

**DATA BASE SYSTEM DEVELOPMENT AND STATISTICAL ANALYSIS
OF FIRE ACCIDENTS OF SEVERAL COUNTRIES**

In-Tae Kim

RM & IC, Korean Fire Protection Association, Korea

In-Won Kim

Department of Chemical Engineering, Kon-Kuk University, Korea

Hee-Oeul Song

Department of Chemical Engineering, Kon-Kuk University, Korea

ABSTRACT

The fire accident cases of several countries such as Korea, Japan, United States, etc., were collected and compared statistically. The trends of fire accidents in several countries will help us establish detailed plans for fire protection and reduce the possible fire accidents in the future. For construction of data base system, the program FADS was developed, which is operable in Windows environment.

INTRODUCTION

Human life qualities have been improved by development of science technology but have been faced with more various and high risks. Fire accidents have been increased continuously since human started to use the fire. Because of increases of energy consumption, automated and large-sized buildings, fire frequency and severity are also on the rise. A lot of fire accidents occurred by human errors could be prevented or reduced.

But they are on the increasing trends in many countries.

In order to reduce fire accidents, it is important to understand general tendency including understanding specific contents of the accidents through case studies. Namely, we can determine the basic fire policy by comparing and analyzing fire statistics. Also, constructing data system is absolutely needed to propose detailed plan for fire protection.

In Korea, a systematic approach for the analysis of accidents is needed. In this work, therefore, the analysis of fire accidents and the development of data base system were studied.

TRENDS IN FIRE ACCIDENTS

The Number of Fires

Recently, the number of fires in Korea based on population is similar to that of Japan. However, the trends show that the number would be increasing in Korea. The percentage of the number of fires in Korea to that of Japan was 41% in 1985, 73% in 1990, and 117% in 1995.

During 1985-1995, the number of fires in the United States of America, 8,540 cases per million population on the average per year, was the highest among the subject countries of this study. The number of fires in the United Kingdom, 7,182 fires, was similar to that of U.S.A. But fires in U.S.A. has been decreased by 1.6% on the average per year and fires in U.K. has been increased by 2.2%. On the other hand, fires in Korea has been increased by 12% on the average per year. Fig. 1 shows the fire trends. Korea's fires increased in number more than three times from 1985 to 1995.

Casualty

Table 1 shows that the death rates by fire per million person in the U.S.A. was the highest in 1985, but the rates decreased steadily. In 1995, Japan's death rates were higher than that of U.S.A. For the 1985-1995, population increase rates of Korea and U.S.A. were almost the same 0.9%, 1.0%, and U.K. and Japan showed similar rates of 0.3%, 0.4%.

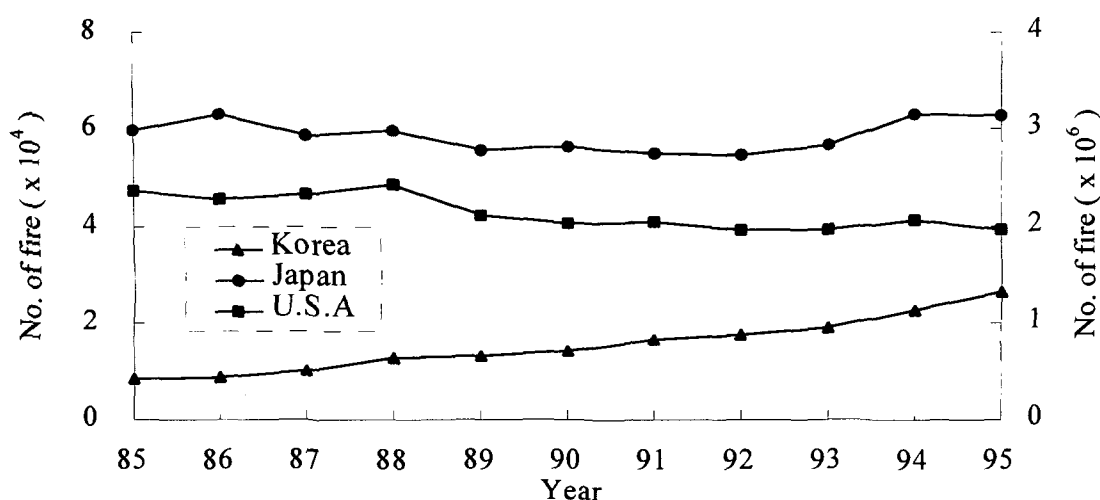


Fig. 1 The number of fires in several countries - Korea and Japan apply to left axis, and U.S.A. applies to right axis.

Table 1 Fire deaths per each countries' population(in millions).

Year	Korea	Japan	U.S.A.	U.K.	Canada
85	6.4	14.4	28.0	21.7	17.3
86	8.1	16.9	24.4	21.8	17.0
87	7.8	15.2	24.0	20.1	16.3
88	10.1	17.2	25.4	19.2	16.1
89	11.1	14.2	21.9	19.1	15.8
90	8.3	14.8	20.8	17.0	15.6
91	12.3	14.6	17.7	14.2	14.2
92	12.0	15.1	18.5	14.0	13.7
93	13.6	14.8	18.0	14.2	12.4
94	12.9	15.2	16.4	-	-
95	13.3	18.8	17.4	-	-

During the same period, 6.26 persons were dead per 100 fire cases on the average per year in China. Korea and Japan showed similar results, 3.07 and 3.27 persons respectively. The lowest country in death rates was U.S.A., 21.1 persons. It showed the number of fires was relatively higher than the number of deaths or the number of deaths was lower than the number of fires.

In the period of investigation, the number of deaths and injuries were 4,997 and 12,932 in Korea, 21,150 and 80,079 in Japan, and 57,309 and 312,690 in the U.S.A.

Direct Losses

Among the subject countries of this work, Japan's direct property losses were the highest as 20,000 U.S. dollars per fire case. The other countries showed similar losses of 3,000-4,000 U.S. dollars.

Within this period, the direct losses were increased by 35.6% in Korea, 16.6% in England, 15.4% in China, 12.9% in Japan and 2.3% in U.S.A. The direct losses per GDP were increased by 14.7% in Korea, 7.7% in China, and 4.3% in England. But other countries showed decreases of 2.9% in U.S.A., 1.8% in Japan and 1.3% in Canada. Especially, Canada's average loss rates as percentage of GDP showed the highest of 0.180% and Korea showed the lowest among the countries as 0.022%. Average losses per year of Korea, Japan, and China were almost the same, and U.S.A., England, Canada showed similar losses (see Table 2).

Table 2 Direct loss rates as percent of GDP.

Year	Korea	Japan	U.S.A.	U.K.	Canada	China
85	0.019	0.048	0.181	-	0.190	0.033
86	0.012	0.045	0.157	0.118	0.190	0.034
87	0.014	0.042	0.158	0.109	0.180	0.071
88	0.026	0.039	0.170	0.137	0.170	0.025
89	0.015	0.035	0.165	0.154	0.170	0.031
90	0.019	0.035	0.142	0.182	0.180	0.030
91	0.020	0.036	0.165	0.177	0.190	0.026
92	0.022	0.034	0.138	0.142	0.180	0.033
93	0.019	0.035	0.135	-	0.170	0.036
94	0.043	0.037	0.121	-	-	0.028
95	0.029	0.040	-	-	-	-

DATA BASE SYSTEM OF FIRE ACCIDENTS

Accident cases and various materials were collected from Korean Fire Protection Association and other sources including Fire Statistical year book of Fire Service Bureau in Ministry of Home Affairs. After classifying the contents, the data was inputted according to form shown in Fig. 2.

The total of 13,554 cases have been inputted as of Sep., 1997. Among the cases, the number of fires in Korea is 8,600, 1,087 in Japan, and 1,216 in U.S.A. Among the fire places, 10,724 cases occurred indoors and 2,830 cases occurred outdoors. Among the causes of fire, the fires by human errors marked 70% and 9501 cases.

The screenshot shows a software window titled "Untitled - 사고 사례 database". The menu bar includes "파일(F)", "편집(E)", "레코드(R)", "검색", "보기(V)", and "도움말(H)". The toolbar contains various icons for file operations and navigation. The main form area is divided into several sections:

- Title:** Dryer fire
- Record ID:** 19971001 (Date range: 1997년 3월 15일 -> 19970315)
- Accident ID:** 19940628 (Accident Time: 오후 5시 5분 -> 1705)
- Accident Cause:** human error
- Accident Type:** electric
- Location:** Home
- Related Equipment:** electric equipment
- Country:** 미국 (City: Dallas)
- Company Name:** X co.
- Place:** unclassified place
- Death Toll:** 4 (Injury Summary: 부상자합계)
- Damage:** \$ (Insurance: 보험금)
- Dispatch 1:** UPI 19970702 (Dispatch 2: 출전2, Dispatch 3: 출전3)
- Category 1:** electric (Category 2: 색인어2: home, Category 3: 색인어3: dryer)
- Registration No.:** 19970608-08
- Original Source:** 작성자 Mr. KIM

On the right side, there is a vertical column of buttons: First Record, Prev. Record, Next Record, Last Record, 입력 준비, 입력 완료, 자료 수정, 자료 삭제, 전체 발생 건수, 국가별 비교, 제목 검색, 사고 원인별, 사고 유형별, 업종별, 관련 설비별, 세부 지역별, and 소분류 비교. At the bottom, there are "준비" and "NUM" buttons.

Fig. 2 Fire accidents input form.

Contents of Form

Fig. 2 shows a data input form. The items of input data are Title, Accident date, Accident cause, Accident type, Accident place, Facilities involved in accident, Materials involved in accident, Accident address, Casualties, Property damage, Sources, Keyword, Registration number and Abstract.

DB System Development

The searching process in the current DB programs for fire accidents is inconvenient: first, input the accident date or period; second, type the appointing word of causes, types, place, etc., and then accident data is displayed. The information was showed as a text file.

New program, FADS was made to be operable in Windows, therefore, it could be used practically and conveniently. In the program, accidents data can be searched and the statistical results are displayed as tables and graphs. Thus users can analyse the results at a glance.

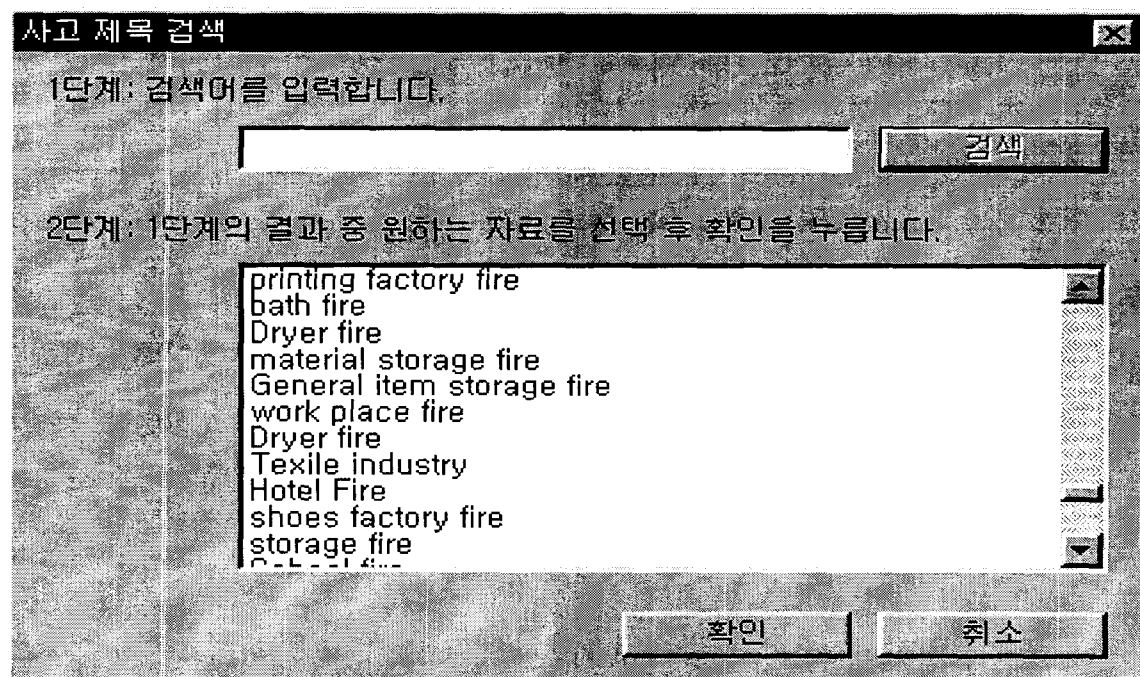


Fig. 3 Search screen by key-word.

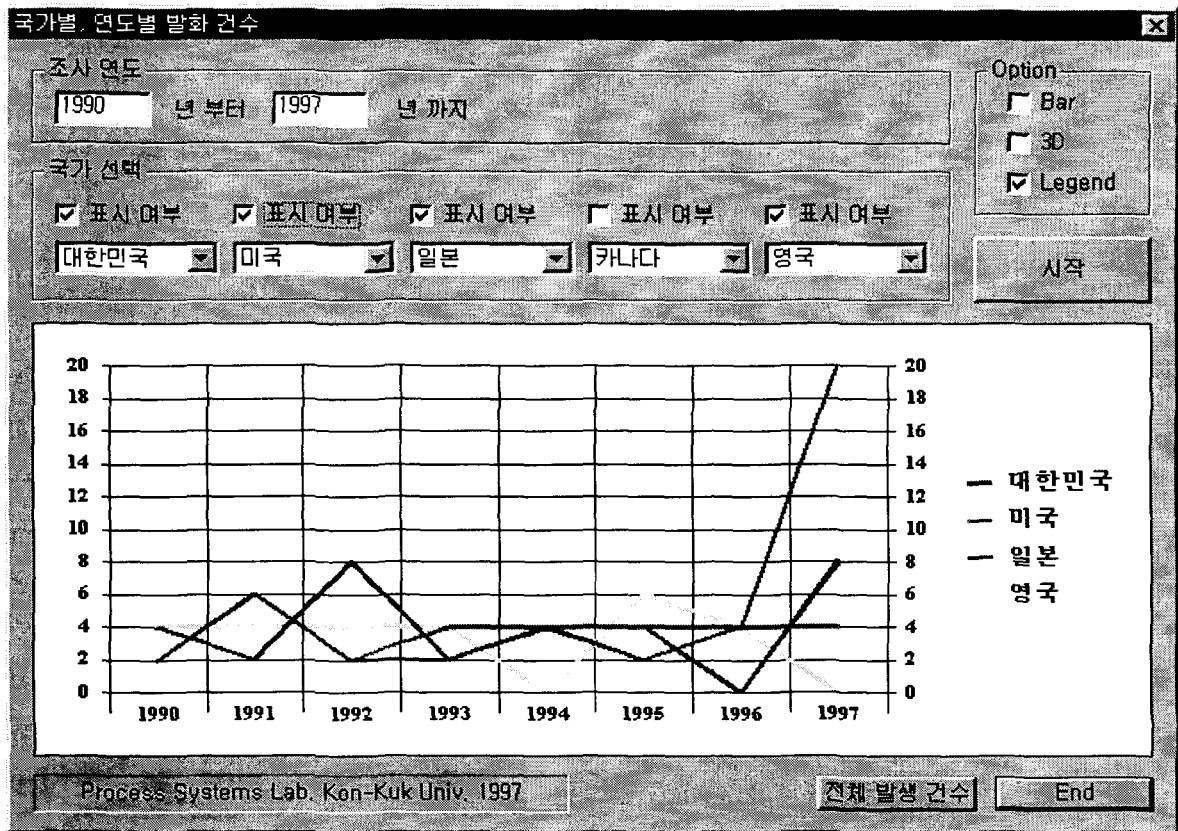


Fig. 4 Result screen by year, cause, country.

CONCLUSION

Among the countries studied in this work, the number of fires occurred in the United States of America was fairly decreased between the year of 1985 and 1995. In 1985, the death rate per population was quite different between the countries, The recent accidents data, however, showed that the number of deaths is between 12 to 18 per million persons. It was difficult to compare the amount of property damage because the estimated methods were different. The direct property losses per fire in Japan were the greatest and the average loss rates in Canada as percent of GDP were the highest among the countries.

More investment is needed for reliable fire statistical reports with necessary information in order to make fire protection policies. Since a proper policy decision can be done through mutual comparison and analysis between countries, the exchange of fire accident reports is needed to make better fire statistics.

REFERENCES

1. Michael J. Karter, Jr., NFPA's Latest Fire Loss Figures, NFPA J., Sep./Oct. 52-59, 1996
2. *ibid.*, Fire Loss in the United States in 1994, 93-100, 1995
3. *ibid.*, Fire Loss in the United States in 1993, 57-65, 1994
4. *ibid.*, Fire Loss in the United States in 1992, 78-87, 1993
5. *ibid.*, U.S. Fire Loss 1991, 32-43, 1992
6. *ibid.*, Fire Loss in the United States During 1990, 36-46, 1991
7. *ibid.*, Fire Loss in the United States During 1989, 56-67, 1990
8. *ibid.*, Fire Loss in the United States During 1988, 24-32, 1989
9. *ibid.*, U.S. Fire Loss in 1987, 32-44, 1988
10. *ibid.*, A Look at Fire Loss in the United States During 1986, 36-46, 1987
11. *ibid.*, Fire Loss in the United States During 1985, 26-39, 1986
12. Haihui Wang, Weicheng Fan, Progress and Problems of Fire Protection in China, Fire Safety J., 28, 191-205, 1997
13. Fire Service Bureau in Ministry of Home Affairs, Fire Statistical Yearbook, KOREA, 1986-1996
14. Forest Administration, Statistical Yearbook of Forest, KOREA, 1986-1996
15. Fire Defense Agency, White Book on Fire Service, JAPAN, 1986-1996
16. Japan Association for Investigation and Propagation of Fire Prevention, Fire Yearbook, JAPAN, May, 1997
17. John R. Hall, Jr., The U.S. Fire Problem Overview Report Through 1995, NFPA Survey Report, Mar., 1997
18. John R. Hall, Jr., International Fire Comparison Report #2, NFPA Survey Report, Oct., 1995
19. John R. Hall, Jr., International Fire Comparison Report #4, NFPA Survey Report, Apr., 1997