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Electrical Post Fire as Cause of Fire Incidents in Region VI, Philippines

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ABSTRACT

The devastating electrical fire incidents affect the economy of the country, and it is essential to answer this problem. The intention of the study is to determine the origin of the electrical fire and recommend for possible solutions. The study sought to find out the causes of electrical fire incidents in Region VI that can be used as a guide for future research and policy guidelines relevant to prevention activities. Descriptive method of research, employing frequency count and mean was used in the study. Statistical Package for Social Science was used to generate and analyze the data. The result showed that the number one cause of electrical fire incidents in Region VI was electrical post-fire. Aklan had the highest rate of electrical fire incidents caused by short circuit. Antique had the highest rate of electrical fire incidents caused by overheat while Iloilo and Negros Occidental had the highest rate of incidents caused by electrical post-fire. The structures involved in electrical fire incidents were electrical posts, residential buildings, commercial buildings, vehicles, and other structures. Furthermore, other appliances had the highest involvement followed by electric fans, ceiling fans, flat irons, and electric water heaters. The electrical post-fire and short circuit are mostly the causes of electrical fire incidents.

Keywords – Social Science, fire incidents, electricity, electrical post, electrical fire, overheat, Region VI, Philippines

INTRODUCTION

The devastating destructive electrical fire incidents are the major causes of fires that affects the economy not only in the Philippines but also in the different countries. The study of Alqassim and Daeid (2014) said that "Fire related incidents in Dubai, United Arab Emirates" were electrical failures showed the highest risk of fire incidents that hits more on residential units. In the case of United States, United Kingdom, and Japan, the percentage of residential fires in each country is more than fifty percent especially in the U.S.A. based on the study of Sekizawa (1994) of Fire Research Institute, Tokyo, Japan. The possible causes of electrical fire incidents are short circuits, overheat, electrical sparks or loose connections according to the Bureau of Fire Protection Region VI. Fire statistics regularly show electricity to be responsible for between 20 and 40 percent of all fire.

An electrical fire is a kind of fire in which a current fault is found to have been the ignition source. An electrical fire can also occur when overheated wirings, motors, appliances, plugs are in contact with, or close to combustible materials. Electrical fire is usually caused by defects in electrical systems that results to high temperature and produce ignition to create fire. Due to this danger of electrical fire and the difficulty to determine its origin or causes, there was a continuous increase of fire incidents from the year 2010 to February 2012 in the Philippines.

According to the National Statistics Center, Region VI was ranked number two in fire incidents mostly due to electrical fire. These are the reasons why the researcher was motivated to conduct this study. Nobody wants his investment in life to turn into ashes in a moment. Property damage and physical or emotional injuries due to electrical fires can be devastating. Every year, electrical fires result in deaths, injuries and hundreds of millions of property damage. Some electrical fires come from faulty products. Many more are caused by the misuse and poor maintenance of electrical equipment, incorrect installation of wiring, short-circuit, overheat, and unattended appliances, but unfortunately, the main source of these causes still needs to be clarified to know the real origin of these causes.

Given the preceding issues, the researcher studied the record of electrical fire incidents of the Bureau of Fire Protection (BFP) of Region VI covering the period 2002 to August 2012. The structures and appliances involved were included in the study. A structured interview was conducted to the fire safety inspectors and arson investigators to give more substantial results of the study. The information obtained through this study may significantly guide future research, planning, and policy activities relevant to disaster preparedness and prevention activities

of local government units, the Bureau of Fire Protection (BFP), the City and Municipal Engineers Office, and other involved agencies. It is expected that it could contribute to the resolution of electrical fire problems.

FRAMEWORK

This study links the electrical post fire as cause of fire incidents in Region VI, Philippines. Electrical system is designed and installed by humans, whose error could not simply be avoided leading to electrical fire incidents, hence this study was anchored on Ferrell's Human Factors Theory introduced by Russell Ferrell (1977), professor of human factors at the University of Arizona. This theory states that accidents are the results of a causal chain (as in multiple causation theory*),* one or more causes being human error, which is in turn caused by three situations such as overload*,* incompatibility, *and* improper activities.

However, not only human factors are given consideration but also the situation of the electrical system of the residential, commercial and industrial establishments in which the "Petersen's Accident-Incident Causal Theory" is related to Ferrell's Human Factor Theory. The later theory states that causes of accident/incident are human error and or system failure. Human error is due to overload, traps and decision to err. Human error may directly cause accident or may cause system failure which in term may cause accident resulting to injury or loss as shown in Figure below.

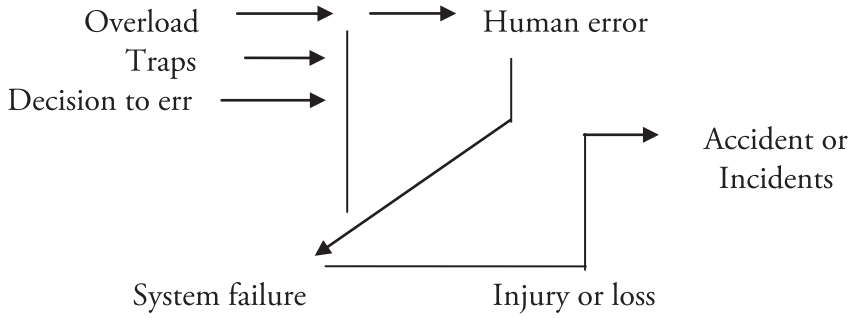

Figure 1. Petersen's Accident-Incident Causal Theory

Traps are due to defective work station, design and incompatible display or control. Decisions to err are caused by illogical decision under situation,

unconscious desire to err and perceived low probability. System failure is due to error in policy, responsibility, authority, accountability, measurement, inspection, correction, investigation, orientation, training, selection, safe operating procedure, standards hazard recognition, records, and others. This body of principles and concepts served as guide posts within which this study nests.

OBJECTIVE OF THE STUDY

The study aimed to determine the causes of electrical fire incidents in Region VI that may significantly guide future research, planning, and policy activities relevant to disaster preparedness and prevention activities. Specifically, it sought to: 1) Describe the causes of electrical fire incidents in Region VI; 2) Describe the causes of electrical fire incidents in terms of province such as Aklan, Antique, Capiz, Guimaras, Iloilo, and Negros Occidental; 3) Determine the structures and appliances involved in an electrical fire incident; 4) Compare the causes of electrical fire incidents in provinces.

METHODOLOGY

Research Design

The descriptive method was used to find out the causes of electrical fire incidents through documentary analysis using the records of electrical fire incidents of the Bureau of Fire Protection (BFP) in the custody of the fire stations of the different municipalities in Region VI as secondary data. The study was conducted in the six provinces of Region VI, namely Aklan, Antique, Capiz, Guimaras, Iloilo, and Negros Occidental. The respondents of the structured interview were the fire inspectors and arson investigators of the fire stations located in the municipalities and cities. The study utilized 82 respondents during the structured interview. The highest number of respondents was from Negros Occidental with 22 or 26.83 percent, followed by Iloilo with 20 or 24.39 percent. There was 17 or 20.73 percent from Capiz, 11 or 13.41 percent from Aklan, while the least were from Antique and Guimaras numbering seven or 8.54 percent and five or 6.10 percent respectively.

The documents needed to be were successfully gathered with the help of the fire marshal and on duty personnel of the different fire department stations. The data were then tallied, analyzed and interpreted with the use of Statistical Package for Social Sciences (SPSS). Face-to-face interview using the organized questions

schedule was conducted among the fire safety inspectors and arson investigators. The purpose of the structured interview is to support and verify the secondary data gathered. The data were analyzed with the use of the following statistical tools: frequency count, percentage, mean, and one way ANOVA. To find out the causes of electrical fire incidents regarding the province such as Aklan, Antique, Capiz, Guimaras, Iloilo, and Negros Occidental; structures and appliances involved in electrical fire incidents, frequency count, percentage, and mean were used. In describing the significant differences in the structures and appliances involved, one-way ANOVA was used.

The percentage was used in determining the ratio of the frequency of response (f) to the total number of respondents (N). It was expressed in percent with the following formula p = x 100.

The ranking was used in arranging the data in this study based on certain criteria.

RESULTS AND DISCUSSION

Causes of Electrical Fire Incidents in Region VI

Table 1 shows that the number one cause of electrical fire incidents in Region VI was electrical post-fire (59.20%), followed by a short circuit (32.20%) as number two, and in downward trend followed by overheat, loose connection, and electrical sparks in third, fourth and fifth. This result is related to the study of Lusk and Mak (1976) that the cause of fires in vertical pole members of wooden high voltage transmission line towers not attributable to surface leakage currents or lightning stroke has been identified as a result of excessive internal Joule losses generated within the pole wood. These Joule losses are a consequence of the electrical conductivity of high moisture content wood and charging currents resulting from the capacitive coupling existing between the poles and the phase wires and high electric field intensities. This was supported by the reports made by The Times of India (2008-12) that the fires occurred mainly due to short circuits. This is also related to the study of Babrauskas (2008) that the factors contributing to ignition in structure fires are short circuits.

The results of the structured interview conducted with the fire safety inspectors and arson investigators of Region VI revealed that the number one cause of electrical fire incidents are accidental in nature due to negligence or carelessness of owners or occupants of the building; overloading of electrical wire resulting to overheating; and unnoticed overheated wire resulting to short circuit.

It implies that electrical competencies have a role in ensuring fire safely. This further implies that concerned agencies need to include safety measures, and the electric cooperative must be informed.

Table 1. Causes of electrical fire incidents in Region VI

Electrical Fire Incidents regarding:	Frequency	Percent	Rank
1. Electrical Post Fire	1,596	59.20	1
2. Short Circuit	868	32.20	2
3. Overheat	170	6.30	3
4. Loose Connection	45	1.76	4
5. Electrical Sparks	17	0.63	5
Total	2,696	100.0	

Causes of Electrical Fire Incident regarding Province

The degree by which causes of electrical fire incident happened differs by province is shown in Table 2. For Aklan, a short circuit was the highest cause of its electrical fire incidents. Overheat ranked second, followed by electrical sparks and loose connection. Electrical post-fire was the least cause of electrical fire incidents in that province.

Short circuit was the most frequent cause of the electrical fire in Antique while electrical sparks and loose connection were the least. Overheat was the number two cause of electrical fire incidents in that province, followed by electrical post-fire. In Capiz, a short circuit like those in Aklan and Antique was the highest cause of electrical fire incidents followed by overheat and then electrical post-fire, loose connection, and electrical sparks as the least cause of electrical fire incidents. Short circuit was the highest cause of the electrical fire in the province of Guimaras. It was followed by electrical post-fire, overheat, loose connection and electrical sparks in descending order. This result concerning short circuit as the major cause of the fire in Aklan, Antique, Capiz, and Guimaras is supported by the study of Patel (2005) that fire incidents which are caused by a short circuit arc caused by faulty, loose or broken conductors are also linked to aged wiring. This is also supported by the study of Lucini (2009) that fire was (22%) ignited by a heater, lamp, or open flame. Eighteen percent were caused by smoking materials or equipment, 12% were due to smoking in bed, 12% were electrical faults. Findings show that the leading factors were another electrical failure, malfunction, Unspecified short-circuit arc and short-circuit arc from defective,

worn insulation.

Electrical post-fire had the highest frequency as the cause of electrical fire incidents in Iloilo. Short circuit ranked second. Overheat ranked third. Loose connection ranked fourth, and electrical sparks ranked fifth. Electrical post-fire had the highest frequency as a cause of electrical fire incidents in Negros Occidental. Short circuit ranked second. Overheat ranked third. Loose connection ranked fourth, and electrical sparks ranked fifth. The above results where electrical post-fire was the number one cause of electrical fire incidents supports the study of Lusk and Mak (1976) that the structure involved is wood pole and the cause of fires in vertical pole members of wooden high voltage transmission line towers not attributable to surface leakage currents or lightning stroke has been identified as a result of excessive internal Joule losses generated within the pole wood.

Table 2. Causes of electrical fire incident regarding province

CAUSES	AKLAN			ANTIQUE			CAPIZ			GUIMARAS			ILOILO			NEGROS OCCIDENTAL		
	F	%	R	F	%	R	F	%	R	F	%	R	F	%	R	F	%	R
Short Circuit	25	65.80	1	22	45.84	1	64	48.12	1	26	50.00	1	228	22.46	2	503	35.67	2
Overheat	8	21.05	2	16	33.33	2	33	24.81	2	3	5.77	3	45	4.44	3	65	4.61	3
Electrical Sparks	2	5.26	3.5	2	4.17	4	2	1.50	5	2	3.85	4.5	5	0.49	5	4	0.28	5
Loose Connection	2	5.26	3.5	4	8.33	3.5	5	3.77	4	2	3.85	4.5	27	2.66	4	5	59.08	4
Electrical Post Fire	1	2.63	4	4	8.33	3.5	29	21.80	3	19	36.53	2	710	69.95	1	833	0.36	1
Total	38	100		48	100		133	100		52	100		1015			1410	100	

Note: F – Frequency, % - Percent, R - Rank

Structures and Appliances involved in Electrical Fire Incidents

Table 3 shows that among the structures involved in electrical fire incidents, electrical post had the highest involvement, followed by residential building, commercial and vehicular. This result is related to the study of Lusk and Mak (1976) that the structure involved is wood pole and the cause of fires in vertical pole members of wooden high voltage transmission line towers was not attributable to surface leakage currents. Lightning stroke has been identified as a result of excessive internal Joule losses generated within the pole wood.

These results are also related to the study of Gloria Nenita Velasco, M.D. entitled, “Epidemiological Assessment of Fires in the Philippines, 2010-2012”

that the majority of fires involved residential areas followed by commercial areas and this represents a significant risk for families, most especially for those who live in slums or squatter areas. The structured interview revealed that electrical fire incidents involving structures were mostly accidental, and the reasons are the negligence of the occupants of the building and overloading of electrical wire resulted to overheating that cause short circuit. This implies the need for the concerned agency to properly implement the fire code of the Philippines to all types of buildings and considering also to include in the electrical fire safety program that the material to be used in the structures must be of standard quality as well as heat resistant.

Table 3. Structures involved in electrical fire incidents

Property/ Structure	**Aklan**	**Antique**	**Capiz**	**Guimaras**	**Iloilo**	**Negros Occidental**	**Frequency**	**Per Cent**
Electrical Post	1	4	29	19	710	833	1596	59.20
Residential Building	32	36	72	19	209	511	879	32.6
Commercial Building		1	7	1	15	23	47	1.7
Vehicular		2	7	3	19	21	52	2.0
Mercantile		1	3	3	11	6	24	0.9
Institutional Building			1			7	8	0.3
Educational Building	1	4			10	3	18	0.6
Industrial		1	1	1	4	1	8	0.3
Others	5	2	9	6	37	5	64	2.4
Total	**38**	**48**	**133**	**52**	**1015**	**1410**	**2696**	**100.0**

Note: Others are property structures not listed in the table

Table 4 shows that the appliances involved in electrical fire incidents were other appliances, electric fans, ceiling fans, flat irons and electric water heater. This result is related to the study of Sekizawa (1994) of Fire Research Institute 3-14 Nakahara, Mitaka, Tokyo 181, Japan entitled "International Comparison Analysis on Fire Risk Among the United States, The United Kingdom, and Japan" that the major causes of residential fires in the U.S.A., the U.K., and Japan. Among these countries, a considerable gap is found in the causes of "Cooking", "Heaters", and "Electric" which stands for electrical appliances and distribution system. This is also related to the report that more than 15 million appliances had been recorded in the last five years for defects that could cause in

a fire. More than 69,000 fires were reported from 2002 to 2009 associated with appliances, according to data analyzed by the National Fire Incident Reporting System (NFIRS). This is also related to the Research on Electrical Fires: State of the Art (2008) that one of the leading factors involve in structure fires are appliances. The structured interview revealed that these electrical fire incidents were mostly accidental, and the primary reasons were negligence or carelessness and misuse of electrical appliances of the occupants of the building. Other fire incidents in appliances involved were due to the cause by unattended appliances. This implies that there is a need for the concerned agency to include the safe and proper use of electrical appliances in their program.

Table 4. Appliances involved in electrical fire incidents

Appliances Involved	Frequency	Percent	Rank
Electric Fan	69	40.60	2
Ceiling Fan	23	13.50	3
Flat Iron	4	2.35	4.5
Electric Water Heater	4	2.35	4.5
Other Appliances	70	41.50	1
	170	100.0	

Note: Other appliances are appliances not listed in the table

Difference in the Causes of Electrical Fire Incidents regarding Province

Results are shown in Table 5 indicate that there was a significant difference in the causes of electrical fire incidents regarding provinces. Aklan had the highest rate of incidents in a short circuit and electrical sparks while Antique had the highest rate of incidents in overheat and loose connection, and Iloilo had the highest rate of incidents in electrical post-fire. This means that the causes of electrical fire among provinces were not the same as indicated in Table 2. This indicates that every province had different electrical troubles that led to the electrical fire.

Table 5. The difference in the causes of electrical fire incidents regarding the province

Source of Variation	Sum-of-square	df	Mean Square	F-Values	P-Values	Remarks
Between Groups	340.585	5	68.117			
Within Groups	5059.462	2690	1.881	36.216	0.000	s.
Total	5400.047	2695				

CONCLUSIONS

The electrical post-fire was mostly the cause of electrical fire incidents, followed by short circuit overheat, loose connection, and the least was electrical sparks. The causes of electrical fire incidents regarding of province are as follows: In Aklan**,** a short circuit was the highest cause of electrical fire incidents. Loose connection and electrical post were the least causes of fire incidents. In Antique**,** short circuit and overheat were the most frequent causes of electrical fire in residential buildings. In Capiz**,** a short circuit is the highest cause of electrical fire incidents and electrical sparks the least cause. In Guimaras**,** a short circuit has the highest rate as the cause of electrical fire incidents. Electrical sparks the lowest rate. In Iloilo**,** electrical post-fire has the highest frequency as the cause of electrical fire incidents. Electrical sparks are considered to be the least cause of electrical fire incidents in the province. In Negros Occidental**,** electrical post-fire has the highest frequency as a cause of electrical fire incidents. Electrical sparks have the lowest. The provinces of Negros Occidental and Iloilo have the highest occurrence of electrical fire incidents. The electrical post was the structure most involved in electrical fire incidents due to weather conditions and poor electrical works and maintenance which affect the electrical installation and materials. Residential building fires have the second highest rate caused by the negligence of the owners or occupants of the building.

The electric fan had a high rate of involvement due to overheat and negligence of the owners or occupants of the building. There was a significant difference in the causes of electrical fire incidents regarding provinces.

TRANSLATIONAL RESEARCH

The study is best appreciated if translated into printed media such as brochures, manuals, and training guide that will help the multiple stakeholders

in the dissemination and transfer of knowledge based on the findings of the study. The translated outputs can likewise be beneficial not only in the Bureau of Fire Department in the province but in national level as well. However, there is still a need to evaluate the impact of these translated media from the end-users' point of view.

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