

2009

KOREAN FIRE DATA



KOREAN FIRE PROTECTION ASSOCIATION

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2010. 12.



KOREAN FIRE PROTECTION ASSOCIATION

FOREWORD

We are pleased to issue the revised edition of the English booklet entitled "Korean Fire Data" which offers an outline of Korean fire statistics during 2009 and fire cases in 2009.

The first edition was published in 1997 in accordance with the "The agreement of Cooperation between NFPA (National Fire Protection Association) and KFPA (Korean Fire Protection Association)." It was probably the first Korean fire related statistics in English which made the way for disseminating of information throughout the world including USA. Since then, the revised editions have been issued annually.

In year 2007 the renovation of nationwide fire incident statistics, 「Korea National Fire Incident Classification System」, had gone into effect, therefore numbers of fire incidents in fire statistics has increased exponentially. There is 50% increase in No. of fires in 2007 from 2006. It is because NEMA included the No. of fires that have no fire loss and casualties which has not been calculated until 2006. There are 65% increase in fire loss from 2006. It is because NEMA has adopted modified calculation method to assess fire loss. Until 2006, NEMA has assessed fire losses conservatively.

In year 2009, fires were decreased by 4.7%(2,313 fires) in numbers, civilian injuries and death toll by 10.1%(275), property loss by -34.3%(131,290).

Fires by occupancy were the highest in residential occupancy by 24.9%(11,767), fires by cause were highest for human error by 48.1%(22,763). Highest numbers of casualties and deaths also are caused by human error by 34.6%(844).

The Most severe fire incident was at *Ganadara* indoor shooting range by a chemical cause(unknown) which ended up with 10 deaths and 6 casualties.

We hope this booklet serves not only to deliver the current Korean fire data but to reduce fire disasters globally.

CONTENTS

■ 2009 Fire Report	1
I . Overview of 2009 Korea Fire Experience	3
II . Fires for the 10-Year Period (2000-2009)	10
■ Fire Investigation Reports	24
○ Fire Occurrences in Apartments and their Analysis	25
○ Fire Incidents in Multi-purpose Assembly Occupancy and their Countermeasures	34

2009 FIRE REPORT

Source : 『*Fire Statistics Yearbook 2009*』
*by the National Emergency Management Agency of
the Republic of Korea*

I. Overview of 2009 Korea Fire Experience

1. Fire Loss Summary

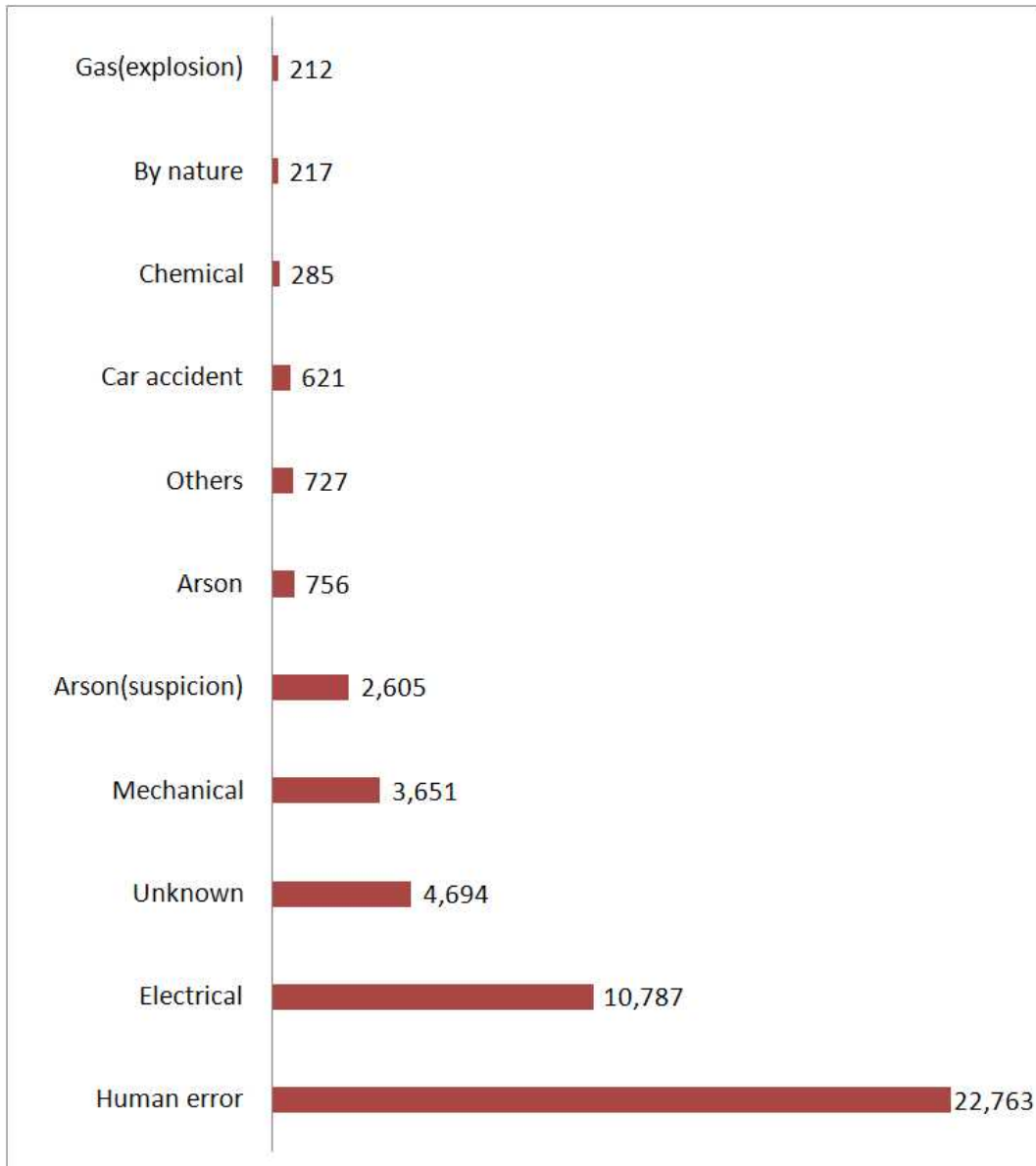
Category	2009	2008	Change in number	Change in percentage
No. of Fires	47,318	49,631	-2,313	-4.7
Deaths	409	468	-59	-12.6
Injuries	2,032	2,248	-216	-9.6
Property Loss (₩ million)	251,853	383,142	-131,290	-34.3

- ※ Note : 1. **1,159.5** ₩(KRW) is worth 1 USD(as of Nov 30, 2010) approximately, the same shall apply hereinafter.
 2. The Property loss values in this report are not adjusted for inflation hereinafter.

2. 2009 Fires by Causes

Category	No. of Fires (Percentage %)		Fire Casualties (Deaths/Injuries)		Property Loss (₩ million)
Total	47,318	100%	409	2,032	251,853
Electrical	10,787	22.80	43	296	62,281
Mechanical	3,651	7.7	1	88	19,315
Gas(explosion)	212	0.45	5	144	2,787
Chemical	285	0.6	13	54	2,255
Car accident	621	1.3	35	48	4,360
Human error	22,763	48.1	87	757	42,099
By nature	217	0.5	0	2	1,387
Arson	756	1.6	35	139	4,279
Arson(suspicion)	2,605	5.5	38	140	11,246
Others	727	1.5	9	43	3,532
Unknown	4,694	9.9	143	321	98,312

2009 Fires by causes

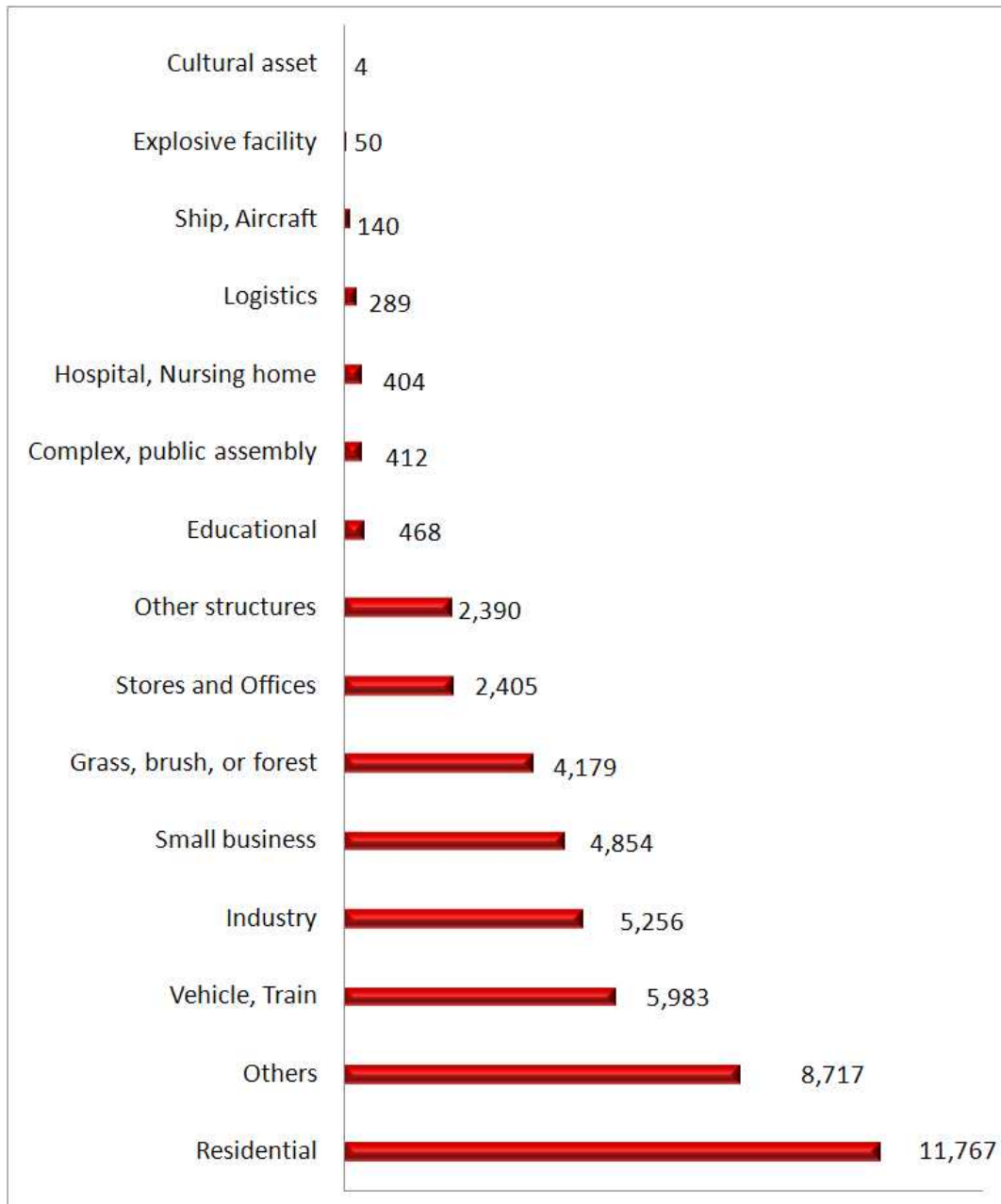


3. 2009 Fires by Property Types

Category	No. of Fires (Percentage %)		Fire Casualties (Deaths/Injuries)		Property Loss (₩ million)
Total	47,318	100%	409	2,032	251,852
Residential	11,767	24.9	226	854	49,792
Educational	468	1.0	2	20	1,817
Stores and Offices	2,405	5.1	23	178	13,460
Complex, public assembly	412	0.9	2	16	3,314
Hospital, Nursing home	404	0.9	0	16	1,802
Industry	5,256	11.1	21	250	111,735
Logistics	289	0.6	3	16	2,947
Cultural asset	4	0.0	0	0	599
Small business ¹	4,854	10.3	40	222	24,134
Other structures	2,390	5.1	8	80	8,634
Vehicle, Train	5,983	12.6	55	162	24,155
Explosive facility	50	0.1	1	14	694
Ship, Aircraft	140	0.3	1	8	1,675
Grass, brush, or forest	4,179	8.8	19	86	3,047
Others	8,717	18.4	8	110	4,047

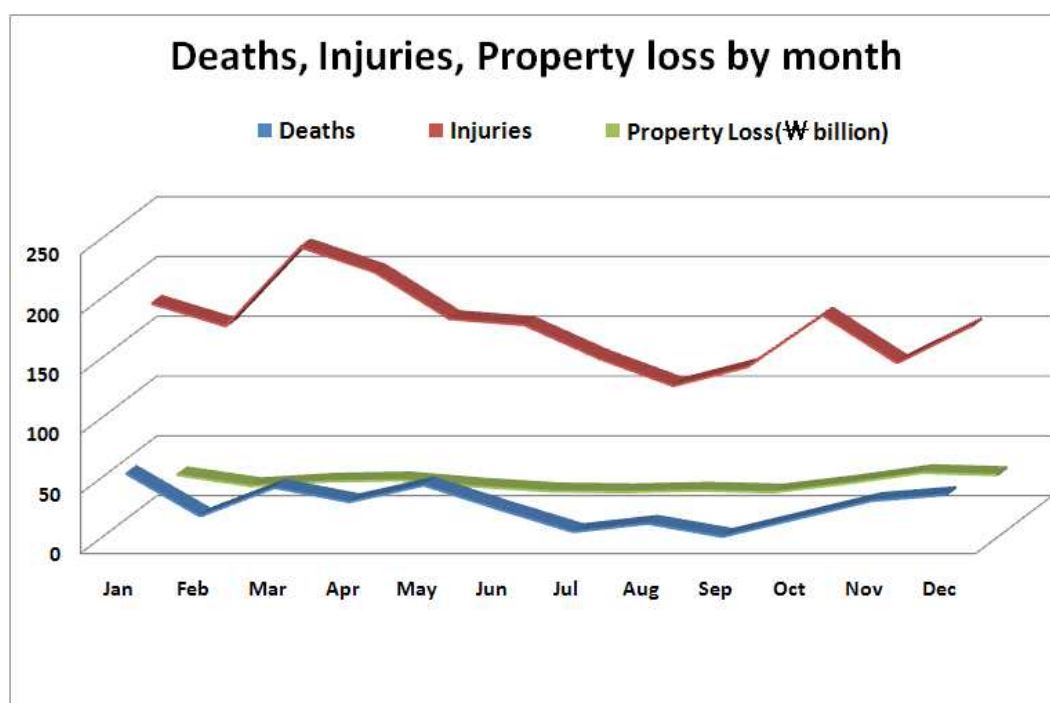
¹ Includes convenience store, grocery shop, hair salon. etc.

2009 Fires by Property Types



4. 2009 Fires by Months

	No. of Fires	Deaths	Injuries	Property Loss (₩ million)
Total	47,318	409	2,032	251,852
Jan.	5,090	62	188	28,420
Feb.	4,045	26	169	19,154
March	5,337	50	235	22,993
April	5,200	38	214	24,096
May.	4,246	52	175	18,805
June	3,411	32	170	14,855
July	2,790	13	142	14,133
Aug.	2,950	20	119	15,447
Sep.	3,111	9	135	13,955
Oct.	3,651	24	178	21,422
Nov.	3,524	39	138	30,181
Dec.	3,963	44	169	28,387



5. 2009 Fires by Major Cities and Provinces

Cities or Provinces	Population ¹ (thousand)	No. of Fires	Deaths	Injuries	Property Loss (₩ million)
Total	49,773	47,318	409	2,032	251,852
Seoul	10,208	6,318	37	220	15,571
Busan	3,543	2,941	50	142	6,657
Daegu	2,490	2,282	11	76	5,075
Incheon	2,710	1,905	15	95	11,124
Daejeon	1,484	1,397	11	86	5,281
Gwangju	1,434	1,540	9	38	3,125
Ulsan	1,115	1,331	6	64	4,266
Gyeonggi-Do	11,461	10,479	79	476	81,776
Gangwon-Do	1,513	2,760	24	80	10,969
Chungcheongbuk-Do	1,527	1,443	17	112	19,189
Chungcheongnam-Do	2,038	2,927	27	113	19,533
Jeollabuk-Do	1,854	1,650	23	72	10,288
Jeollanam-Do	1,913	2,291	20	118	13,257
Gyeongsangbuk-Do	2,670	3,280	38	156	23,418
Gyeongsangnam-Do	3,250	3,968	34	156	19,949
Jeju-Do	563	806	8	28	2,367

source : ¹ Statistics Korea

6. Catastrophic Fires for the Last 5 Year Period (2005 - 2009)

Year	No. of Fires	Deaths	Injuries	Property Loss (₩ million)
2005	5	6	74	25,078
2006	2	13	24	92
2007	11	37	106	8,317
2008	11	68	59	136,714
2009	4	28	8	127,594
Average	6.6	30.4	54.2	59,559

* The catastrophic fire is defined as following according to the "Fire Investigation & Report Regulation".

- Death toll : Not less than five people

- Injuries : Not less than ten people

- Property loss : Not less than two billion Won(₩2 billion)

Fires in Korea during 2009

47,318 fires were reported in Korea during 2009.

- down 4.7% from 2008
- 409 fire deaths
- 2,032 fire injuries
- ₩ 251 billion(about \$ 217 million) in property damage, down 34.3% from 2008

28,249 fires were reported in Structure.

- 325 fire deaths
- 1,652 fire injuries
- ₩ 218 billion(about \$ 188 million) in property damage

6,123 fires were reported in transportation(vehicle, train, ship, aircraft)

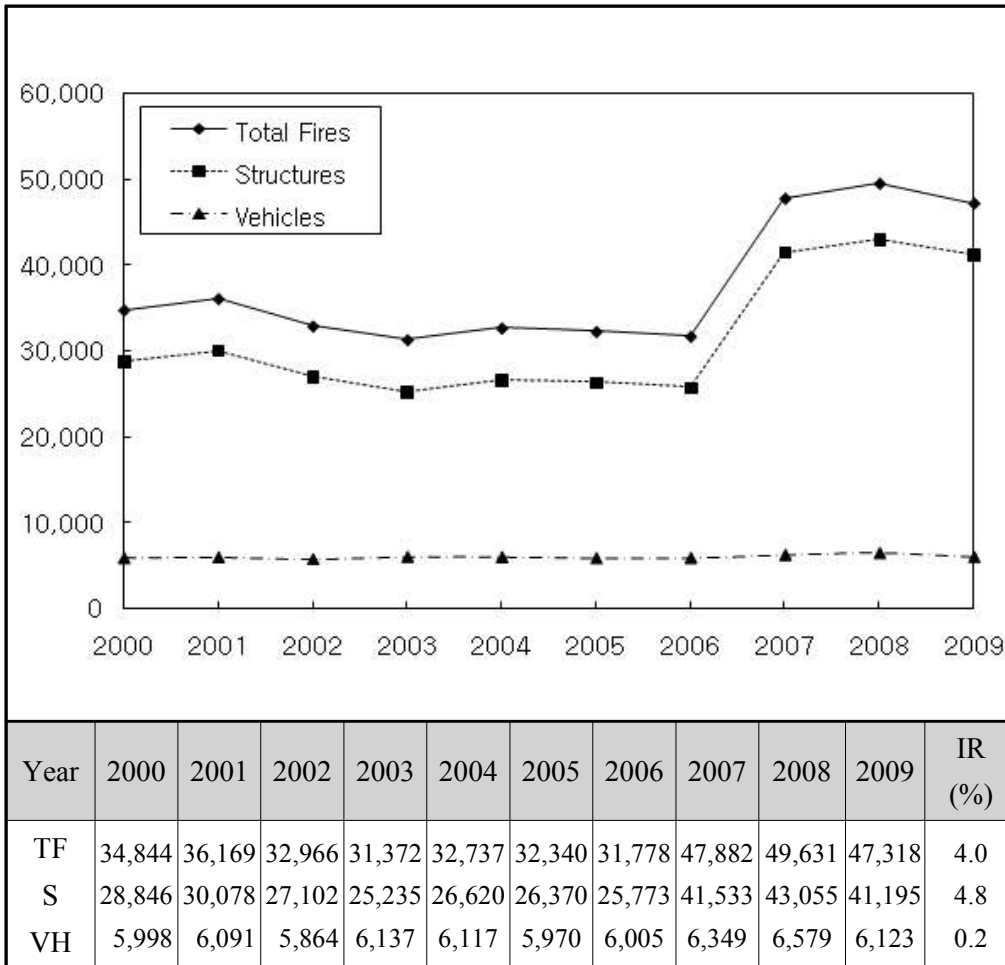
- 56 fire deaths
- 170 fire injuries
- ₩ 25 billion(about \$ 22 million) in property damage

12,896 outside and other fires were reported in Korea.

- 27 fire deaths
- 196 fire injuries
- ₩ 7 billion(about \$ 6 million) in property damage

II. Fires for the 10-Year Period (2000-2009)

1. Number of Fires for 2000-2009

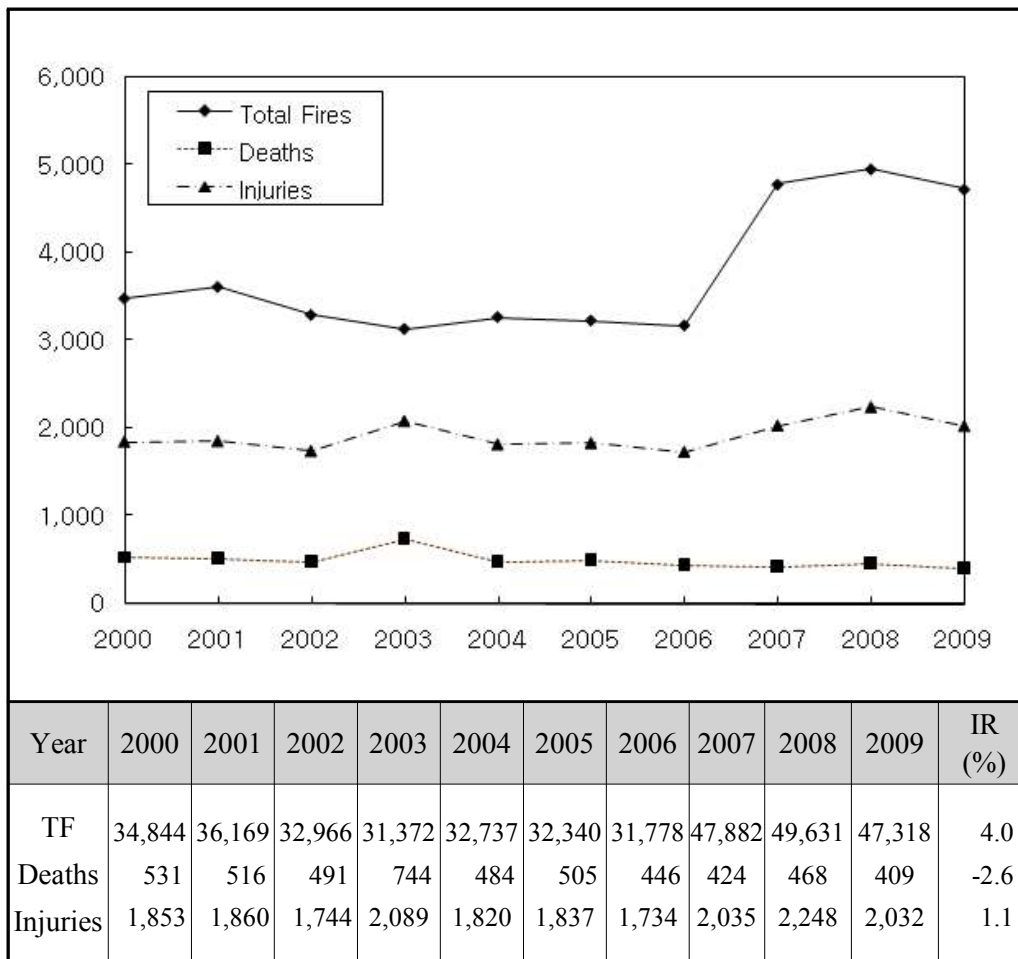


* TF : Total Fires, * S : Structures, * VH : Vehicles, Ships, Aircraft, etc

* IR : Average Increase Rate during 10 years

The number of fires for the last 10-year period has shown an average 4.0 % increase rate per year since 2000. In 2009, total 47,318 fires occurred to be up by 35.8 % from 2000. Fires in Structures marked an average 4.8 % increase rate per year, and resulted in a 42.8 % rise from 28,846 fires in 2000 to 41,195 fires in 2009. Vehicle (vehicles, train, ships, aircraft) fires have risen with an average 0.2 % rate per year to mark a 2.1 % increase rate in 2009 compared to 2000.

2. Fire Casualties for 2000-2009



* TF : Total Fires, * IR : Average Increase Rate

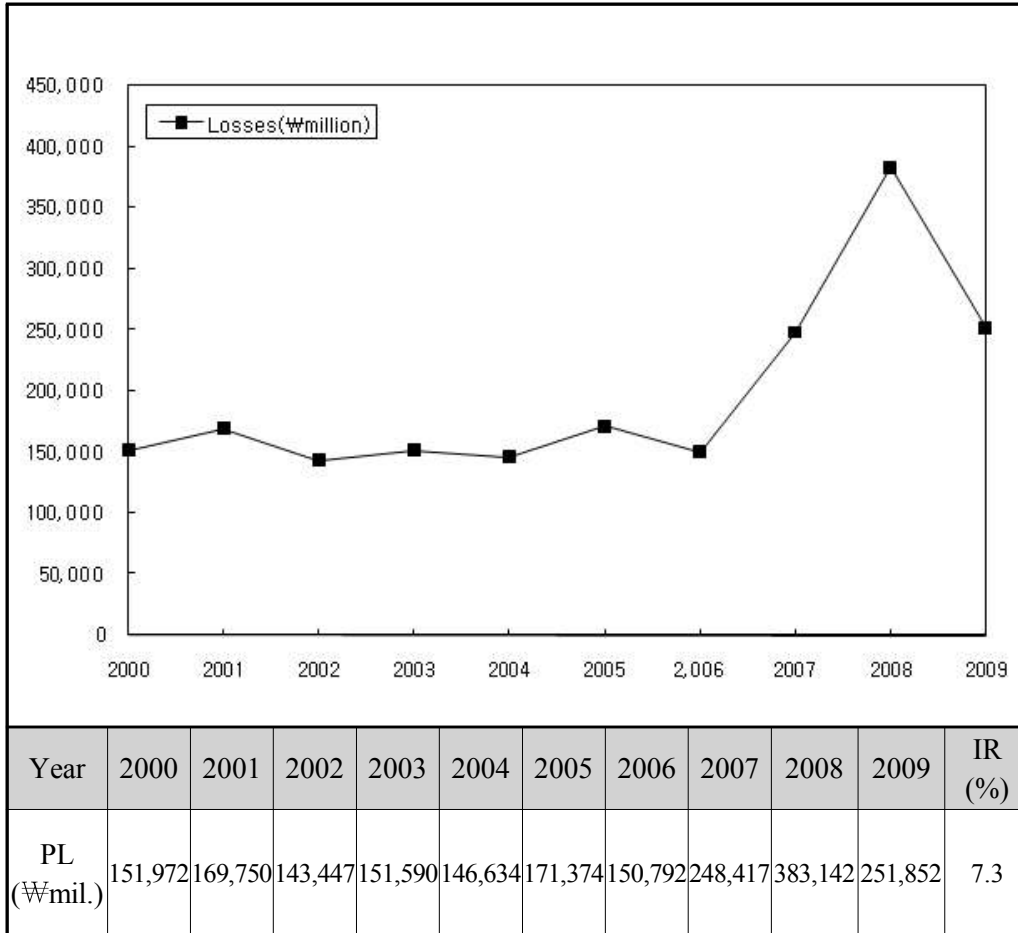
○ Trend in fire deaths

- Deaths in 2009 : decreased average 2.6 % per annum for the last 10-year period
- Numbers in 2009 compared to 2008 : 12.6 % down
- Numbers in 2009 compared to 2000 : 23.0 % down

○ Trend in fire injuries

- Injuries in 2009 : increased average 1.1 % per annum for the last 10-year period
- Numbers rate in 2009 compared to 2008 : 9.6 % down
- Numbers rate in 2009 compared to 2000 : 9.7 % up

3. Property Loss for 2000-2009



* PL : Property Loss, * IR : Average Increase Rate during 10 years

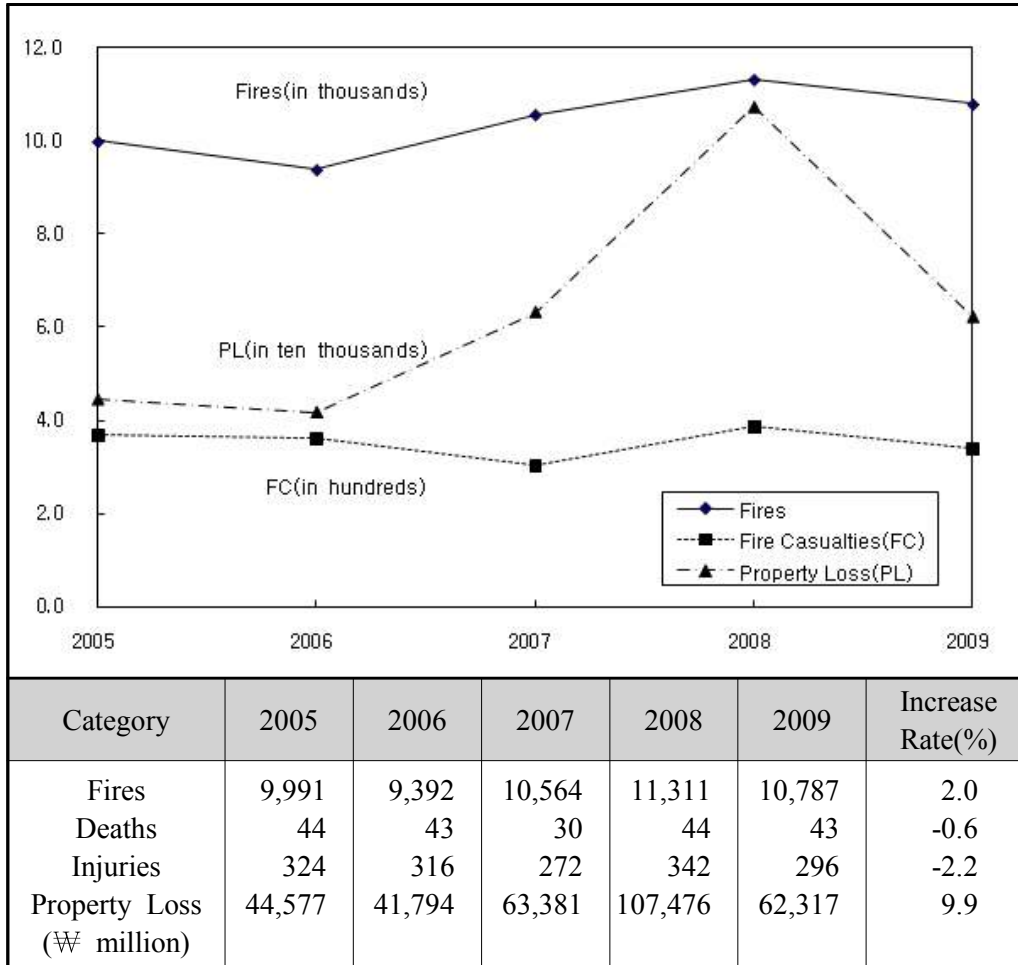
- Trend in property loss
 - Increase trend for the last 10-year period : increased average 7.3 % per annum
 - Numbers in 2009 compared to 2008 : 34.3 % down
 - Numbers in 2009 compared to 2000 : 65.7 % up

- Property loss order by places
 - 1st : Industry ₩111,735 mil. (44.4 % of total ₩251,852 mil.)
 - 2nd : Residential ₩49,793 mil. (19.8 % of total ₩251,852 mil.)
 - 3rd : Vehicle, Train ₩24,155 mil. (9.6 % of total ₩251,852 mil.)

- Property loss order by causes
 - 1st : Electrical fires ₩62,281 mil. (24.7 % of total ₩251,852 mil.)
 - 2nd : Human errors ₩42,099 mil. (16.7 % of total ₩251,852 mil.)
 - 3rd : Mechanical ₩19,315 mil. (7.7 % of total ₩251,852 mil.)

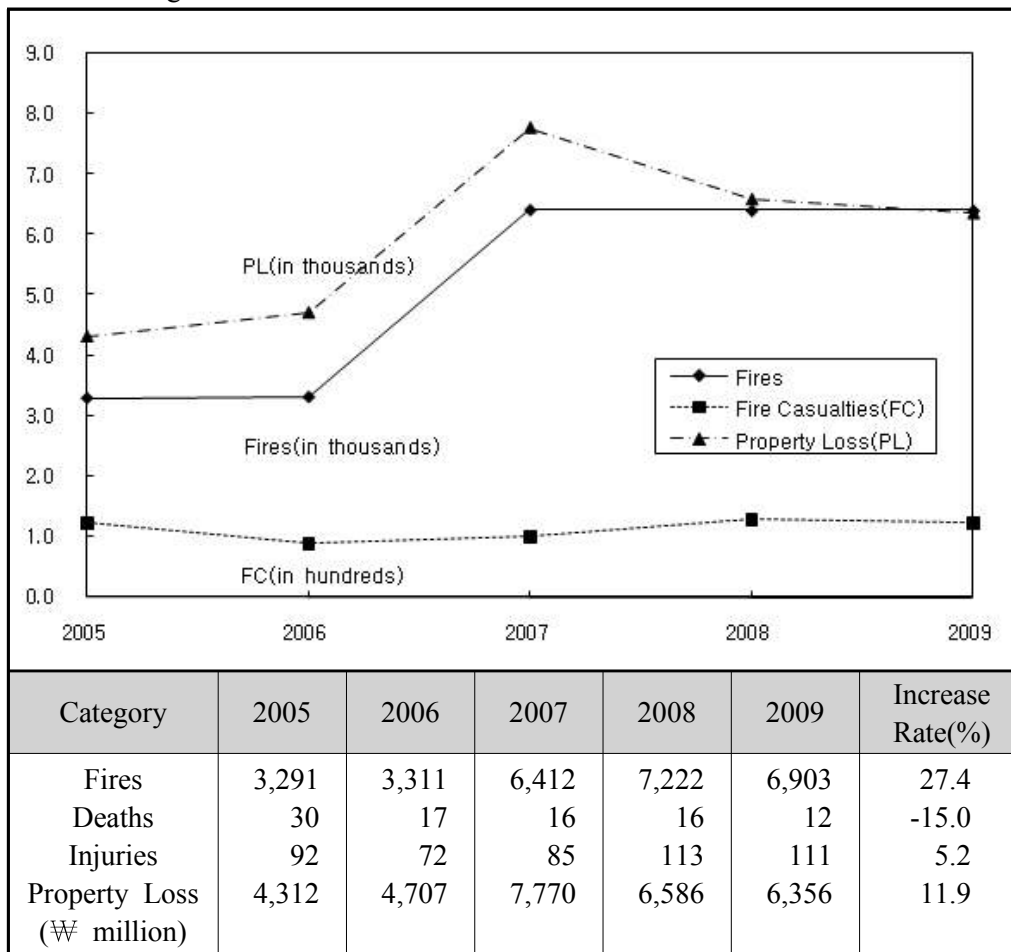
4. Fires by Cause for the 5-Year Period 2005-2009

4-1. Electrical Fires



- Fire trend
 - 5-year : Increased average 2.0 % per annum
 - Numbers in 2009 compared to 2008 : 4.6 % down
 - Numbers in 2009 compared to 2005 : 8.0 % up
- Fire casualties
 - 5-year trend : deaths and injuries decreased average 0.6 % and 2.2 % per annum respectively
 - Numbers in 2009 compared to 2008 : deaths and injuries down by 2.3 % and 13.5 % respectively
 - Numbers in 2009 compared to 2005 : deaths and injuries down by 2.3 % and 8.6 % respectively
- Property loss
 - 5-year trend : Increased average 9.9 % per annum
 - Numbers in 2009 compared to 2008 : 42.0 % down
 - Numbers in 2009 compared to 2005 : 39.8 % up

4-2. Smoking materials



○ Fire trend

- 5-year : increased average 27.4 % per annum
- Numbers in 2009 compared to 2008 : 4.4 % down
- Numbers in 2009 compared to 2005 : 109.8 % up

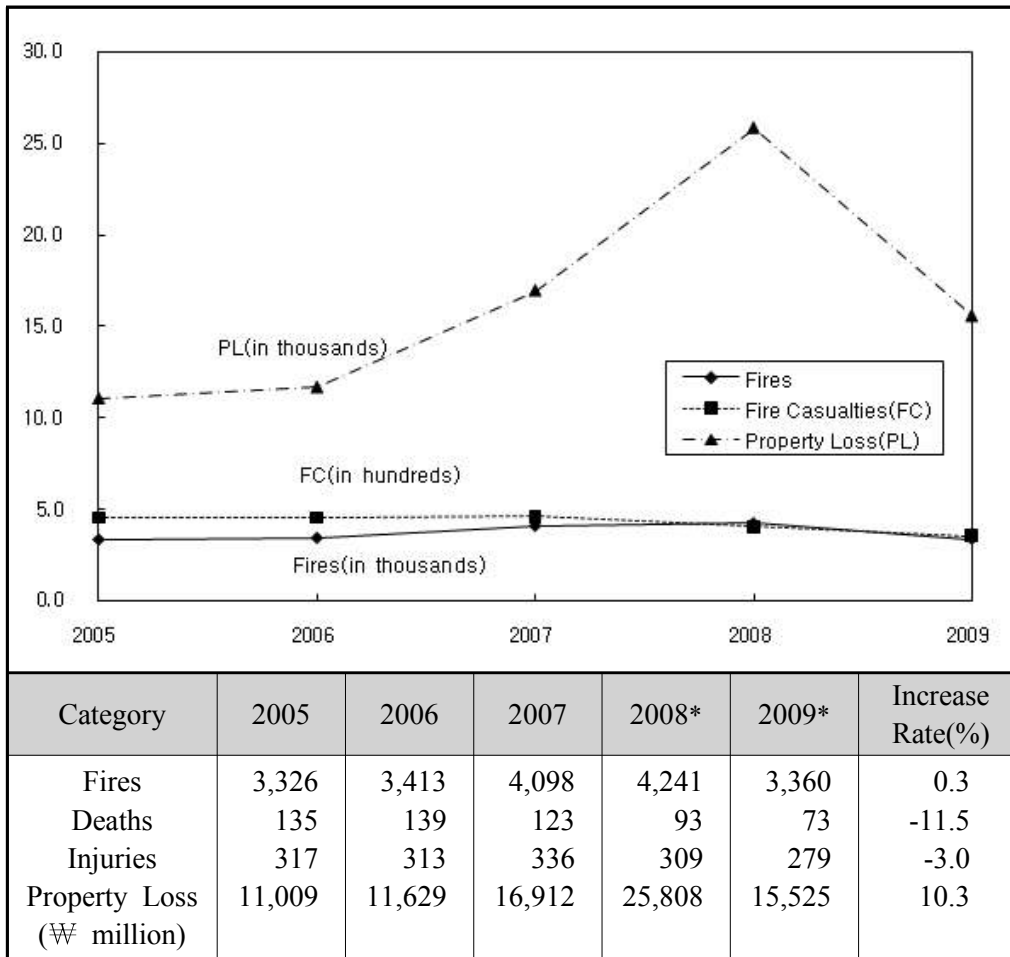
○ Fire casualties

- 5-year trend : deaths decreased average 15.0 % per annum and injuries increased average 5.2 % per annum
- Numbers in 2009 compared to 2008 : deaths and injuries down by 25.0 % and 1.8 % respectively
- Numbers in 2009 compared to 2005 : deaths down by 60.0 % and injuries up by 20.7 %

○ Property loss

- 5-year trend : increased average 11.9 % per annum
- Numbers in 2009 compared to 2008 : 3.5 % down
- Numbers in 2008 compared to 2004 : 47.4 % up

4-3. Arson



*: including fires by suspicion of arson

○ Fire trend

- 5-year : increased average 0.3 % per annum
- Numbers in 2009 compared to 2008 : 20.8 % down
- Numbers in 2009 compared to 2005 : 1.0 % up

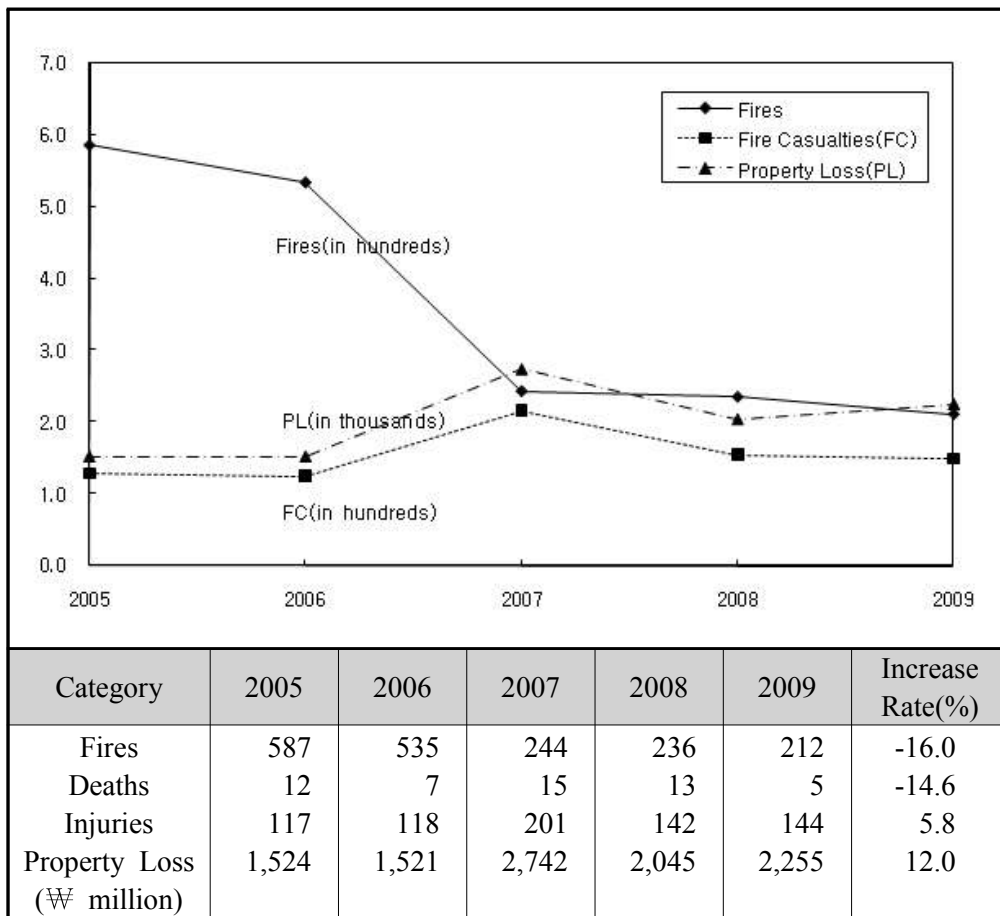
○ Fire casualties

- 5-year trend : deaths and injuries decreased average 11.5 % and 3.0 % per annum respectively
- Numbers in 2009 compared to 2008 : deaths down by 21.5 % and injuries down by 9.7 %
- Numbers in 2009 compared to 2005 : deaths down by 45.9 % and injuries down by 12.0 %

○ Property loss

- 5-year trend : increased average 10.3 % per annum
- Numbers in 2009 compared to 2008 : 39.8 % down
- Numbers in 2009 compared to 2005 : 41.0 % up

4-4. Gases



○ Fire trend

- 5-year : decreased average 16.0 % per annum
- Numbers in 2009 compared to 2008 : 10.2 % down
- Numbers in 2009 compared to 2005 : 63.9 % down

○ Fire casualties

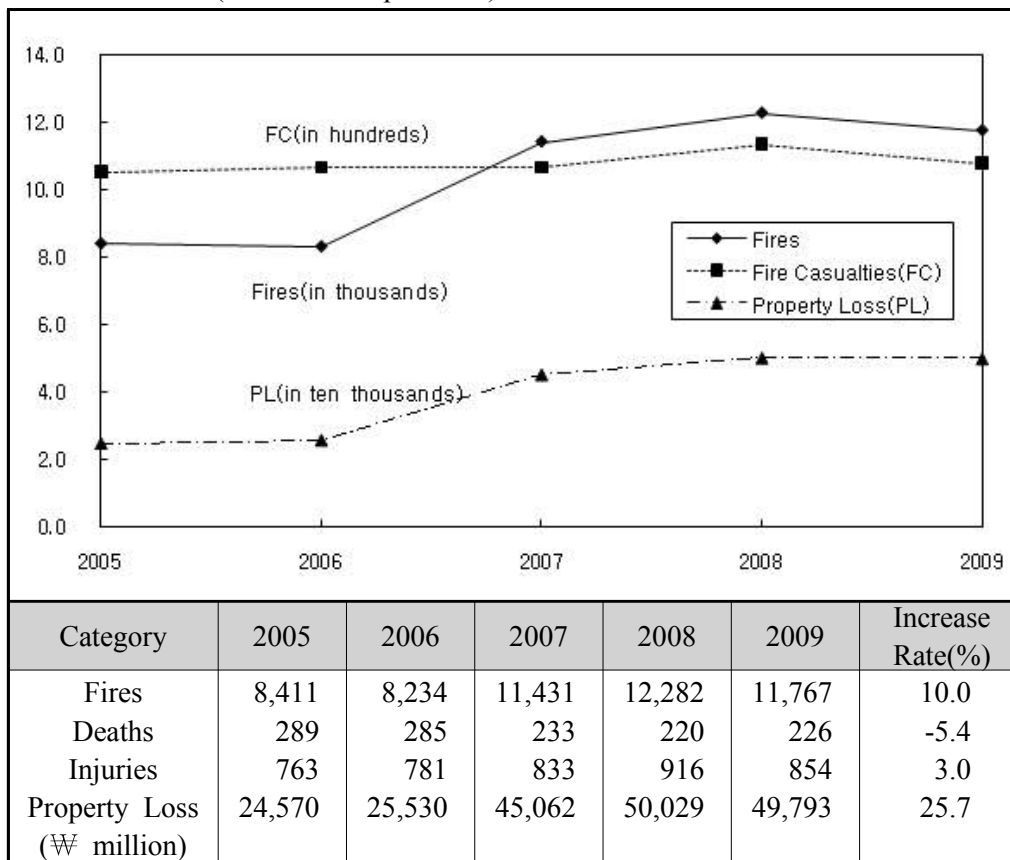
- 5-year trend : deaths decreased average 14.6 % and injuries increased average 5.8 % per annum
- Numbers in 2009 compared to 2008 : deaths down by 61.5 % and injuries up by 1.4 %
- Numbers in 2009 compared to 2005 : deaths down by 58.3 % and injuries up by 23.1 %

○ Property loss

- 5-year trend : increased average 12.0 % per annum
- Numbers in 2009 compared to 2008 : 10.3 % up
- Numbers in 2009 compared to 2005 : 48.0 % up

5. Fires by Property Type for the 5-Year Period 2005-2009

5-1. Residential (Houses & Apartment)



○ Fire trend

- 5-year : increased average 10.0 % per annum
- Numbers in 2009 compared to 2008 : 4.2 % down
- Numbers in 2009 compared to 2005 : 39.9 % up

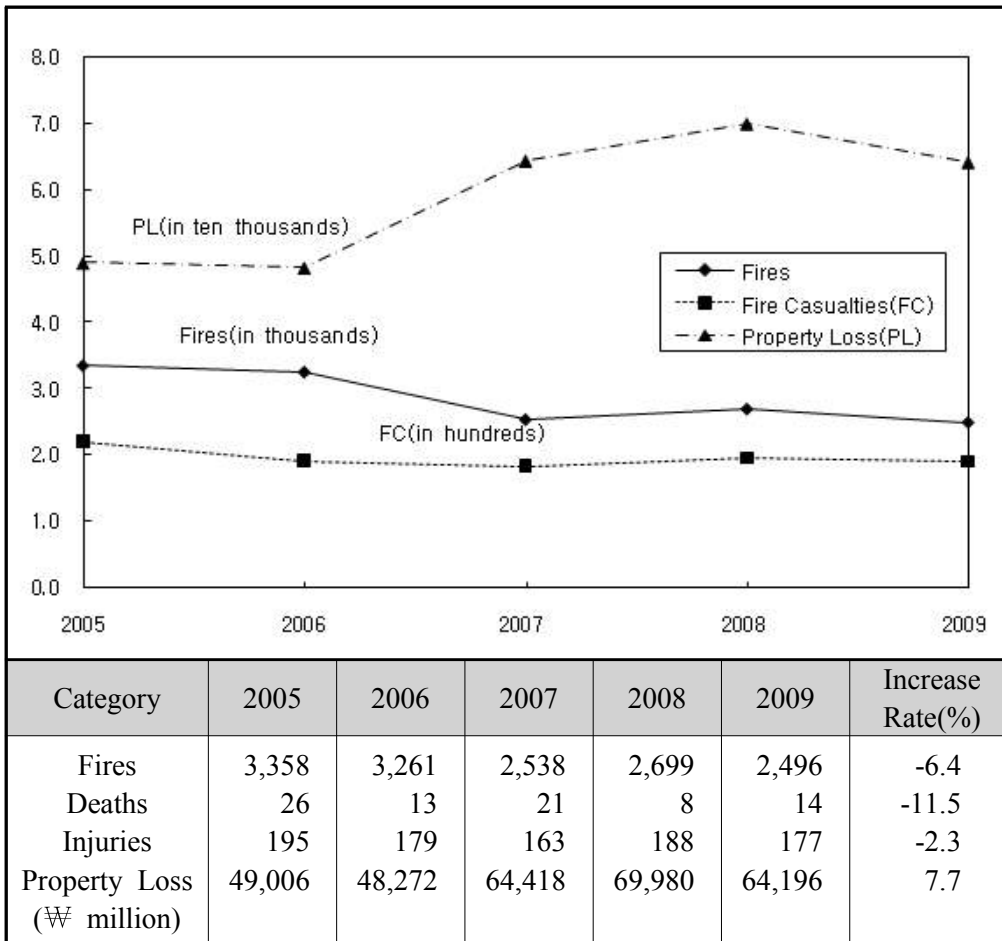
○ Fire casualties

- 5-year trend : deaths decreased average 5.4 % per annum and injuries increased average 3.0 % per annum
- Numbers in 2009 compared to 2008 : deaths up by 2.7 % and injuries down by 6.8 %.
- Numbers in 2009 compared to 2005 : deaths down by 21.8 % and injuries up by 11.9 %

○ Property loss

- 5-year trend : increased average 25.7 % per annum
- Numbers in 2009 compared to 2008 : 0.5 % down
- Numbers in 2009 compared to 2005 : 102.7 % up

5-2. Factories¹



¹ including manufacturing facilities(mining, mechanical, fiber, petrochemical, printing, electrical, pulp, chemical and others)

○ Fire trend

- 5-year : decreased average 6.4 % per annum
- Numbers in 2009 compared to 2008 : 7.5 % down
- Numbers in 2009 compared to 2005 : 25.7 % down

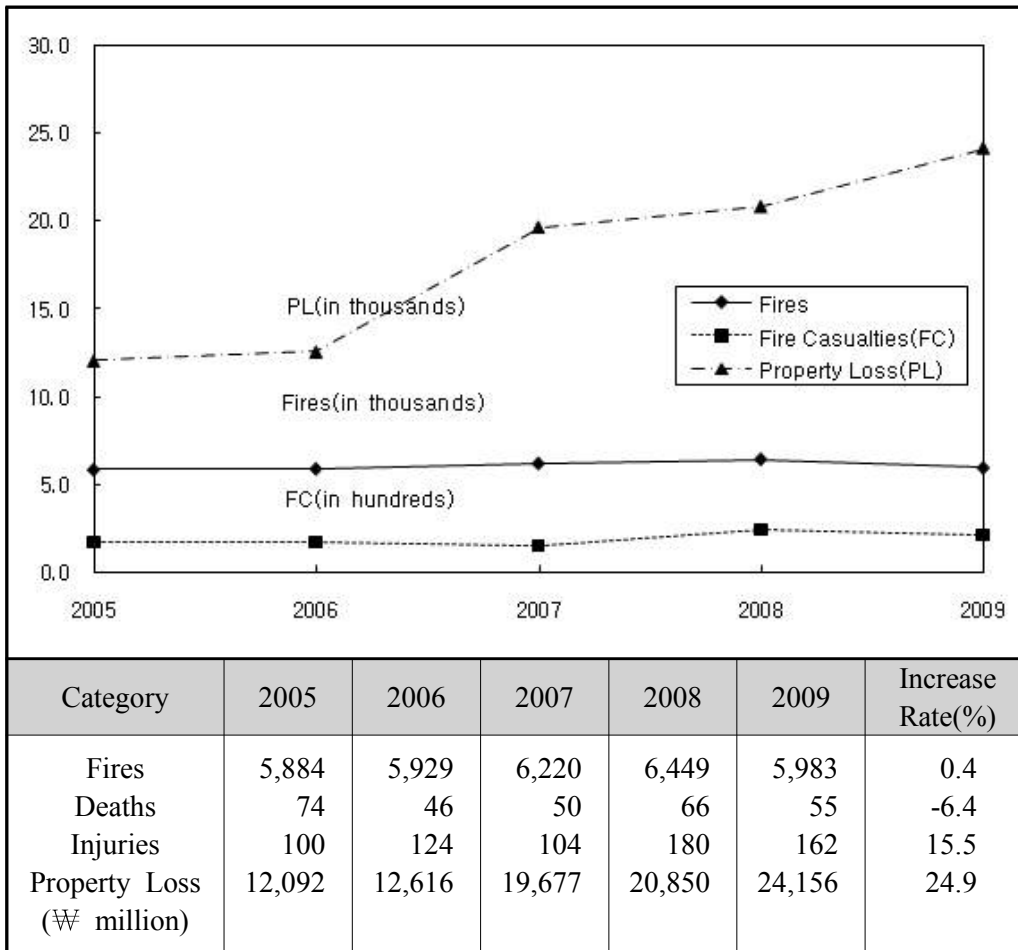
○ Fire casualties

- 5-year trend : deaths and injuries decreased average 11.5 % and 2.3 % per annum respectively
- Numbers in 2009 compared to 2008 : deaths up by 75.0 % and injuries down by 5.9 %
- Numbers in 2009 compared to 2005 : deaths down by 46.2 % and injuries down by 9.2 %

○ Property loss

- 5-year trend : increased average 7.7 % per annum
- Numbers in 2009 compared to 2008 : 8.3 % down
- Numbers in 2009 compared to 2005 : 31.0 % up

5-3. Vehicles



○ Fire trend

- 5-year : increased average 0.4 % per annum
- Numbers in 2009 compared to 2008 : 7.2 % down
- Numbers in 2009 compared to 2005 : 1.7 % up

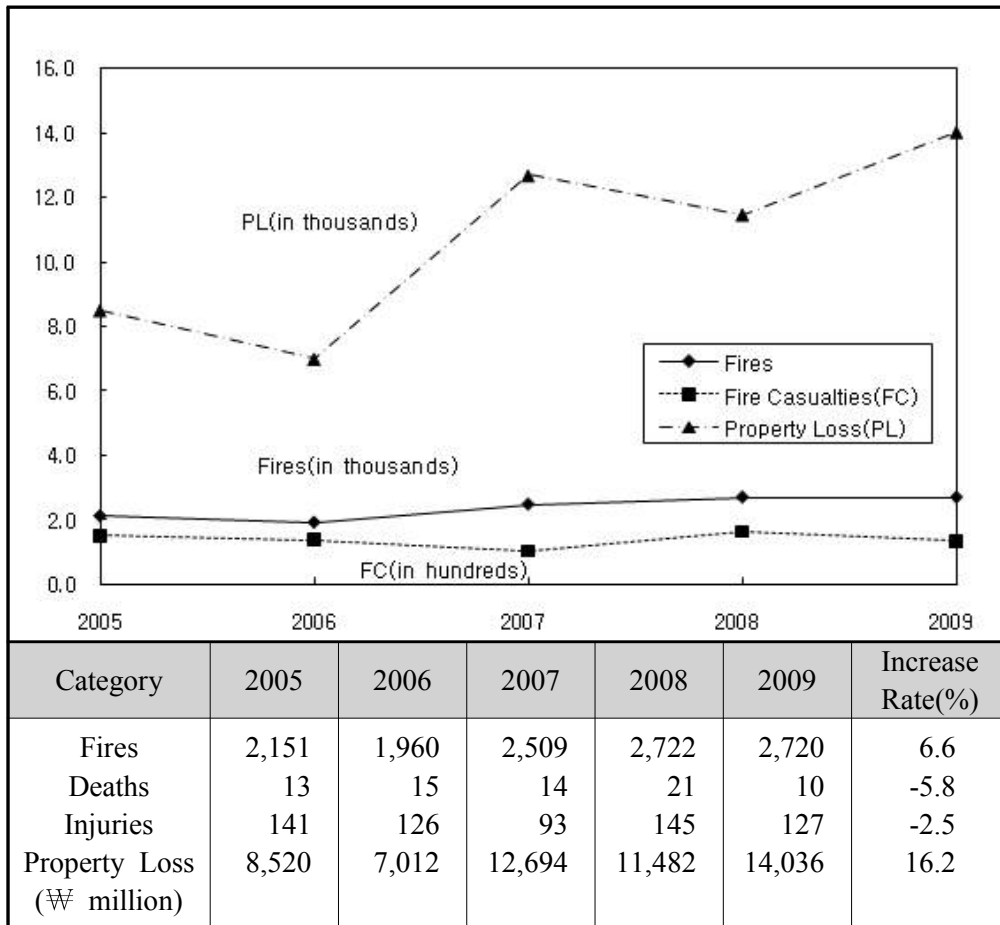
○ Fire casualties

- 5-year trend : deaths decreased average 6.4 % and injuries increased average 15.5 % per annum
- Numbers in 2009 compared to 2008 : deaths down by 16.7 % and injuries down by 10.0 %
- Numbers in 2009 compared to 2005 : deaths down by 25.7 % and injuries up by 62.0 %

○ Property loss

- 5-year trend : increased average 24.9 % per annum
- Numbers in 2009 compared to 2008 : 15.9 % up
- Numbers in 2009 compared to 2005 : 99.8 % up

5-4. Restaurants



○ Fire trend

- 5-year : increased average 6.6 % per annum
- Numbers in 2009 compared to 2008 : 0.1 % down
- Numbers in 2009 compared to 2005 : 26.5 % up

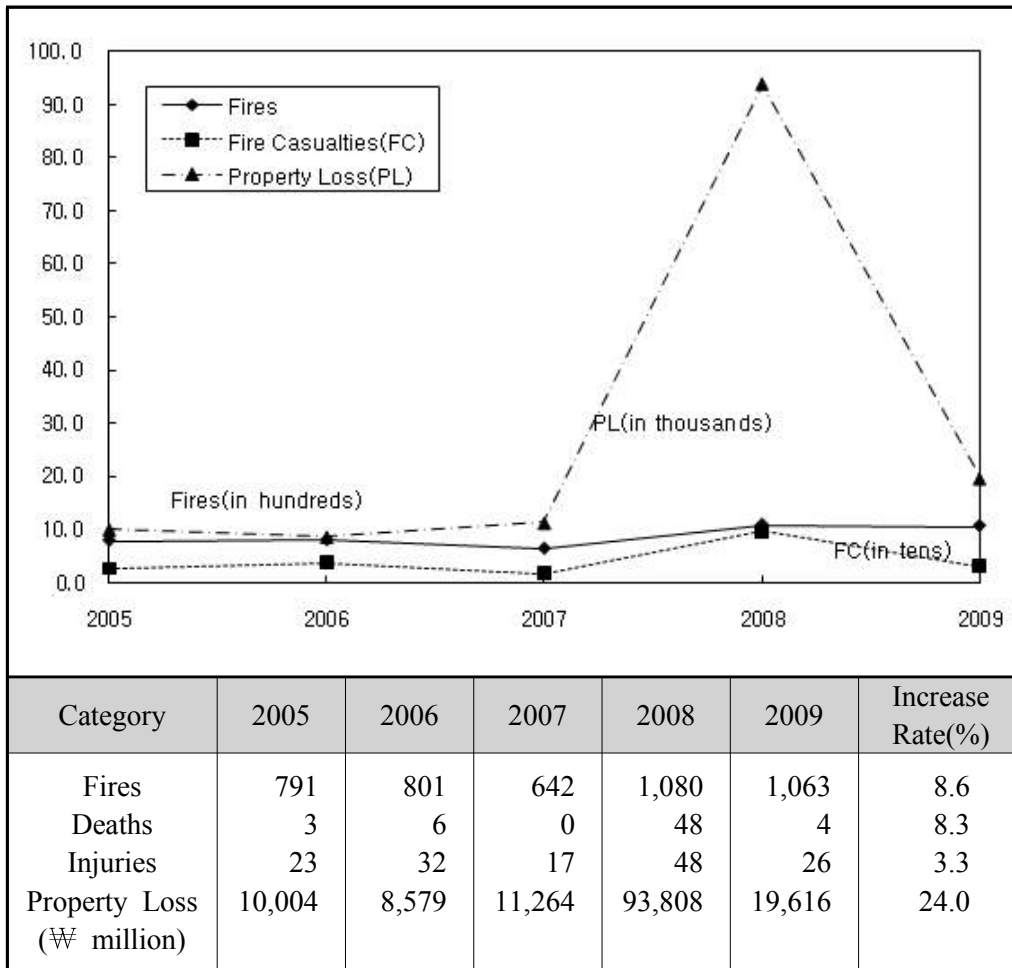
○ Fire casualties

- 5-year trend : deaths and injuries decreased average 5.8 % and 2.5 % per annum respectively
- Numbers in 2009 compared to 2008 : deaths down by 52.4 % and injuries down by 12.4 %
- Numbers in 2009 compared to 2005 : deaths down by 23.1 % and injuries down by 9.9 %

○ Property loss

- 5-year trend : increased average 16.2 % per annum
- Numbers in 2009 compared to 2008 : 22.2 % up
- Numbers in 2009 compared to 2005 : 64.7 % up

5-5. Warehouses



○ Fire trend

- 5-year : increased average 8.6 % per annum
- Numbers in 2009 compared to 2008 : 1.6 % down
- Numbers in 2009 compared to 2005 : 34.4 % up

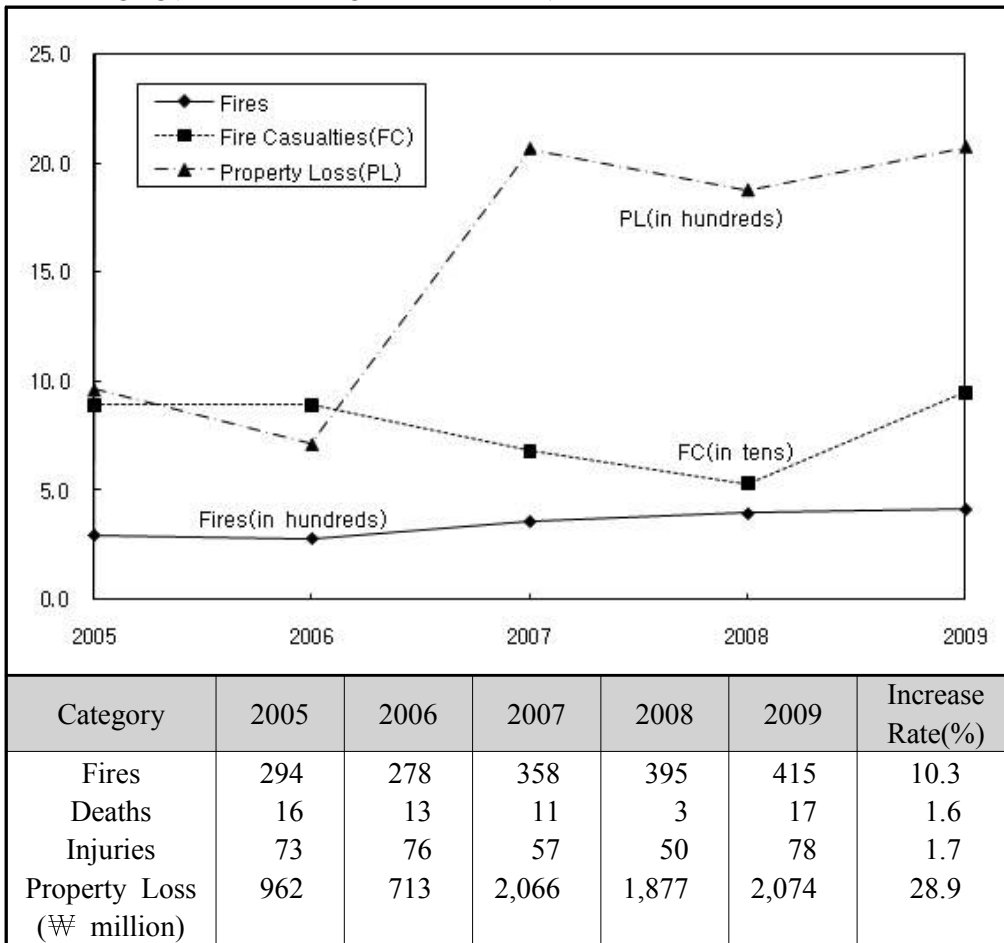
○ Fire casualties

- 5-year trend : deaths and injuries increased average 8.3% and 3.3 % per annum respectively
- Numbers in 2009 compared to 2008 : deaths down by 91.7 % and injuries down by 45.8 %
- Numbers in 2009 compared to 2005 : deaths up by 33.3 % and injuries up by 13.0 %

○ Property loss

- 5-year trend : increased average 24.0 % per annum
- Numbers in 2009 compared to 2008 : 79.1 % down
- Numbers in 2009 compared to 2005 : 96.1 % up

5-6. Lodging(hotel, motel, guest house, etc)



○ Fire trend

- 5-year : increased average 10.3 % per annum
- Numbers in 2009 compared to 2008 : 5.1 % up
- Numbers in 2009 compared to 2005 : 41.2 % up

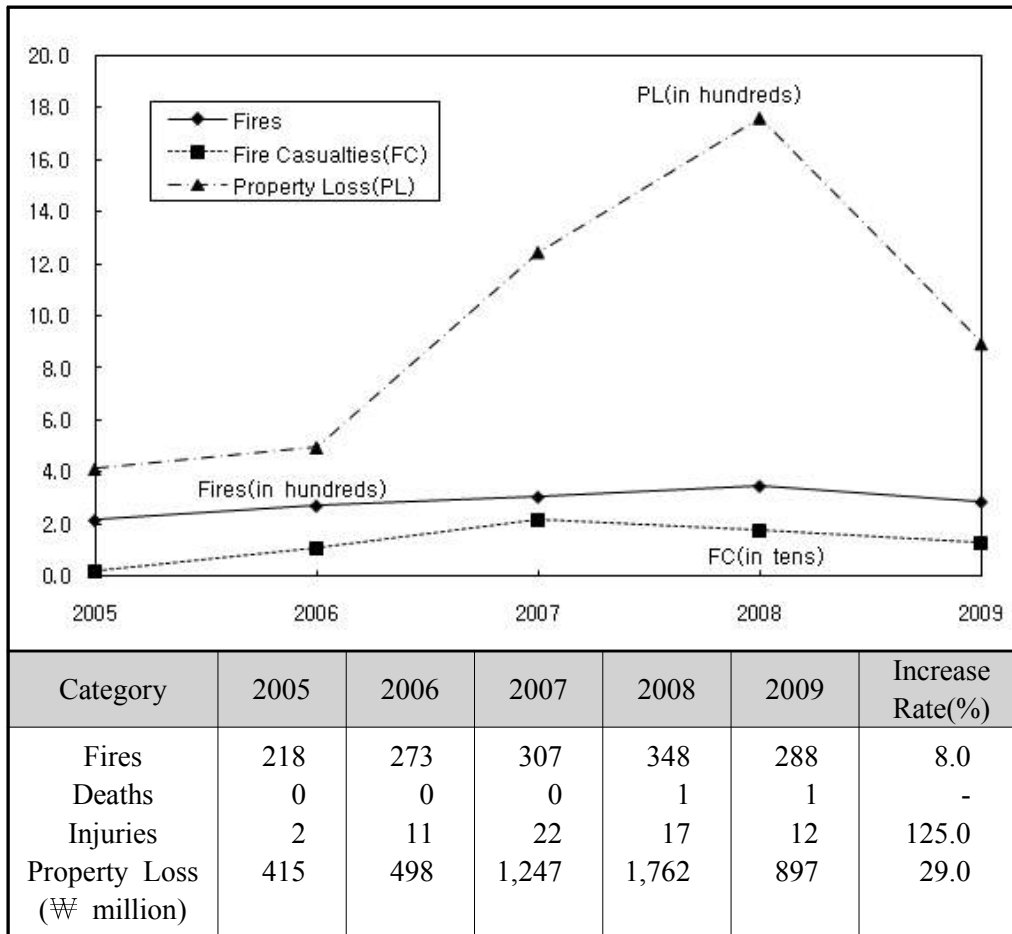
○ Fire casualties

- 5-year trend : deaths increased average 1.6 % per annum and injuries increased average 1.7 % per annum
- Numbers in 2009 compared to 2008 : deaths up by 466.7 % and injuries up by 56.0 %.
- Numbers in 2009 compared to 2005 : deaths up by 6.3 % and injuries up by 6.8 %

○ Property loss

- 5-year trend : increased average 28.9 % per annum
- Numbers in 2009 compared to 2008 : 10.5 % up
- Numbers in 2009 compared to 2005 : 115.6 % up

5-7. Schools



○ Fire trend

- 5-year : increased average 8.0 % per annum
- Numbers in 2009 compared to 2008 : 17.2 % down
- Numbers in 2009 compared to 2005 : 32.1 % up

○ Fire casualties

- 5-year trend : injuries increased average 125.0 % per annum
- Numbers in 2009 compared to 2008 : injuries down by 29.4 %.
- Numbers in 2009 compared to 2005 : injuries up by 500.0 %

○ Property loss

- 5-year trend : increased average 29.0 % per annum
- Numbers in 2009 compared to 2008 : 49.1 % down
- Numbers in 2009 compared to 2005 : 116.1 % up

FIRE INVESTIGATION REPORT

**Fire Occurrences in Apartments
and their Analysis**

Fire Occurrences in Apartments and their Analysis

1. Introduction

A fire in an apartment building tends to result in limited damage to households and often causes smoke-blackening to the upper floors. Moreover, the water used to extinguish fire often causes damage to the adjacent households.

Given the limited extent of damage, fire outbreaks in apartment buildings rarely have attention across society. Note, however, that the fire occurrence rate of apartment buildings is considerably high since many households are concentrated within a single apartment complex.

The Annual Statistics on Fire in 2009 showed that 11,767 out of 47,318 fires broke out in residential occupancies, with 2,778 occurring in apartment complexes and residential and commercial apartment complexes (mixed-use apartments).

The rate of fire occurrence per apartment complex is 16.8%, considering the fact that there are approximately 16,500 apartment complexes nationwide as of 2009.

Fires in an apartment building are likely to cause more casualties compared to fires in office buildings, since fire often breaks out when residents in apartments are taking a rest or sleeping. Note, however, that the evacuation characteristics are similar to those of high-rise buildings.

Out of a total of 2,778 fires in apartment buildings in 2009, 159 caused casualties specifically 31 deaths and 204 injuries.

<Table 1> Causes of death from fire in apartment buildings in 2009

Cause of death	Death toll
Multiple causes	1
Inhalation of smoke and toxic gases	9
Inhalation of smoke and toxic gases, burn injury	12
Jumped off the building during evacuation	1
Burn injury	6
Others	1
Unknown causes	1
Total	31

Jumping off a high floor often leads to death during fire incidents, but most deaths from fire in apartment buildings are attributable to the inhalation of toxic gases as in most other fires.

II. Fire Incidents

1. Case 1

A. General Information

- Date : Around 12:50 on March 11 (Wed.), 2009
- Place : Gangnam-gu, Seoul
- Cause : Cigarette fire
- Casualty : 1 death
- Property Damage : KRW 51,658,000

B. Status of Fire

(1) Start of Fire

The fire broke out on the 11th floor - which was occupied by a household consisting of parents, a daughter, and four sons - in the 13-story apartment building. The daughter (aged 36, died in the fire) was home alone when the fire started.

The apartment had the floor extended from the living room to the balcony. The victim was thought to have been trapped in the fire -- because the small room as the initial ignition point was located toward the entrance -- was believed to have fallen off the balcony while attempting to avoid the flames in the balcony windows. The investigation revealed that the fire was caused by a cigarette butt that was still lit in the waste basket inside the small room.

(2) Fire extinguishment and rescue

Flames burst through the balcony when the fire brigade arrived on the scene; the victim was in the porch, with her upper body poking through the window of the living room. The victim fell off while the aerial ladder was approaching the 7th floor for rescue operation, and she was transported to the hospital. Firefighters headed to the front door, broke open the locked door, and put out the fire using the indoor fire hydrant.

(3) Casualties

The victim who was brought to the hospital died during the first-aid treatment.



<Photo 1> Left side in the small room (location of waste basket)



<Photo 2> Small room, the point of origin



<Photo 3> View of the apartment (area encircled in red indicates the location of the fall)



<Photo 4> Point of fall in the living room

2. Case 2

A. General Information

- Date : Around 23:45 on September 28 (Sunday), 2008
- Place : Dongdaemun-gu, Seoul
- Cause : Electrical problem caused by overloaded fan
- Casualty : 4 (1 dead, 3 injured)
- Property Damage : KRW 50,000,000

B. Status of Fire Incident

(1) Start of Fire

The fire broke out on the 13th floor - which was occupied by a household composed of two persons; grandfather(aged 73) and grandson(aged 10) - in the 15-story apartment building. Two nephews who came to Seoul to attend the wedding ceremony of a family member went to bed in the small room beside the front door; the grandfather and grandson slept in the main room. The two nephews brought and plugged in a fan that had not been used for a long time because it was very hot in the small room; the fire broke out in the small room while they were sleeping with the fan turned on. The fire was believed to have been caused by the overloaded fan that ran at night in the small room.

One(aged 62) of the two nephews discovered the fire, alerted the grandfather of the fire outbreak, and rushed to the main room to rescue the grandson trapped by the fire. With the front door enveloped in flames, they could not escape from the fire; the nephew edged toward the outdoor unit of the air conditioner in the porch of the main room together with the grandson. The nephew fell off before the rescue team arrived; he was transported to the hospital but died there.

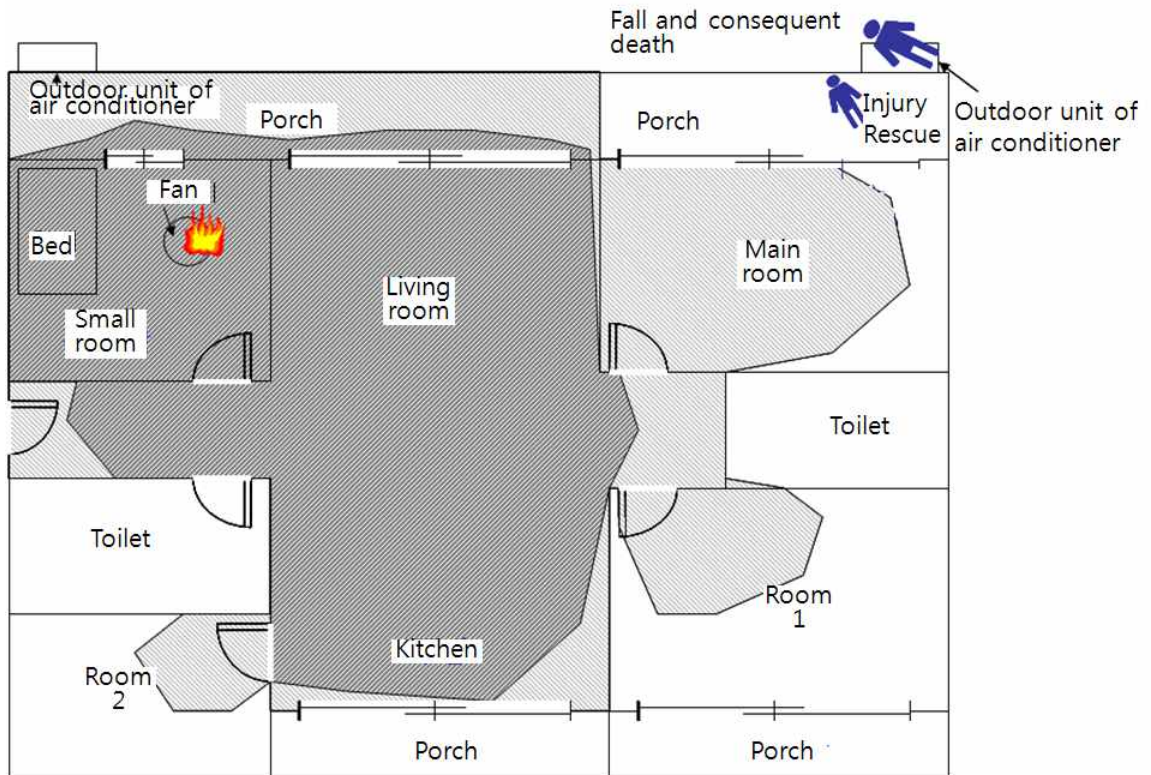
(2) Fire extinguishment and rescue

The stair landing on the 13th floor of the apartment building was filled with smothering smoke when the fire brigade arrived, and the entrance to the front door burst into flames. Flames erupted through the windows, raising concern of a possible propagation of the fire into the upper section of the apartment building. Firefighters made their way into the room and rescued the grandson while extinguishing the fire; two other persons crying for help from the 14th floor -- which was just above the floor where the fire started -- were also rescued.

(3) Casualties

Two persons were safely rescued during the fire on the 13th floor, but the

grandson was brought to the hospital to receive treatment for injury caused by the simple inhalation of smoke; the nephew who fell off died. Two other persons rescued on the 14th floor were transported to the hospital for the treatment of injury caused by the simple inhalation of smoke.



<Fig. 1> Floor plan of the floor where the fire started



<Photo 5> Small room as the point of origin



<Photo 6> Inside the main room

III. Evacuation and Countermeasures

A. Evacuation and rescue

Going to the place near the porch or window to wait for rescue increases

the chance of survival the most if the chance for escape was missed or in case escape itself is impossible in fire outbreaks on high floors of an apartment building.

The fall in the aforesaid fire is considered to be an unconscious action to avoid shortness of breath caused by the heat and smoke during the fire or the result of losing composure and mistakenly letting go of the supporting object held firmly.

The injured persons who waited for rescue to be completed even in an extremely difficult situation eventually survived. Fall or jumping off the building may prove to be fatal or result in irreversible damage, unless safety measures such as air mattress, etc., are put in place.

B. Delay of fire spread

Closing the doors of the room and the living room will be very much useful in delaying the fire propagation, earning the necessary time for rescue. Nearly all doors inside the apartment unit are wooden doors, but they could help delay fire spread.

C. Safe area during the fire

As we can see from the floor plan showing the fire occurrence, there is always area that is not so much affected by the fire. Windows farthest from the fire are relatively safe. Moving toward the wrong direction during fire will result in death or injury, although people tend to move toward the opposition direction of the fire by instinct.

Making the right decision even in an extremely difficult situation will ensure survival. The best way may be to keep a firm grip of the situation without losing composure and to go to a safe area and wait for rescue.

D. Training and education

Children may face difficulties in traveling even a short distance to leave the area in the event of fire because they cannot cope well with fire in the house. Children are influenced heavily by the words and behaviors of parents, however; therefore, parents would do well to go through the fire drill with children at home.

<Fire drill>

- Draw the floor plan of the house. At this time, indicate the entrance, exit, arrangement of furniture, etc., on the plan.
- Set a meeting point outside the house in case of fire.

- Set imaginary locations of fire outbreak and indicate the escape route leading to the outside.
- Practice with the family regularly by assuming various fire outbreak situations.

<Fire prevention education>

Fire prevention measures and related tasks include many prohibitions; therefore, any explanation on them to children must be accompanied by a sufficient description of the reasons. Figuring out and managing the potential hazards of fire at home are also important.

- Be sure to turn off any electric apparatus that is not in use.
- Do not poke the electrical outlet with chopsticks, etc.
- Do not plug several power cords into one outlet.
- Do not play with fire with friends or brothers or sisters.
- Do not run or play around the gas range and heat-providing devices such as an iron.

FIRE INVESTIGATION REPORT

**Fire Incidents in Multi-purpose Assembly
Occupancy and their Countermeasures**

Fire Incidents in Multi-purpose Assembly Occupancy and their Countermeasures

1 . Introduction

Multi-purpose Assembly Occupancy as stipulated in Article 2 of the Special Act on the Safety Control of Multi-purpose Assembly Occupancy refer to the business facilities specified in the Presidential Decree, which are at high risk of causing many injuries and fatalities in fire that breaks out while services are provided to many and unspecified people.

Examples of Multi-purpose Assembly Occupancy include dining area (rest area), bakery, general restaurant, bar, karaoke bar, movie theaters, video room, public bath, PC lounge, karaoke room, postnatal care center, off-campus housing unit, phone room, sleeping room, cola-theek (a kind of discothek), etc. Statistics on Preventive Firefighting Administration in 2009 (National Emergency Management Agency) counts the number of Multi-purpose Assembly Occupancy nationwide at 177,114 as of 2009.

A fire in Multi-purpose Assembly Occupancy causes massive casualties compared to the intensity of fire. Therefore, it has been considered as a big problem every year.

At least 54% (96,298) of all Multi-purpose Assembly Occupancy are small businesses, occupying less than 150 square meters and crowded inside; thus making massive casualties unavoidable in fire incidents. Worse, adequate indemnification for loss of life or injury has remained difficult.

The fire at "Shanghai karaoke bar" and an indoor shooting range in Busan in 2009 attracted wide attention. The fire at "Shanghai karaoke bar" in Busan was caused by electrical failure in the singing room on the first basement floor of the 6-story building, leaving 8 dead and 1 injured. Property damage from the fire was estimated at KRW 30 million.

Meanwhile, the fire at an indoor shooting range in Busan left 15 people dead and 1 person seriously injured as the area was engulfed in flames and toxic gas a mere 3 seconds after the fire broke out.

This paper seeks to examine the fire incidents in Multi-purpose Assembly Occupancy, which have been social problem, identify the problems, and explore measures to cope with such.

II. Fire incidents

<Table 1> Major fire incidents in Multi-purpose Assembly Occupancy

Date	Place	Location	Dead	Injured
May 16, 2001	Yejihakwon (private education institute)	Gwangju, Gyeonggi-do	10	23
January 29, 2002	Daega bar	Gunsan, Jeonbuk	15	-
July 6, 2003	Gawon coffee shop	Dangjin, Chungnam	5	-
January 12, 2004	MYROOM - off-campus housing unit	Suwon, Gyeonggi-do	4	4
September 2, 2005	Suseong City World dry sauna	Daegu	5	53
July 19, 2006	Nau off-campus housing unit	Jamsil-dong, Seoul	8	12
July 25, 2008	Tower off-campus housing unit	Yongin, Gyeonggi-do	7	11
January 14, 2009	Shanghai Karaoke bar	Namhang-dong, Busan	8	1
November 14, 2009	Ganadara shooting range	Sinchang-dong, Busan	15	1

A. Case 1

(1) General Information

- Date : Around 01:25 on July 25, 2008
- Place : Tower off-campus housing unit, Gimryangjang-dong, Cheoin-gu, Yongin-si, Gyeonggi-do
- Cause : arson (suspected)
- Casualty : 18 persons (7 dead, 11 injured)
- Property Damage : KRW 119,000,000

(2) Damage and Cause of Fire Incident

The Tower off-campus housing unit set ablaze was on the 9th floor of the 10-story commercial building; it had 68 rooms arranged like cells of a honeycomb, with each room measuring less than 6.6 m².

Approximately 150 m² out of the 552.9 m² total floor area of the off-campus housing unit was destroyed in the fire. Damage by charring and smoke blackening resulted from the fire, with the rapid propagation of toxic gases said to have increased the casualties. The fire was extinguished

at 2:05 pm -- roughly 40 minutes after it started -- by the firefighters who arrived at the scene.

The police investigation found a trace of fire on the mattress of the bed in room no. 8, which had been extinguished for an unknown reason during the combustion, as well as a sign of the propagation of flames through the ceiling of the hallway following the complete destruction of room no.6 (for men), the presumed point of origin, by fire.

Considering the fact that more than two points of the ignition were located separately at room no. 6 and room no. 8, an unidentified person was assumed to have set combustible materials such as beddings, etc., ablaze intentionally inside room nos. 6 and 8 using an unidentified ignition mechanism.



<Photo 1> Inside the off-campus housing unit after the fire



<Photo 2> Inside room no. 6, the suspected point of origin

B. Case 2

(1) General Information

- Date : Around 20:44 on January 14, 2009
- Place : Shanghai karaoke bar, Namhang-dong, Yeongdo-gu, Busan
- Cause : Electrical failure
- Casualty : 9 persons (8 dead, 1 injured)
- Property Damage : KRW 30,000,000

(2) Damages and Cause of Fire Incident

The fire broke out in a 6-story building with one basement floor, which started from a karaoke room on the basement floor.

Except the staff of the karaoke room, all victims who were killed in the fire were employees of the same company who gathered for a dinner party. A total of 12 fire trucks rushed to the scene after the fire was reported, and the fire was extinguished about 20 minutes later.

The staff of the karaoke room as the first witness of the fire stated that he smelled a pungent burning odor while walking along the hallway in front of room no. 6 and reported to the police after he found that the ceiling of the hallway leading up to room no. 7 and the emergency exit were clouded with smoke.

The investigation on the cause of the blaze found that the ceiling, walls, sofa, etc., of room no. 6 out of a total of 7 rooms of Shanghai karaoke bar were destroyed overall; damage by charring and smoke-blackening was sustained by other rooms.

The fire started when the heat emitted from the imperfect electrical contact of the ventilator in the ceiling of room no. 6 caused ignition to the plastic structure of the ventilator and wood in the surrounding area, etc. The burning ventilation cap fell onto the sofa inside the room, which made the flame spread to the ceiling, sofa, walls, etc., instantly at the same time, engulfing the room and ceiling.

The final evaluation verified that a burning ventilation cap falling onto the sofa caused the spread of blaze to the ceiling, sofa, walls, etc., at the same time, burning down the room and ceiling.



<Photo 3> Firefighters at the fire scene



<Photo 4> Burnt Area in blaze

C. Case 3

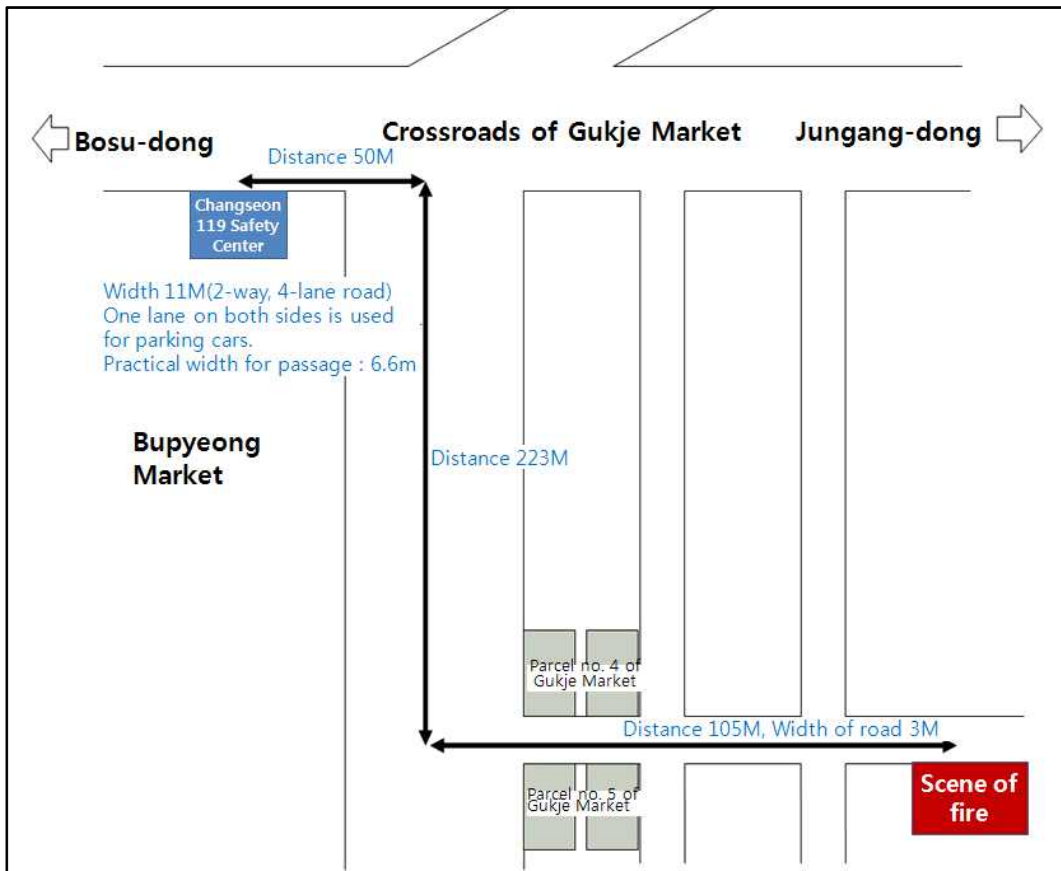
(1) General Information

- Date : Around 14:23 on November 14, 2009
- Place : Ganadara shooting range, Sinchang-dong, Jung-gu, Busan
- Cause : Explosion of gunpowder
- Casualty : 16 persons (15 dead, 1 injured)
- Property Damage : KRW 45,000,000

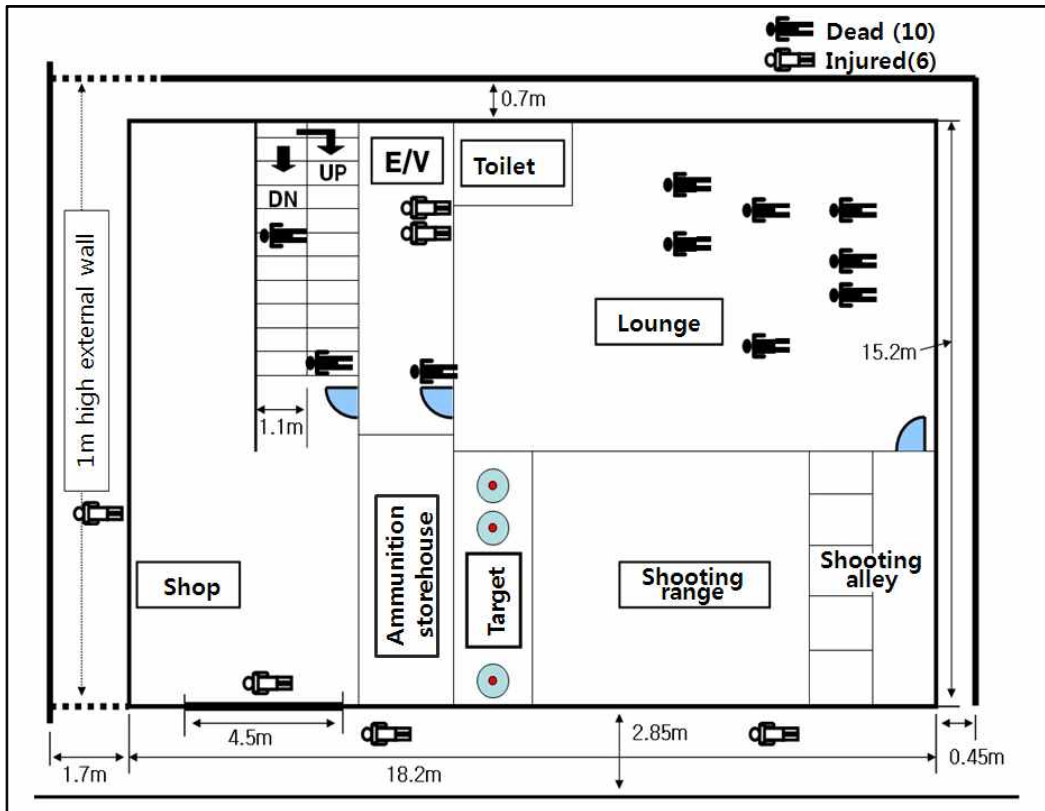
(2) Damages and Cause of Fire Incident

The fire broke out with a sudden bang and immediately swept through the indoor shooting range while a group of Japanese tourists were at the shooting alleys for firearm practice.

The shooting range fire killed a total of 15 people (10 Japanese tourists, 5 Koreans), and left 1 person injured. A close investigation on the cause of the fire, which was repeated several times, led to the conclusion that it was caused by the powerful explosion of residual gunpowder traces left from firing at the shooting range.



<Fig. 1> Map of the fire scene



<Fig. 2> Dead body location (on the day of the incident)

Images captured by surveillance cameras inside the shooting range showed that no sooner had a strong light appeared 1.5m away from shooting alley no. 1 at 2:23:46 pm (on November 14) than red flames swept through the range with intensive flash.

Three seconds after the fire broke out, Japanese tourists at shooting alley no. 4 and 5 and staff rushed out in a hurry; the sound-absorbing materials of the walls inside the range were already set ablaze, however. Four seconds later, the entire indoor shooting range was enveloped in violent flames and black smoke rising to great heights.

The National Institute for Scientific Investigation explained the cause of the fast flame propagation, saying that about 10% of the gunpowder in the bullet would be ejected from the barrel to build up within 1m in the radius when a firearm was discharged; according to them, the residual gunpowder was the very combustible material that might have caused the violent flames, pressure, and massive amount of smoke.

A garbage bag containing residual gunpowder, etc., was recovered from the place 1.5m away from shooting alley no. 1, the suspected point of origin. This garbage bag contained residual gunpowder and other combustible materials.

A lot of residual gunpowder was found to have built up inside the hole of sound-absorbing materials made from egg carton-shaped polyurethane foam; the fire was presumed to have been caused by an unknown source of ignition.

Residual gunpowder that built up inside the sound-absorbing material was said to have been set ablaze in a row, setting off the chain of fast combustion and chemical explosion with strong pressure just like when several boxes of matchsticks are set ablaze at the same time.



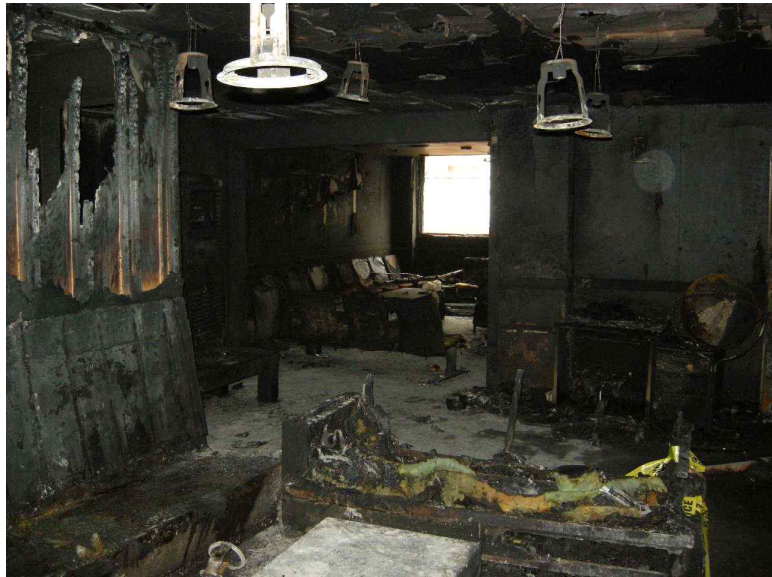
<Photo 5> fire scene



<Photo 6> Main entrance



<Photo 7> Shooting alley



<Photo 8> Lounge



<Photo 9> Ceiling inside the room

III. Characteristics of risk to Multi-purpose Assembly Occupancy and fire prevention measures

A. Characteristics of risk

Multi-purpose Assembly Occupancy are exposed to complex hazards and are always vulnerable to the risk of large-scale accidents amid the diversification of facilities and increase of visitors.

(1) Structural problems

Efficiency of space utilization is the central functional requirement of multiple available premises to attract many people. They often move into low-rent basement floors or high floors in buildings and consequently face the risk of fire and hindrances to escape such as concentrated space, rooms without windows, closed indoor areas, etc., which complicates the fire safety measures.

(2) Combustible indoor decorations

Multi-purpose Assembly Occupancy are vulnerable to fire outbreaks and are highly likely to emit toxic gases in the event of fire because they often use decorations made from combustible materials to attract many customers.

(3) Constant use of potential ignition source

Multi-purpose Assembly Occupancy are faced with many hazards of fire from lighting systems, air-conditioning electrical systems, gas facilities, inflammable articles in kitchen, and others. Fire in multiple available

premises is often caused by carelessness and arson from anonymous visitors.

(4) Lack of safety awareness among owners of multiple available premises
Many multiple available premises are small businesses; they are often illegal businesses seeking only profit. The alarming lack of awareness toward safety measures among the owners of multiple available premises - who, for example, do not pay adequate attention to the maintenance of firefighting facilities, keep the emergency exit closed, and keep obstacles blocking the evacuation route - has led to increased damage and loss of life and property in fire outbreak situations.

B. Preventive measures

The Special Act on the Safety Control of Multi-purpose Assembly Occupancy established based on the fire protection equipment codes pursuant to multiple available premises has been in force since July 2009 to protect the property of people and ensure public safety against fire incidents in Multi-purpose Assembly Occupancy, which occur every year and make for a highlighted problem.

This Special Act sets forth more stringent requirements for safety assurance, such as notification pursuant to the permit of multiple available premises, fire safety education for relevant staffs, installation of firefighting facilities, restrictions on indoor decorations, maintenance of evacuation/firefighting facilities, etc,

Nonetheless, death toll and injury from fire in Multi-purpose Assembly Occupancy continue to rise for two primary reasons. First is the lack of awareness of fire safety among owners and employees of Multi-purpose Assembly Occupancy. Second, poor Multi-purpose Assembly Occupancy focus on tackling a variety of problems related to sales at the expense of safety assurance like firefighting facility maintenance.

(1) Mandatory fire insurance to promote autonomous risk management based on the social safety system

The National Emergency Management Agency acknowledged the limits of fire prevention activities such as the government-led inspection of firefighting equipment and facilities; it has proceeded with the introduction of mandatory fire insurance for multiple available premises in a bid to expand the role of society in risk management. Such is aimed at raising the awareness of the public with regard to safety and encouraging them to assume self-responsibility for safety management. This kind of institutional change will help the fire prevention and management functions of the

government, bolstered by the risk management functions of private-sector fire insurance.

The objective of mandatory fire insurance is to establish social safety networks that provide appropriate compensation under the insurance to victims of accident and indemnify the insured poor business owners against the liability for damages including that to other people's properties and casualties besides the damage to their own properties.

The mandatory fire insurance helps promote spontaneous awareness of fire safety and ensure compensation for loss of life and property arising from fire. Therefore, it has the advantage of promoting the financial stability of multiple available premises owners.

(2) Strengthening the maintenance and inspection of evacuation and firefighting facilities

The best way to curtail fire incidents under the current laws is to provide fire safety education to relevant staffs, restrict the use of combustible interior decorations, and ensure the installation of firefighting facilities and alert systems. Note, however, that such facilities and systems often turned out to have been out of order and useless in Multi-purpose Assembly Occupancy that were burned down in fire.

In other words, facility managers should be adequately familiar with the utility of those facilities and ensure that they are always working properly; simply providing education to multiple available premises operators who do not have adequate knowledge of safety is not enough.

Fire safety will be assured only when a professional safety manager inspects the Multi-purpose Assembly Occupancy, checks whether the evacuation/firefighting facilities are working properly, and reminds business owners and employees of areas that need improvement.

As such, fire inspection by the fire department and safety inspection by safety-related organizations need to be reinforced further to ensure that all safety hazards -- which may turn into disasters -- are detected and eliminated.

This is provided under the Agreement of Cooperation between KFPA and the NFPA. Please feel free to contact Research & Investigation Team of KFPA if you have any inquiries. (E-Mail kfpa@kfpa.or.kr, Tel 82-2-3780-0200, Fax 82-2-3780-0329)

2009 KOREAN FIRE DATA

Published in December 2010

Edited by Research & Investigation Team

Published by Korean Fire Protection Association

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Registered No. 13-794 (1997.8.14)

Printed by

ISBN 978-89-88874-91-2 93530

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