

A study on the present conditions of safety
management at the laboratory
실험실 안전관리 실태에 관한 고찰

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Abstract

본 연구에서는 산업체 안전관리자에 대한 설문 조사에 의해 실험실의 안전사고 발생요인과 특성에 대해 고찰하였다. 연구 결과는 실험실 안전 실태를 나타내고 있으므로 안전예방에 도움이 될 것으로 기대된다. 화재, 폭발, 유해 가스의 흡입, 중독 등과 같은 실험실 안전 사고가 증가함에도 불구하고 사전 안전교육이 제대로 이루어지지 않고 있으며, 실험실 안전 시설이 미비한 것으로 나타났다.

1. Introduction

Recently our domestic industries including small & medium industry as big industry tend to intensify efforts to set up or improve experiments and research facilities, in order to meet the rapidly changing industrial environment.

The function of research and development pursues challenge and creation with research and development project actively being carried out for the development of new materials and technical processes and more and more workers being engaged in such activities.

In the field of research and development, most of the testing is manually done by researchers, and instruments, materials and energy used in experiment characteristically tend to be changed. Since means and methods of such jobs have not yet been

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standardized, dangers lurk in all the time and accidents frequently happen. In advanced countries, special guidelines are prepared in order to prevent accidents from occurring and much research activities are carried out in this field[1,2,3,4,5].

Domestically, a guide on the laboratory has been announced in connection with laboratory safety but few research has been made except a recent on the laboratory safety for chemical industry[6,7,8]

For this study, a survey has been conducted regarding laboratory safety at work site on the personnel in charge of safety enrolled with the industrial safety education institute.

This study is to contribute to prevention of safety accident at the laboratory through research and analysis of safety management situations of industrial work site which include distribution of type of work, causes of accidents at the laboratory, safety education, provision of personal protectives, fixing of safety signs, and status of environmental safety, etc.

2. Definition of laboratory accident

Recently, industrial accidents are shown the trend of decrease by the data of the accident statistics[9]. But, the number of the dead is increased and the amount supplied of the accident compensation is increased together. Therefore, in order to standardization of the field work, prevention of important industrial accident, preservation of autonomous safety at field work, and construction of good style management, etc. are accomplishing substantial propulsion for the prevention of industrial accidents from the operation area of laboratory.

Laboratory safety means freedom from physical danger and mental disturbance, and depending on the type of laboratory. It must be provided with requirements such as safe keeping units, devices for protection or defense, locking devices, knowledge and technology for preventing occupational disease.

The unstable behaviour and condition which stand in the way of smooth running of laboratory must be got rid of and the safe experiment assured through control of the given environment. Safety accident means what causes to reduce research efficiency through unstable behaviour or condition which unintentionally precedes and brings about loss of life or property either directly or indirectly. The loss of life and property caused by such accident is called a injury.

3. Feature of laboratory accident and its cause

There is a great possibility of accidents occurring in the laboratory because a certain work procedure cannot be fixed in advance as in the production process and the effect of skill on the job cannot be expected. In the research and development, it is frequent that new materials are handled of which a full research has not been carried out or few documents are available illustrating its danger. It usually happens that those new materials

are handled under extreme temperature or pressure.

Laboratory may be classified into chemical and physical laboratory and the causes of accidents for them are as follows:

- (1) Explosion of dangerous materials and fire by catching flame
- (2) Burn by contact with highly heated materials
- (3) Breathing in of poisonous gas or toxication
- (4) Skin contact with chemicals and eye injury
- (5) Injury by glass instrument
- (6) Cut due to mechanical cause and abrasion

Because of those causes of danger, accidents frequently occur from handling of chemicals or materials for removal of poisonous elements. The patterns of accidents in laboratory are classified by accidents due to experiment, inflammable materials, direct cause, and physical injury[10,11].

4. Survey and analysis

4.1 Method of survey

In order to examine the situation of safety management of laboratory, 106 representatives of 102 firms are selected at random from among those enrolled with the Industrial Safety Education Institute, and questionnaires are handed out to each selected person to be filled up and collected.

4.2 Composition of questionnaires

The questionnaire that period of surveying is 12 week from September to December contains 18 questions related to the categories such as general situation(distribution of jobs and number of workers), condition of equipment at the laboratory, number of workers, safety accident and its pattern, safety education status, personal protectives and safety sign, questions regarding the environmental safety at the laboratory.

5. Survey results and studies

5.1 Pattern of safety accident at the laboratory

Distribution by occupation is based on the Korean standard of industrial classification and the research has been carried out on the manufacturing industry classified into different sectors[12,13]. Table 1 illustrates distribution by manufacturing sectors. Accordingly, this study deals with manufacturing sectors occupying 76% of total industry. The rest of the

sectors such as manufacturing chemicals, petroleum, coal, rubber and products occupy 46% of the total industry.

Table 1. Distribution by manufacturing sectors

Type of manufacturing sector	Number of firm (%)
Manufacturer of foods and tobacco	12 (12)
Manufacturer of textile, garment, and leather	19 (19)
Manufacturer of woods, wooden products	1 (1)
Manufacturer of paper and paper products, printer and publisher	5 (5)
Manufacturer of chemical compound, petroleum, coal, rubber, and their related products	47 (47)
Manufacturer of non-metal mineral products	8 (8)
Primary metal industry	3 (3)
Manufacturer of fabricated metal products, machine, and equipment	4 (4)
Other manufacturer	3 (3)

Table 2 shows the number of laboratories and the number of workers at the each laboratory. From Table 2, we learn that more 80% of the firms surveyed have their own laboratories or are planning to have one, and more accidents at the laboratory are expected to occur if more laboratories are to be set up. Furthermore, more attention must be paid to the safety of laboratory. 81% of the laboratories surveyed employ less than 50 workers while 7% employ more than 100 workers.

Table 2. Present situation of holding laboratory

Situation	Number of response
Holding laboratory	81
Holding no laboratory	16
Planning to hold laboratory	4
No response	1

Table 3 shows frequency of accidents at the laboratory at the time of research or experiment and 26 firms among 102 firms having laboratories(26%) experienced accidents during working hours.

This result corresponds to the result of research by Jeun and Go[14].

Table 3. Safety accidents at the time of experiment

Accident	Number of response(%)
Accident occurred	25
No accident occurred	73
No idea of accident	2

Table 4 shows patterns of accident such as fire by inflammable liquid and chemicals (11 cases), explosion(9 cases), and electric shock(2 cases), etc.

Table 4. Frequency of accident according to the pattern of safety accident at the laboratory

Pattern of safety accident	Frequency of accidents
Fire	11
Explosion	9
Injury	8
Toxication	3
Electric shock	2
Others	2

Table 5 shows persons to whom the cause of accident is attributed. The table shows that the 54 cases (40%) are attributed to the director of the institute (chief of laboratory), 48 cases (36%) to the victim, 10 cases (7%) to the department of safety management or manager in charge of safety, and 5 cases (4%) to owner of the business. This analysis is considered as an indication that the management of line organization required by the law for industrial safety and health may be applied to the safety management of laboratory because whenever accident occurs the line of organization may be held responsible for the accident.

Table 5. Responsibility for safety accident at the laboratory

Responsibility for safety accident	Number of accident(%)
Chief of laboratory	40
Victim	36
Safety manager	7
Owner of business	4
No response	13

5.2 Status of safety education, personal protectives, and safety signs

Table 6 shows the condition of safety education for the staffs of laboratory. 53 persons (50%) say that the safety education is carried out at the laboratory while 45 persons (45%)

say that no safety education is carried out at the laboratory.

The fact that 45 persons (45%) say that no safety education is carried out at the laboratory is deemed to have something to do with the safety accident of laboratories, so the safety education for the laboratory staff must be intensified. Also, 68 cases (64%) of safety education are found to be carried out by safety manager with 33 cases (31%) by chief of laboratory while 4 cases (4%) by the instructor from outside the company.

Table 6. Present condition of safety education at the laboratory

Item	Safety education statue			Instructor			
	Executed	Not executed	No response	Chief of laboratory	Manager in charge	Instructor from outside	Others
Number of response (%)	50	45	5	31	64	4	1

Table 7 show the condition of personal protectives supplied to the laboratory staffs and safety signs fixed at the laboratory. 81 cases (76%) of the firms surveyed have personal protectives supplied to the laboratory staffs. 47 cases (44%) of the firms surveyed respond that they have safety signs fixed in the laboratory while 57 cases (54%) of the firms surveyed respond that they have no safety signs fixed at the laboratory. This means that the condition of fixing safety signs at the laboratory is still poor.

Table 7. Present condition of personal protectives supplied and safety signs fixed

Item	Personal protectives		Safety signs		
	Supplied	Non-supplied	Fixed	Non-fixed	No idea
Number of response(%)	76	24	44	54	2

5.3 Condition of environmental safety

Table 8 shows that 41 cases (39%) of the firms surveyed have break rooms and shower rooms while 65 cases (61%) have none of them.

Table 8. Present condition of environmental safety at the laboratory

Item	Break room		Shower room	
	Set-up	Non set-up	Set-up	Non set-up
Number of response(%)	39	61	39	61

Table 9 shows the result of survey on the ventilating facilities of the laboratory. 48 cases (45%) of the firms surveyed have good ventilating facilities while 51 cases (48%) are partially ventilated and 7 cases (7%) poorly ventilated. More than 50% of the firms having laboratories have poor ventilating facilities, and it is required that the ventilating facility of the laboratory must be inspected in order to maintain safe conditions at the laboratory.

Table 9. Present condition of ventilating facility at the laboratory

Item	Well ventilated	Partially ventilated	Poorly ventilated
Number of response(%)	45	48	7

6. Conclusion

We have analysed and studied the results of survey conducted on the persons enrolled with the Industrial Safety Education Institute regarding the safety management at the domestic laboratory. Based on this study, the following conclusion obtained:

- (1) More than 80% of the firms surveyed have laboratories or are planning to have one, and 26 firms among 102 firms having laboratories experienced accidents.
- (2) Patterns of the safety accident are classified into fire, explosion, injury, toxication, and electric shock in order of frequencies. 76% of the persons surveyed respond that cause for accidents may be attributable to the victim as well as to the director of the institute (chief of laboratory).
- (3) 50% of the firms surveyed execute safety education for the staffs of the laboratory while 45% do not. 64% of the firms surveyed respond that managers execute safety education for staffs while 31% respond that chiefs of laboratories execute the safety education.
- (4) 76% of the firms surveyed supply personal protectives to the workers while 44% fix safety signs at the laboratory and 54% do not.
- (5) 39% of the firms surveyed have break rooms and shower rooms at their laboratories and 65 cases (61%) have none of them. 55% of the firms surveyed have poor ventilating facilities.

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