forth in writing. The committee will have a chairman, a secretary, and members.

Solutions of Safety Problems

Determination of Top Priority Problems. The priority will be given for these aspects:

- (a) Correction of hazardous conditions existing in the plant.
- (b) Training of personnel.
- (c) Formation of a safety committee.
- (d) Correction of unsafe practices.

Particular attention will be given to:

- (a) Falls of persons, from the same or different levels.
- (b) Falls of objects.
- (c) Material handling, especially manual handling.
- (d) Machinery, at points of operation, transmissions, and moving parts.
- (e) Prevention of fire.

Miscellaneous Activities

First-Aid Facility. These plants must have, at least, some first-aid kit near the working place, and the medical attention for injured personnel may be gotten from a Hospital under contract with this company. The hospitals belong to the National Health Service in a great majority.

Emergency Plans. There will have to be a group with the knowledge of the activity to be performed in the case of an emergency. The most current emergencies are: earthquakes, fire, and explosions. The safety committee may be a place where these emergencies may be discussed.

Maintaining Interest in Safety. This may be reached by the use of posters and awards for men without accidents in the year.

Safety Activities for a Plant of the Middle

Industry Over 100 Workers

Safety Information

Injury Reporting. All information about work accidents must be collected, recorded and reported. It must include lost-time accidents, doctor's cases, and first-aid cases. This information will be supplied by the foremen, supervisors, or safety inspectors, and first-aid attendants or nurses. All this information must be collected, classified according to USASI Z 16.1 (59), and recorded by the Safety Department. A report of each disabling injury must be sent to the National Health Service using special forms supplied by it.

Personnel Records of Accidents. The accident information is recorded so that the injury experience of each employee can be kept. A special form is used for the injury record of employee, like that shown in the Manual of Accident Prevention (60). The card used for this purpose will contain information about the injury such as date, classification, days charged, cost, and a brief comment on accident cause and a notation of the file in which the detailed report of the accident is kept.

Standards and Codes. Standards and codes to be applied in the industry like government rules, and laws concerned with work accidents must be collected and filed in the Safety Department.

Safety standards issued by the United States of America Standard Institute (USASI), and those of industrial associations mentioned in Chapter V and concerned with the kind of industry will be permanently consulted and used by the safety personnel and other who requires special information.

Safety Inspections. These inspections must be accomplished routinely by:

- (a) Safety inspector
- (b) Supervisors and foremen
- (c) Safety Committee

Safety inspectors and foremen must make inspections every day, as part of their normal work trying to uncover unsafe conditions or practices. When the safety inspector finds an unsafe practice, he must communicate it to the foreman of that worker, or to the supervisor.

Safety Committee members must make periodic inspections in the plant.

Accident Investigation. When an accident has occurred, the safety inspector, the supervisor or foreman and members of Safety Committee must investigate the causes of the accident in order to prevent any new accidents. A written report of the supervisor must be sent to management and to the Safety Department. The study of the accident might include the interview of the injured employee, when the doctor has given his approval.

Accident Costs. The cost inherent to accidents must be evaluated, whenever possible in investigating accidents. The supervisor must deliver a report in a special form, similar to that suggested in the "Accident Prevention Manual for Industrial Operation" (61). Other information may be obtained from the Accountant of the plant.

Safety Organization

The safety organization includes the formation of the Safety Department with a safety specialist in charge of it, and dependent personnel. A safety committee completes the safety organization.

The Safety Department can be formed by one person, the safety specialist, or of this person and one, two, or three safety inspectors, according to the size of the plant and the hazards present. Some clerical personnel complete the Safety Department. The head of this department will assign the safety responsibilities among his personnel and the line personnel.

Role of Top Management. Management must accept and make clear its responsibility in making the plant a safe place in which to work. Management must understand that it is its responsibility to safeguard the machinery and equipment, tools, processes used in production, and maintenance work to minimize accident occurrence. Management must make known to supervisors, foremen, and workers that it is interested in avoiding accidents in the plant.

Role of Supervision. Supervisors and foremen must know the purposes of the safety program and must have a clear understanding of what management expects from them. They must have knowledge of accident prevention and they must correct unsafe practices of their workers and collaborate with safety personnel and all concerned with accident prevention. Safe production must be their goal.

Role of Individual Employee. The employee must have clearly in mind that he has his own part in this program and his responsibility is in utilizing machinery, equipment, tools, processes, and safeguards in an intelligent and safe manner to protect himself from being injured and to protect his fellow workers from harm.

Role of Safety Specialists. The Safety Department may be constituted by the following personnel.

- (a) Safety Director
- (b) Assistants for inspections
- (c) Assistants for clerical work

The Safety Director may be an engineer or a technician (4 years of college), according to the kind of industry and the possibility of getting trained personnel. The Safety Director will be the person responsible for the safety program before management, and the promoter of any safety activity in the plant. The assistants must collaborate with the Safety Director in all phases of the program, such as inspections, investigations, statistics, etc.

Safety Training. It must reach safety assistants, supervisors, union representatives, and workers.

(a) Safety assistants may be technicians or people with high school and special courses in safety engineering, taken in the National Health Service or other institutions.

(b) If the Supervisors have not had a previous course on accident prevention, the Safety Department will develop a basic course for supervisors. This course may be a minimum course of five one-hour sessions. This course will contain basic principles, first, following by development of a working procedure by which the supervisor is implemented to practice what he has learned. This course may be scheduled to be conducted on a daily basis, Monday through Friday, during working hours, with attendance mandatory.

All levels of supervision are to be training, starting with the top of each activity, followed by the next lower level of supervision, until all supervisors have had the course. Besides this course, there will be

monthly meetings for discussion of accident prevention matters. They serve to remind supervision of the principles and procedures which they learned in the previous course.

(c) If Union Representatives have not received a previous course in any institution, the Safety Department must include some meetings about accident prevention.

(d) Training of workers includes the following:

- (1) Individual -- covers indoctrination of new employee and on-the-job instruction given by the supervisor who will explain to him how to do the work correctly.
- (2) Group -- periodic meetings of workers with their supervisor to discuss accident prevention matters that are of interest for the entire group. They may be made once a month, and the Safety Department must collaborate with the supervisors.

Safety Committee. This committee may be formed by the Safety Director, who acts as Secretary, a top supervisor or manager, who will be chairman, two foremen and two workers' representatives. The functions of this committee will be similar to those shown before in this chapter.

Solution of Safety Problems

Determination of Top Priority Problems.

- (a) Correcting unsafe conditions
- (b) Training of supervisors
- (c) Forming of a Safety Committee
- (d) Training of workers
- (e) Training of Labor Union Representatives

(f) Training regarding emergency plans

(g) Maintaining interest in safety

Correction of Unsafe Conditions. In order to correct the unsafe conditions it will be necessary to develop some activities as the following:

(a) Safety inspections of the plant, made by safety personnel, supervisors, and members of the safety committee.

(b) Job safety analysis, done by the safety specialists according to the need.

(c) Particular attention to falls of persons.

(d) Particular attention to falls of objects.

(e) Material Handling.

(f) Machinery.

Miscellaneous Activities

First Aid Facilities. According to the size of the plant and hazards in it, either a dispensary or first aid kits only will be required in the sections of the plant. According to the size, too, it will be necessary to hire a nurse, a first aid attendant, and/or a physician.

Emergency Plans. The Safety Department is responsible for training some groups of foremen and workers to act in the event that a catastrophe occurs. The most probable emergencies are fire, earthquake, and explosion.

Maintaining Interest in Safety.

(a) To study the need of a program for maintaining interest.

(b) To establish incentives for safety in the plants.

(c) To conduct contests among sections offering attractive awards.

Off-The-Job Safety. This activity will be one to accomplish in a

long-term program, and a tentative activity may be conducted giving safety educations about off-the-job hazards. Especially, home safety and recreational safety may be emphasized. This activity may be handled in collaboration with the Labor Union.

All the safety activities described before, for middle industries under or over 100 workers, are for a short-term program, and others activities may be included for a long-term according to the evaluation of the short-term program, after three years.

After this period, the emphasis will be given in those activities related to maintain the interest of workers in safety and off-the-job safety, besides those aspects that continue to be safety problems.

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