EXPLORING FIRE SAFETY AWARENESS AMONG THE MALAYSIAN PUBLIC

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ABSTRACT

Are you confident that your home and family are safe from fire? Do you what to do if fire strikes your home? The answer to this question would reflect your level of awareness towards fire safety.

Fire cases in Malaysia have been increasing rapidly over the years. Majority of the cases involved residential buildings which viciously had caused property losses, severe injuries to the victims and even caused death. This scenario is significantly worrying with regard to national development, as the prime purpose of owning a house is to provide shelter and security to the residents.

Issues arose and surveys conducted over the recent years as shown in the media revealed that the main contribution towards the increase of fire cases in Malaysia is due low level of fire safety awareness among the public. Furthermore, there have been lacks of fire safety measures such as installing smoke detectors and portable fire extinguishers at most houses in Malaysia as compared to houses in Britain, Australia and New Zealand where it had significantly reduced the fire fatalities and losses.

Over the recent years, there have been campaigns, seminars and trainings on fire safety conducted by the National Fire and Rescue Department. However, these fire preventive measures somehow rather failed to up lift the level of fire safety awareness among the public since the numbers of fire cases throughout the years are still at the worrying stage. Perhaps there should be a question to be kept in our mind regarding the responsibility on promoting fire safety awareness among the public. Does it solely lies to the regulating authorities or it is the responsibility of each individual?

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Chapter 1 – INTRODUCTION

1.0 INTRODUCTION

Do you ever think about your safety in case of fire? Are you confident that your home and family are safe from fire? If yes, do you take all the necessary precautions to minimize the risks? However, if the answer is no, you are definitely risking your life which includes your family, from the severity of fire.

Over the years, fire cases in Malaysia have been increasing rapidly. The increased numbers are due to lack of awareness on fire safety among Malaysian public, as quoted by the current Minister of Housing and Local Government, Datuk Seri Ong Ka Ting in October 2004 (The Star, October 2004) (6). From a survey conducted in Kuala Lumpur and Selangor in 2005, only 60.58% from 3,061 respondents were aware of fire safety while the balance are not sure or surprisingly do not know at all about fire safety (Sukri, N.A, 2005) (19). According to *Bernama* (7), an average of 2,200 fire cases a year happened in Malaysia during that particular period of time. Within the same period of time, it was also stated that 90% of fire cases happened due to negligence and lack of awareness on fire safety from the public. The fire cases involved premises such as houses, offices, shops, workshops, stores, schools and factories. Awareness in this context is being defined as having knowledge of fire safety (www.answers.com) (24).

The statistics of the national's fire cases produced by the National Fire and Rescue Department for a time frame of ten years from the year 1995 to 2004 showed that residential buildings, particularly on terraced houses, ranked the highest of all fire cases in the respective years. More sadly, these cases involved severe injuries to the victims or even caused death. In 2001, there were 62 deaths caused by fire incidents, followed with 46 in 2002, 100 in 2003 and 65 in 2004 as shown in Table 1 and 2 (Berita Harian, March 2003 (12) & National Fire and Rescue Department).

NEGERI	JUMLAH PANGGILAN	PANGGILAN KEBAKARAN	PANGGILAN MENYELAMAT	PANGGILAN KHIDMAT KHAS	MATI	CEDERA	TAKSIRAN KERUGIAN (RM)	TAKSIRAN DISELAMATKAN (RM)	PANGGILAN PALSU
PLS	472	286	44	140	0	0	4381517	2099871797	6
KED	1928	1280	169	479	2	1	35013855.79	450768830.6	30
PP	3485	1517	570	1398	2	3	56097376.4	4448910141	46
PRK	4267	2272	517	1478	6	28	32188700	132391300	57
S'GOR	9173	4491	794	3888	5	7	136014226	1062812712	149
WPKL	2010	1268	491	251	5	6	35519232	254466190.7	60
N.S	2931	1452	323	1156	4	0	18257521.4	251876620.9	38
MEL	1896	1168	282	446	0	4	12565325.4	413385298.5	51
JOH	4974	2788	705	1481	17	24	167423364.8	648037838.4	177
PHG	2490	1458	333	699	1	3	15979746.36	1442985611	26
TRG	1957	1181	174	602	1	0	8157265	27287531	32
KEL	1354	827	168	359	5	8	17011619	66083830	9
SAB	2288	1696	197	395	15	5	49980395.63	105316962.5	24
SWK	1325	843	195	287	2	18	24256159	76284389	25
LAB	481	250	21	210	0	0	1845760	5653865	5
JUMLAH	41031	22779	4983	13269	65	107	614,692,063.78	11,486,132,916.71	735

Table 1: Fire Loss Statistic 2003, shows total of death caused by fire
(source-National Fire and Rescue Department)

NEGERI	JUMLAH PANGGILAN	PANGGILAN KEBAKARAN	PANGGILAN MENYELAMAT	PANGGILAN KHIDMAT KHAS	MATI	CEDERA	TAKSIRAN KERUGIAN (RM)	TAKSIRAN DISELAMATKAN (RM)	PANGGILAN PALSU
PLS	472	288	44	140	0	0	4381517	2099871797	6
KED	1928	1280	169	479	2	1	35013855.79	450768830.6	30
PP	3485	1517	570	1398	2	3	56097376.4	4448910141	46
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SAB	2288	1696	197	395	15	5	49980395.63	105316962.5	24
SWK	1325	843	195	287	2	18	24256159	76284389	25
LAB	481	250	21	210	0	0	1845760	5653865	5
JUMLAH	41031	22779	4983	13269	65	107	614,692,063.78	11,486,132,916.71	735

Table 2: Fire Loss Statistic 2004, shows total of death caused by fire
(source-National Fire and Rescue Department)

Most houses in Malaysia do not have fire safety system or equipments such as portable fire extinguisher, smoke detectors or heat detectors installed. This factor would harm the resident if there is a fire outbreak at home and at the same time will increase the number of fire cases in the country which caused tremendous loss in properties and lives (Sukri, N.A, 2005) (19).

Another factor that contributes to the rise of fire cases especially in residential building is the low attitude of the majority of the public in taking the initiative to search for knowledge on preventing fire, as been stated by Datuk Jaafar Sidek Tambi, the Director General of Malaysia Fire and Rescue Department during a one day seminar on 'Safety Management and Fire Prevention in Buildings' which was conducted in Ipoh on May 2004 (Utusan Malaysia, May 2004) (11). Due to this dire attitude, fire may spread to adjacent property and may cause loss to other people's property as well. In any case of fire in residential building, children and the elderly are the group of people to be at the high rank of the fire risk (Butcher, E.G, 1983) (3).

Apart from these factors, there is another factor that has viciously contributed to fire cases that claimed many lives in recent years, which is, the installation of grille at houses (Bernama, July 1998) (7). Many of us think that having grille installed at home is for security reason and some of us may use for its aesthetical value. However, how many of us ever think of the danger behind these bars?

There were cases where victims of fire were trapped inside the house just because they could not unlock the grille. The grille was either fixed or the keys were out of reach for the victims (Bernama, July 1998) (7). In a more tragic case which took place in Kelana Jaya in April 2001 that involved the death of three siblings, the victims were left helpless behind the grille and were suffocated till death although being noticed by the neighbors (Utusan Malaysia, April 2001) (2).

There is no law in the country that forbids the installation of grille at home due to the potential harm it can cause during fire. The Malaysia Fire and Rescue Department has officially produced the guidelines for grille installation for residential building on the 1st of August 2004.

Recently, in November 2005, the National Fire and Rescue Department has launched a fire safety campaign with the slogan of *"Keselamatan Keluarga Kesejahteraan Negara"* in order to increase awareness on fire safety among the public. However, how many of us have genuinely complied and followed the contents of the conducted campaign.

Is the responsibility on fire safety lies on the regulating authorities only? Or perhaps, there is the possibility that the campaign messages do not reach the target audiences effectively?

1.1 ISSUE

The issue to be highlighted in this study is the high number of fire cases throughout the years in ten years time ranging from 1994 to 2003 as stipulated in Table 3, the fire case statistics produced by the National Fire and Rescue Department. As mentioned earlier, from the statistic, residential buildings topped the table every year compared to other buildings which consists of shops, factories, stores, workshops, shopping complexes, offices, restaurants, schools and institutional buildings, and hospitals.

The percentages of cases for the ten year time frame involving residential buildings ranged from 25% lowest to the highest of 51%, and with the average of 42.1%, as the number of cases for the last five years had increased to an average of 49%, as can be seen in Table 4 (National Fire and Rescue Department).

JENIS BANGUNAN	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
KEDAI	261	284	318	321	329	282	297	252	326	378
KILANG	245	238	329	380	240	264	243	217	261	232
SETOR	145	145	236	152	100	155	148	131	158	158
BENGKEL	47	43	60	41	94	49	59	52	54	62
TEMPAT PERHIMPUNAN	18	14	7	10	83	11	17	21	8	12
PUSAT MEMBELI BELAH	7	14	18	16	53	12	6	8	9	2
PEJABAT	73	82	89	94	89	74	78	69	74	91
RESTORAN	6	16	23	24	53	48	15	27	15	18
RUMAH KEDIAMAN	**1039**	**1030**	**535**	**714**	**1148**	**1242**	**1388**	**1207**	**1445**	**1478**
SETINGGAN	125	135	132	137	197	102	111	77	83	90
SEKOLAH/INSTTITUSI	55	38	44	34	135	66	78	61	52	62
HOSPITAL	6	56	33	9	35	3	4	3	3	6
GUDANG	8	6	8	6	64	2	5	4	1	10
TEMPAT HIBURAN	16	23	54	46	53	16	18	15	8	13
LAIN-LAIN	440	362	300	384	338	299	270	345	390	449
JUMLAH	2491	2486	2186	2368	3011	2625	2737	2489	2887	3061

Table 3: Fire Cases Statistic in Malaysia from 1994 to 2003, shows residential buildings contributed most of the fire cases.
(source-National Fire and Rescue Department)

Tahun	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	Purata %
Rumah Kediaman (bil. kes)	1039	1030	535	714	1148	1242	1388	1207	1445	1478	
Jumlah kes kebakaran	2491	2486	2186	2368	3011	2625	2737	2489	2887	3061	
%	41.7	41.4	25	30.2	38.1	47	51	48.5	50	48.3	42.1

Table 4: Percentage average of fire cases from 1994 to 2003
(source-National Fire and Rescue Department)

From the statistics available, it can be assumed that the high number of fire cases involving residential buildings is due to the lack of awareness on fire safety among the public (Utusan Malaysia, May 2004). This has been confirmed by Datuk Jaafar Sidek Tambi, the Director General of Malaysia Fire and Rescue Department that the increased number of cases in the recent years showed that awareness on fire hazard among the public are still low (Utusan Malaysia, May 2004) (11).

On top of that, he also added that apart from the lack of awareness, other causes that contributed to fire cases in residential buildings are negligence among households (especially in the kitchen), short circuits and installation of grille without complying to the guidelines stipulated by the Fire and Rescue Department (Utusan Malaysia, May 2004) (11). On the other hand, the statistics shown in Table 5 and 6 also indicate that among the states in Malaysia, Selangor had the highest number of fire cases, and incidentally, most cases involved residential buildings (National Fire and Rescue Department).

	NEGERI															
JENIS BANGUNAN	PLS	KED	PP	PRK	SEL	KL	NS	MEL	JOH	PHG	TRG	KEL	SBH	SWK	LAB	JUM
KEDAI	3	12	36	25	67	40	19	18	57	14	19	11	29	27	1	378
KILANG	3	18	14	15	45	5	7	6	70	8	6	3	16	9	0	232
SETOR	2	11	8	14	31	16	10	10	17	5	5	5	9	10	2	156
WORKSHOP	0	4	1	4	16	10	0	2	9	2	1	3	3	7	0	62
HOTEL	0	1	1	0	1	4	1	0	0	3	0	0	1	0	0	12
PUSAT BELIAN	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	2
PEJABAT	1	3	7	6	11	16	2	4	11	4	3	5	7	6	1	91
TEMPAT HIBURAN	0	0	1	1	0	2	0	0	2	1	2	0	0	3	1	13
RESTORAN	0	2	1	2	3	3	0	1	1	0	2	1	0	1	1	18
RUMAH KEDIAMAN	11	91	115	151	245	80	57	41	159	55	56	53	176	113	5	1478
SEMINGGAN	0	3	3	3	13	34	1	3	11	2	3	0	3	15	3	90
GILIK DAPUR	2	2	7	12	8	28	1	5	25	10	0	2	1	12	0	121
MAKMAL	0	0	1	0	1	0	0	0	0	1	0	1	0	0	0	4
SEKOLAH	1	1	4	6	5	4	1	0	6	4	2	1	2	2	0	42
ASRAMA	0	2	2	0	5	1	1	2	2	2	0	0	0	5	0	20
HOSPITAL/KLINIK	0	0	0	0	0	0	0	0	3	1	1	0	0	0	1	6
GUDANG	0	0	3	1	2	0	1	0	1	0	0	0	2	0	0	10
LAIN-LAIN	4	11	38	17	65	19	11	13	32	23	19	48	7	27	2	324
JUMLAH	27	161	242	250	524	260	112	102	406	166	124	177	261	233	14	3059

Table 5: Fire Cases Statistic in Malaysia, according to states and types of buildings in 2003 (source-Selangor Fire and Rescue Department)

	NEGERI															
JENIS BANGUNAN	PLS	KED	PP	PRK	SEL	KL	NS	MEL	JOH	PNG	TRG	KEL	SBH	SWK	LAB	JUM
KEDAI	4	15	31	36	56	39	14	18	57	20	7	13	16	20	1	347
KILANG	0	7	14	21	80	12	10	15	57	13	1	0	14	7	1	252
SETOR	2	5	17	24	34	22	8	2	30	15	5	11	15	8	1	205
WOKSYOP	2	1	5	6	13	3	1	2	4	7	2	1	2	1	0	50
HOTEL	0	0	2	0	0	1	1	2	1	1	0	0	1	1	0	10
PUSAT BELAJI	0	1	0	0	5	5	0	1	0	1	0	1	1	0	0	15
PEJABAT	2	2	13	4	21	15	3	1	5	5	4	3	5	2	0	85
TEMPAT HIBURAN	0	0	2	1	2	1	0	1	2	1	1	1	3	0	0	15
RESTORAN	0	2	3	1	4	5	1	2	5	0	0	0	1	1	0	25
RUMAH KEDIAMAN	11	89	95	148	228	83	52	62	158	97	70	105	199	98	10	1497
SETINGGAN	2	0	3	5	21	35	2	0	13	2	0	3	13	3	0	109
BILIK DAPUR	3	3	11	8	17	14	3	7	39	1	5	4	5	6	1	127
MAKMAL	0	1	0	2	1	1	3	0	1	2	0	0	0	0	1	12
SEKOLAH	1	2	2	1	9	4	4	5	4	4	1	2	5	2	0	46
ASRAMA	0	1	2	3	3	2	1	4	2	2	1	1	6	4	0	32
HOSPITAL/KLINIK	0	0	0	0	0	0	1	0	0	0	0	0	0	2	1	4
GUDANG	0	0	0	0	3	0	0	0	1	0	0	0	2	1	0	7
LAIN-LAIN	8	7	42	20	53	18	14	12	31	18	20	31	19	11	1	315
JUMLAH	35	136	243	280	560	261	116	134	415	189	121	180	307	160	17	3154

Table 6: Fire Cases Statistic in Malaysia, according to states and types of buildings in 2004 (source-Selangor Fire and Rescue Department)

A house is a place for shelter and definitely not a place where a person were to be taken off his life tragically. With the high number of deaths due to fire cases which had occurred in residential buildings, perhaps it is high time for Malaysian to be aware not only on burglary but also on fire safety. The numbers of deaths due to fire cases can be reduced if the level of awareness and knowledge on fire safety among the public in terms of the technical aspects and the action plans in an emergency are at an optimum level. The public should also be aware that the obligation of fighting fire is not merely to be laid on the shoulders of the firemen alone, but it should also be shouldered by each and every individual (Utusan Malaysia, May 04) (11).

There have been several awareness campaigns such as seminars, talks, and trainings organized throughout the years. Despite that, the standard level of awareness among the public is still disappointing (Subang Jaya Fire Station). In other words, the campaigns had not fully raised the awareness of the public to a higher level.

For years, many individuals are not familiar with fire extinguisher equipments. They are not serious about fire safety (The Sun, June 2004) (22). For instance, many of the portable fire extinguishers installed in buildings are not being utilized in fire cases due to the perception of the public that the use of these equipments is only meant for firemen. Many of them do not even know how to use it (Utusan Malaysia, May 2004) (11).

Nevertheless, in order to reduce the fire cases correlated to residential buildings, the government had looked into the possibility of requiring homeowners to install smoke detectors and keep portable fire extinguisher in their house as a fire safety measures. According to the President of Institution of Fire Engineers International, William Peterson, who is also the chief fire officer of Plano Fire Department of Texas, smoke detectors were required in every

bedroom and every room between the bedroom and the exit from the dwelling on American homes. On top of that, they are also moving towards requiring fire sprinklers in residential of multi-family occupancy where many families live under one roof. The implementation of the smoke detectors installation in homes, had led to a 50% reduction in the number of fire fatalities and losses for the last 20 years (The Star, October 2004) (6).

Malaysia Fire Protection Association president Steven Ooi added that smoke detector installation was also compulsory in Australia, New Zealand and Britain (The Star, October 2004) (6). Since the implementation of the installation of fire safety equipments at homes had shown positive results in those mentioned countries, it is wise for Malaysia to imitate the action taken.

1.2 OBJECTIVES OF STUDY

1. To measure the level of awareness among the Malaysian public on fire safety within landed residential building.
2. To draw proposals on educating the Malaysian public on the importance of fire safety in order to raise the level of awareness.

1.3 HYPOTHESIS OF STUDY

The level of awareness of the Malaysian public is below the standard of those in the developed countries. And yet, the fire safety campaigns conducted through the years were not sufficient and adequately effective in obtaining the high level fire safety awareness. However, the attitude of the public also contributes to the low level of fire safety awareness.

The levels of awareness amongst the public varied. It is dependent on the individual's background, which comprises among others, the educational level, nature of work, the living environment, gender and age.

People with high level of education may have more awareness compared to those of low educational background. In terms of nature of work, professionals and those who work in technical areas tend to have better level of awareness compared to general workers and housewives. As for gender, women may have lower level of awareness relatively to men and finally for age, individuals who are over 50 years of age may have better understanding on fire safety awareness compared to other range of age. These predictions can be confirmed in the analysis chapter later on.

1.4 SIGNIFICANCE OF STUDY

Since the fire cases have set off losses in property and claimed many lives from one year to another (Berita Harian, March 2003) (12), this study may assist in reducing those losses by identifying the level of fire safety awareness the among public. Apart from that, this study will outline appropriate proposals or approaches on how to educate the public on fire safety that could increase the level of awareness.

This study will also inculcate *sense of protective* among the public. Protective in this phrase can be described as the protection of the property and life. By understanding this phrase, it might raise the level of awareness. As for research purposes, this study will be a useful reference for obtaining information relating to fire safety awareness in the near future.

1.5 SCOPE OF STUDY

The study will concentrate on measuring the level of fire safety awareness among the public and the safety measures that the public undertake. As for the case study, it will cover solely on landed residential buildings of not more than two-storey height in Shah Alam at Section 2 and Section 17 where there will be three different types of housing ranging from low-cost housing, medium-cost housing and high-cost housing in order to proof the hypothesis of the study. Medium-cost housing includes low and high medium as well. The study was not conducted at other places other than the mentioned areas.

1.6 LIMITATION OF STUDY

The study will only focus on exploring the level of awareness in terms of fire safety among the Malaysian public. In terms of case study, it will only concentrate on fire cases in Shah Alam which recorded as one of the highest number of cases in Selangor involving residential buildings not exceeding two-storey of height. Records also showed that the majority of cases involved houses not exceeding two-storey (Selangor Fire and Rescue Department).

The types of houses surveyed are low-cost housing located at section 17, medium cost housing and high-cost housing in section 2. The survey on the installation of fire extinguishers other than smoke and heat detectors and portable fire extinguisher will not be covered in this study as these are the fire safety agent that has been discussed in fire safety at homes.

1.7 METHODOLOGY

This study is regarded as quantitative study whereby it typically use quantitative data derived from surveys, and case studies, for gathering the information to inform the conclusions and recommendations of the study. The research findings of this study can be quantified (www.caret.co.uk) (27).

There are 3 main phases involved throughout the process of this study which consists of the followings:

1. information gathering
2. fieldwork
3. data processing

1.7.1 INFORMATION GATHERING

This is the theoretical part of the study which consists of works associated with literature search for this study. The data and information has been obtained from relevant sources such as reference books, journals, articles, and internet. Some of the information has to be collected straight from the resource centre such as the National Fire and Rescue Department, Selangor Fire and Rescue Department, Subang Jaya Fire Station and Majlis Bandaraya Shah Alam.

1.7.2 FIELDWORK

The fieldwork is where the survey of this study is conducted. Basically, it took approximately 3 days to get complete feedbacks from the respondents. Even though the fieldwork was carried out over the weekend, most of the respondents are only available at 9am to 11 am and 5pm to 7pm. In other words, it is not easy to get full cooperation from the respondents.

The first thing to be determined for the fieldwork is the case study. As discussed earlier, Selangor has the highest number of fire cases in the country which involved residential buildings. According to Selangor Fire and Rescue Department, Shah Alam recorded the highest case among the districts in Selangor. In addition, Shah Alam also has the highest population of residents in Selangor (Majlis Bandaray Shah Alam-MBSA) which consists of various levels of income groups of people which would give numerous feedbacks regarding to this study. Hence, Shah Alam has been chosen as the location for the case study.

There will be three different types of housing ranging from low-cost housing, medium-cost housing and high-cost housing located in Section 17 and Section 2 respectively which were the subject of study. Significantly, these three types of housings are related to the hypothesis of the study which stated that the levels of fire safety awareness among individuals vary and is determined by the individual's background.

Questionnaires related to the study are distributed to each and every house. In this study, one respondent per household is sufficient to answer the questionnaires. The distributions of the questionnaires were personally administered. The main advantage of this method is that the researcher can collect all the responses within a short period of time. Any doubt that the respondents might have on any of the questions in the questionnaires could be clarified clearly (Sekaran, U, 2003) (16).

The design of the questionnaires needs to be parallel with the objectives of the study. The questionnaires need to have indicators related to the study in order to facilitate processing of findings after all questionnaires are collected. For this particular study, the indicators involved are demographic, awareness, attitude, risk and opinion. On the other hand, the questionnaires were based on previous questionnaires conducted on a similar scope of study.

The number of samples was determined according to the combined population of the three designated types of housings. The population was obtained from Majlis Bandaraya Shah Alam. Samples for each type of housing were established according the *Table for Determining Sample Size* by Krejcie and Morgan. By using this table determining sample, it has 95% certainty of confidence level (Krejcie, V & Morgan, W, 1970) (8).

1.7.3 DATA PROCESSING

This is the final phase of the study whereby all the responded questionnaires are processed in order to get the results in meeting the objectives of the study. All the data and findings will be processed by using cross tabulation method of analysis. Cross tabulation will display one-way, two-way, or multi-way tables containing counts, and percents. As for this study, the data will be categorized into several categories as the questionnaires. The result of the findings will be tabulated in graphs and tables. Once the level of fire safety awareness has been measured, appropriate recommendation to increase the level of fire safety awareness in order to reduce the fire cases can be illustrated.

1.8 CHAPTER ARRANGEMENT

This study is being divided into 6 chapters. The chapters are as follows:

Chapter 1 - INTRODUCTION

This chapter consists of introduction to study. The issue of this study is being highlighted in order to support the significance of the study. Apart from the issue, this chapter also introduces the objectives of study, significance of study, hypothesis of study, scope of study, limitation of study, and the methodology of study that shows the stages involved throughout the process of the study. Recommendations for educating and increasing the level of awareness of the public on fire safety are referred primarily on the objectives of study.

Chapter 2 – Literature Review

INTRODUCTION AND SCIENCE OF FIRE

All literature searches regarding fire studies (within the scope of this study) are compiled into two parts consists of chapter 2 and 3. Chapter 2 is a compilation literature search on the historical background of fire and the science of fire. Fire science refers to the chemistry characteristics of fire. The information was taken from various sources of references such as reference books, journals, articles, and internet.

Chapter 3 – Literature Review

HUMAN FACTORS AND FIRE PRECAUTIONS

Chapter 3 is the second part of the compiled literature search. The focus is on the study of human factors towards fire and fire precaution measures. Apart from reference books, journals, articles, and internet, some of the information for this literature search has to be collected straight from the resource centre such as the National Fire and Rescue Department, and Subang Jaya Fire Station Fire. These data collection (chapter 2 and 3) was carried out in the first phase of the methodology.

Chapter 4 – CASE STUDY

Areas of housing surveyed are in Shah Alam which comprises three different types of housing ranging from low-cost hosing, medium cost housing, and high-cost housing located in section 17 and section 2. This chapter will give an insight on the background of Shah Alam and the justification of low-cost, medium-cost and high-cost housings according to the inputs given by Majlis Bandaraya Shah Alam. The respondents were given questionnaires during the fieldwork for the case study and the responded questionnaires are processed in chapter 5.

Chapter 5 – FINDINGS AND ANALYSIS

All findings of this study will be represented in this chapter. The findings are being analyzed based on feedbacks from the respondents through the questionnaires handed out.

Chapter 6 –CONCLUSION AND RECOMMENDATIONS

The conclusion is achieved according based on the analysis of the finding. The conclusion will be related to the hypothesis of the study. Hence, it can be revealed whether the hypothesis is achieved or otherwise. Furthermore, based on the conclusion, suitable recommendations can be drawn in order to meet the objectives of the study.

chapter Two
introduction & science of fire

2

LEARN ABOUT FIRE SAFETY

Chapter 2 – INTRODUCTION AND SCIENCE OF FIRE

2.0 THE CHRONICLES OF FIRE

Fire, the phenomenon of combustion as seen in light, flame, and heat; is one of the basic tools of human culture. The word combustion can be defined as a rapid chemical reaction of two or more substances with a characteristic liberation of heat and light; it is commonly called burning. Fire has been used numerously since millions of years ago up until now.

During the ancient Greeks and later, fire was considered one of the four basic elements, a substance from which all things were composed. Its great importance to humans, the mystery of its powers, and its seeming capriciousness has made fire divine or sacred to many people.

The belief that fire is sacred is widespread in mythology, and such beliefs have survived in some highly developed cultures. The connection between the Greek colony and the metropolis was that fire kindled in the colony from a brand brought from the mother city's fire.

Controlling fire for the purposes of providing heat and light was one of humankind's first great achievements. The ability of fire to generate heat and light made possible migration to colder climates and enabled people to cook food which is regarded as a decisive step in the perennial fight against disease.

Smoke signals were the early uses of fire for communication, and fire soon enabled advancements in metallurgy such as smelting and forging. Archaeology indicates that ancestors of modern humans such as *Homo erectus* seem to have been using controlled fire as early as some 790,000 years ago. According to The American Heritage Dictionary, *Homo erectus* is defined as an extinct species of humans, regarded as an ancestor of *Homo sapiens* (Wikepedia Encyclopedia) (36).

Today, the applications of fire are numerous. In its broadest sense, fire is used by nearly every human being on earth in a controlled setting every day. Owners of internal combustion vehicles use fire every time they drive. Thermal power stations provide electricity for a large percentage of humanity. However, fire is also used more directly; many nomadic peoples still use fire for cooking. It is also used for smoking, and as a weapon. In fact, the use of fire by militaries has a long history up to the present day.

Fire has supplied much of the energy which has helped humans since ancient times, from the wood fires which served many prehistoric purposes to the oil, gas and coal power stations of today which supply the vast majority of the world's electricity which estimated nearly 80%. Mexico is typical with thermal energy providing 76% of all energy. The burning of wood is often the first association to the word fire. It is common in a developing country for wood to be the primary energy source as well. (Wikepedia Encyclopedia) (36).

2.1 THE BIGGEST FIRE IN HISTORY

The world history is rife with stories and lore that blame great fires for the destruction of vast areas or entire cities. From the great fire that sacked Rome in 64 B.C. to the fires that raged through the Australian landscape in 2002, fire remains one of man's most difficult battles. Here are some of the most famous fires that occurred in the last few centuries:

i. The Great Fire of London

The Great Chicago Fire, London's historical fire is probably the second most-famous. This fire began in a baker's shop on September 2, 1666 and lasted for several days. Surprisingly, the Great London Fire has no reported death toll. It destroyed more than 13,000 structures.

London was also a city largely built of wood, another kindling waiting to burn. When the city was rebuilt, builders used brick and stone to prevent a disaster of such proportions from ever happening again

(www.angliacampus.com) (23).

Picture 1: The Great Fire of London

ii. The Great Chicago Fire

The Great Chicago fire is probably the most famous fire that occurred within the past hundred years or so. This fire occurred on the evening of October 8, 1871. The summer of 1871 was unusually dry in Chicago. With all its wooden buildings, Chicago was kindling waiting to burn. Incidentally, the city of Chicago had finished building all of the downtown's sidewalks out of wood right before the fire.

This fire killed 300 people and destroyed more than 17,000 structures - over 2000 acres in 27 hours. The origin of the fire is uncertain, though popular legend attributes its origin to a woman named Mrs. O'Leary. Mrs. O'Leary was milking her cow at the start of the fire.

Legend has it that a farm animal kicked over her lamp, setting the barn on fire and starting the spread of one of the biggest fires in history. The fire destroyed the entire downtown core of Chicago and most of its North side.

The history of National Fire Prevention Week has it roots in the Great Chicago Fire. On the fire's 40th anniversary, the Fire Marshals Association of North America decided to commemorate it with something that would keep the public aware of the dangers of fire and the importance of fire prevention (www.fire-extinguisher101.com) (30).

Picture 2: The Great Chicago Fire

iii. San Francisco Earthquake Fire

San Francisco's great fire occurred as a result of a tremendous earthquake that took place in the morning of April 18, 1906. Fires began from stoves and lamps that were overturned from the earthquake. The earthquake destroyed the city's water mains, making it nearly impossible for firefighters to fight the blaze. As a result, the fire lasted for three days until firefighters decided to dynamite entire blocks to prevent the spread of the fire. This disaster took its toll, killing 3,000 people and destroying close to 300,000 structures (www.fire-extinguisher101.com) (30).

Picture 3: San Francisco Earthquake Fire

2.2 DEFINITION OF FIRE

The word *fire* has various meanings. In this context of study, it can be defined as a rapid, persistent chemical change that releases heat and light and is accompanied by flame, especially the exothermic oxidation of a combustible substance. In a simpler definition, it is the visible signs of combustion (www.answers.com) (24).

Alternatively, according to Wikipedia Encyclopedia (36), fire can be defined as a form of combustion. Linguistically, the word fire refers to the combination of the brilliant glow and large amount of heat released during a rapid, self-sustaining burning of combustible fuel. Technically, fire is not a state of matter; it is an exothermic oxidation process by which heat and light energy are given out.

While combustion on the other hand, is defined as the process of burning where there is a chemical change, especially oxidation, accompanied by the production of heat and light (Reader's Digest Word Power Dictionary) (15).

2.2.1 FIRE TRIANGLE

There is no such way that a fire can initiate on its own. It needs three main support elements in order to produce combustion. Those support elements are fuel, heat and oxygen. The integrations of the three elements are illustrated in the fire triangle.

Figure 1: The Fire Triangle

The fire triangle is a simple model, from the science of firefighting, for understanding the ingredients necessary for most fires. It has largely been replaced in the industry by the fire tetrahedron, which provides a more complete model.

The *triangle* illustrates the rule that in order to ignite and burn, a fire requires three elements as mentioned earlier, which are fuel, heat, and oxygen. The fire is prevented or extinguished by removing any one of them. A fire naturally occurs when the elements are combined in the right mixture. For example, more heat needed for igniting some fuels, unless there is concentrated oxygen.

When a fire runs out of *fuel* it will stop. Fuel can be removed naturally, as where the fire has consumed all the burnable fuel, or manually, by mechanically or chemically removing the fuel from the fire. Fuel separation is an important factor in wild land fire suppression, and is the basis for most major tactics. Other fuels may also be chemically altered to prevent them from burning at ordinary temperatures, perhaps as part of a fire-prevention measure.

Without sufficient *heat*, a fire cannot begin, and it cannot continue. Heat can be removed by dousing some types of fire with water; the water turns to steam, taking the heat with it. Note that water will actually increase or spread some other types of fires. Separating burning fuels from each other can also be an effective way to reduce the heat. In forest fires, burning logs are separated and placed into safe areas where there is no other fuel. Scraping embers from a burning structure also removes the heat source. Turning off the electricity in an electrical fire removes the heat source, although other fuels may have caught fire and continue burning until the firefighter addresses them and their fire triangles too.

Oxygen may be removed from a fire by smothering it with an aqueous foam, or some inert gas for instance carbon dioxide and halon, dry chemicals, or enclosing it where the fire will quickly use up all of the available oxygen. A candle snuffer uses this principle. Oxygen for the fire may also be instantaneously consumed, if only for a moment, by more sophisticated means such as using explosives to snuff an oil well gas fire. Once the gas fire is out, it is not hot enough to start again, but workers must be extremely careful not to create sparks (Wikepedia Encyclopedia) (36).

2.2.2 FIRE TETRAHEDRON

The fire triangle is a useful teaching tool, but fails to identify the fourth essential element of fire which is the sustaining *chemical reaction*. This has led to development of the fire tetrahedron that is a triangular pyramid having four sides including the bottom part of the triangular pyramid. In most fires, it does not matter which element gets removed due to the fire fails to ignite, or it goes out. However, there are certain chemical fires where knowing only the fire triangle is not sufficient enough.

Combustion is the chemical reaction that feeds the fire more heat and allows it to continue. With most types of fires, the old fire triangle model works well enough, but when the fire involves burning metals such as lithium and magnesium, it becomes useful to consider the chemistry of combustion. Putting water on such a fire could result in the fire getting hotter or even exploding because such metals can react with water in an exothermic reaction to produce flammable hydrogen gas. Therefore, other specialized chemicals must typically be used to break the chain reaction of metallic combustion and stop the fire. The important thing to remember is by taking any of these four things away of the fire tetrahedron, you will not have a fire or the fire will be extinguished (www.fpst.okstate.edu) (31).

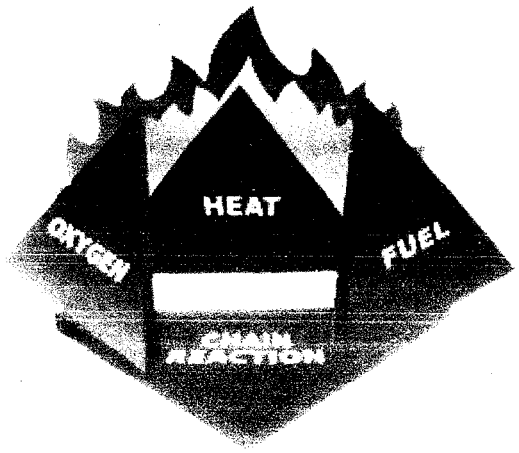

Figure 2: The Fire Tetrahedron

2.2.3 CHARACTERISTICS OF FIRE

As a visible signs of combustion, fire has several characteristics which would help us in understanding the nature of fire in depth. Basically, there are 4 main characteristics of fire we need to know (www.usfa.dhas.gov) (35). The characteristics are as follows:

i. Fire is FAST

In any case of fire, time is always limited. In less than 30 seconds a small flame can get completely out of control and turn into a major fire. It only takes minutes for thick black smoke to fill a house. In minutes, a house can be engulfed in flames. Most fires occur in the home when people are asleep. If you wake up to a fire, you won't have time to grab valuables because fire spreads too quickly and the smoke is too thick. There is only time to escape.