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Analysis of Potential Fire Due to Short Current in Semi-permanent Buildings at Tinumbu Street in Aisle 148-149 Makassar City

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Abstract – **Fires can occur if several other factors are met heat sources, flammable materials and oxygen. The biggest potential cause of fires in buildings is electricity. This research aims to prove whether electrical short circuits trigger fires in residential homes or semi-permanent buildings, especially in electrical installation equipment. This type of research is quantitative using experimental methods, which are descriptive analysis to determine the effect of a particular treatment on other treatments under controlled conditions, to find out for sure the main cause of the fire. This research show that the mothers' knowledge is quite limited regarding the use of household electricity and the tools used are old enough to cause short circuits. This is also triggered by the use of electrical installations that do not meet PUIL 2000 and SNI standards. Researchers need to provide education to residents, especially housewives, about the effectiveness of using electricity at different times of the day. An explanation of the load distribution system for electrical devices is a top priority in this education. In this education, various forms of explanation and direction are provided regarding the importance of saving energy during peak hours and the importance of knowing the use of energy-saving products (LED lights). With the program to use environmentally friendly and energy efficient household electricity, mothers' understanding of the concept of environmentally friendly PLN will be more developed and more efficient in terms of welfare and family comfort from various environmental threats due to electricity disturbances.**

Keywords: Fire, short circuit, electricity, environmentally friendly

I. INTRODUCTION

Electrical energy is a primary need for humans in carrying out their daily activities. On the other hand, the nominal electricity tariff is always increasing, so it is necessary to take steps to save electricity consumption. Electricity consumption in semi-permanent houses and luxury houses will depend on several factors, including the size of the home, the number of electronic devices, lighting needs and the lifestyle of the occupants. Semi-permanent houses are one of the levels of fire vulnerability due to negligence in the use of electricity, which often occurs in densely populated settlements. Of the several factors that trigger fires, the most common ones are caused by short circuits

Fires can also occur if several other factors are met, namely a heat source, flammable materials and oxygen. The biggest potential cause of fires in buildings is electricity. Very large currents can cause cables and electrical equipment to become hot, especially if the insulation class is low, so they heat up more quickly and catch fire. When an overcurrent occurs, the function of the protective device is to stop the flow of the overcurrent, but not all MCBs work well, which can cause conductors and equipment to get hotter and eventually catch fire [1].

According to [2], the number of fire cases in the city of Makassar in 2020 decreased to 141 cases, and fell again in 2021 to 138 cases. However, the number increased slightly in 2022 with 151 cases. In the case of the large fire that occurred on Jalan Tinumbu, alley 149 in 2021, which burned around 30 semi-permanent houses, this is a frequent location. From [3], the cause of fires that occurred in other areas in Indonesia turned out to be the same case, incidents in other areas were also dominated by short circuits, incorrect electrical cable connection and the accumulation of electrical sockets must be avoided.

The problem is based on the frequent occurrence of fires due to electrical short circuits, this is the result of a lack of public understanding regarding the use, selection of correct and safe electrical equipment as well as the high number of houses that have the potential to catch fire due to electrical installations that are more than 20 years old, human error, and houses made of wood. [4]. To know for sure the main cause of a fire is often difficult to know, usually the real evidence has been burned and destroyed by fire, the damage caused to electrical installations due to fire is often shown to be arcing, between conductors due to insulation damage, thus it can be taken The conclusion is certainly wrong that the fire occurred from electricity.

Sometimes electrical fires are caused by imperfect contact, that is, sometimes it connects, sometimes it doesn't, resulting in sparks [5]. Of course, this will increase the level of risk and vulnerability to dangers that arise, if knowledge and understanding regarding the use of electricity is not known as early as possible. Meanwhile, [6] believes that the potential for other fires to occur in densely populated residential areas is caused by several factors such as the age of the installation,

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standardization, planning, installation and operation of existing electrical installation equipment/components.

Seeing the problems above, researchers are interested in raising these problems to carry out research with the title "Analysis of Potential Fires Due to Electricity in Semi-Permanent Buildings". Based on the background of the problem explained above, a problem arises, is it true that electrical installation equipment is the source of electrical short circuits or overloads that can cause fires in residential homes or semi-permanent buildings? The aim of this research is to prove whether electrical short circuits really trigger fires in residential homes or semi-permanent buildings, especially in electrical installation equipment.

II. METHODOLOGY

A. *Types of Research*

This type of research is quantitative research using experimental methods with a demonstration approach, which is descriptive analysis to find the effect of certain treatments on others under controlled conditions [7]. The use of reading techniques/note-taking techniques is a technique used to record data that has been collected from the results of reading techniques, or by recording past events, and selecting data accordingly [8].

B. *Approach Method*

Demonstration and example approach, where a demonstration shows and plans how a job or how something can be done. This method involves breaking down and demonstrating something through examples [9]. This method is very easy to understand through the planning stage of "How and why" a short circuit occurs. This approach is very effective, as it is easier to show residents how to do it, because it is combined with activity aids such as: pictures, electrical equipment, material texts, lectures and discussions.

This process is aimed at finding the cause of a fire caused by an electrical short circuit or overload. In this study, the population is the cables and electrical equipment used for residential electrical installations with a power of 450 VA. According to [10], residential electrical installations with a power of 450 VA are also called single-phase, single-group lighting electrical installations with a current protection of 2 Ampere.

Meanwhile, the samples used by adjusting the field data in this study are 2 Ampere MCB, NYZ cable, speaker cable, and antenna cable and its socket. The research variables used in this study are cable length, cable cross-sectional area, and cable insulation resistance.

III. RESULTS AND DISCUSSION

A. *Result*

Based on data obtained from residents, in this case the head of the RT/RW said that the number of housing units in alley 148 was 38 housing units, with permanent and semi-permanent housing conditions. Meanwhile, in aisle 149 there are 36 housing units. All types of buildings in this residential area include permanent, can look at solid wall and floor foundations, and semi-permanent categories look different in terms of walls or foundations made of half a wall and the other half is made of bamboo or wood [11]. So that identification about using electricity on household is a priority for application in this area.

Several samples of houses were taken in these two locations, based on the dominance of semi-permanent category units. The percentage of 80% dominates the area, so data collection is adjusted to the condition of the house, which has the potential for short circuit danger. The unit selection system was carried out in field conditions where several cables were stretching around the housing unit, which seemed not well organized, so the researcher deemed it necessary to take data as a research sample.

Figure 1. Initial Stage Research Atmosphere Aisle 148

Figure 2. Initial Stage Research Atmosphere Aisle 149

This research was carried out so that people in aisle 148-149, especially housewives, understand more about home security factors, and are aware of the importance of knowing the network installation route at home. Installing the electrical network incorrectly has many risks that can harm the house and its residents. Starting from the possibility of occupant accidents to short circuits in electrical installations, which can lead to a house fire.

Table 1. Data on Aisle 148 Household Appliance Users

No.	Tool Type	Quantity
1	Refridgerator	21
2	Washing Machine	6
3	Microwave	2
4	Magic Jar	25
5	Dispensers	20
6	Water pump	15
7	Iron	23
8	Laptop	5
9	Cellphone	30
10	Air Conditioning	15
11	Television	28
12	Fan	12
13	Light	30
14	Internet	3
15	Electric Oven	3

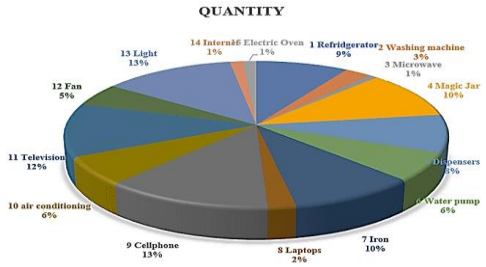

Figure 3. Graph Data on Aisle 148 Household Appliance Users

Table 2. Data on Aisle 149 Household Appliance Users

No.	Tool Type	Quantity
1	Refrigerator	16
2	Washing Machine	6
3	Microwave	0
4	Magic Jar	19
5	Dispensers	12
6	Water pump	10
7	Iron	16
8	Laptop	1
9	Cellphone	25
10	Air Conditioning	14
11	Television	25
12	Fan	12
13	Light	28
14	Internet	1
15	Electric Oven	1

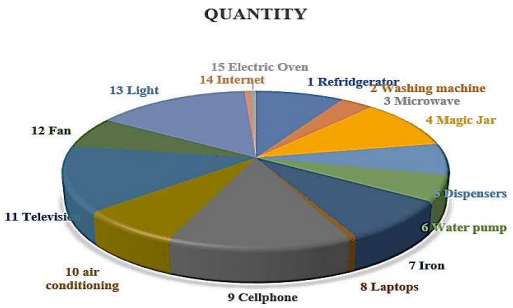

Figure 4. Graph Data on Aisle 149 Household Appliance Users

From data on electricity usage or consumption in each aisle, it looks quite varied, and is in the medium category. The standard use of electrical capacity for each housing unit is dominated by 1300 watts (45%), 900 watts (31%), 2200 watts (24%). Meanwhile, the type of activity that uses household electricity is as a housewife, with a percentage of 78%.

The behavior of housewives in using electricity at the same time, often occurs at night. This is done because some housewives are quite busy doing activities in the morning. According to interviews conducted with several mothers, they said that at night more activities use electricity, such as ironing while watching TV, cooking, using AC, charging several cellphones and sometimes while cooking.

Figure 5. The Electrical Circuits Being Used Simultaneously

Meanwhile, the electrical energy used by the tools used requires quite a high load, especially at night.

The nine pieces of equipment are turned on at the same time for ± 2 hours with a total load of 1220 Watts while the maximum capacity of the connection terminal is 1300 Watts. After 2 hours, temperature measurements were carried out on each connecting terminal of the contact point, the following data was obtained:

Table 3. Electricity Usage Load at The Same Time

No.	Load Type	Load capacity (watt)	Temperatur (°C)
1	Refrigerator	150	46
2	Magic jar	80	40
3	Dispenser	200	51
4	Magic Jar	250	45
5	Dispensers	20	46
6	Water pump	300	55
7	Iron	150	47
8	Laptop	25	42
9	Cellphone	30	44

From these data, it can be seen that the temperature of the connection terminal has increased due to the influence of excessive loading. For loads with a larger capacity, the temperature generated at the connection terminals is also higher. This is because the load requires a greater current according to its capacity, so that the point at the connection terminal for the load will experience heating. The increase in current causes heat in the conductor at the existing connection terminal point.

In a different place in aisle 148, there is a socket outlet placed on the outside of the building, which has no cover

or protection at all. In cases like this, a short circuit can occur due to water splashing from outside. This requires education to residents, to better understand a good electricity network system.

Figure 6. Sockets Outside The House Without Canopy or Protector

Therefore, researchers and their team consider it necessary to provide education to residents, especially housewives, about the effective use of electricity at different times of the day. Explanation of the load distribution system for electrical devices is the main priority in this education.

B. Discussion

The temperature of the socket will increase due to the influence of excessive loading. For loads with a larger capacity, the temperature generated by the socket will also be higher. This is because the load requires a greater current according to its capacity, so that the point at the socket for the load will experience heating. This increase in current causes heat in the conductor at the contact point. Installing a socket that doesn't fit properly can also be a factor in causing excessive heat. This is the same as in cable connections, namely that there is an air gap. This air gap will change its properties to become a conductor, which can cause electrical sparks at high temperatures. These sparks are what make the sockets and plugs melt. If this happens continuously, it can trigger a fire.

Testing steps and educational processes related to the proper use of electricity, so that people can better understand the importance of knowing about electrical devices in the household. The behavior of housewives in using electrical installation equipment in their homes has become a concern for researchers to provide education in the form of posters regarding appropriate and economical electrical network systems. The description of the poster that the researcher provided is:

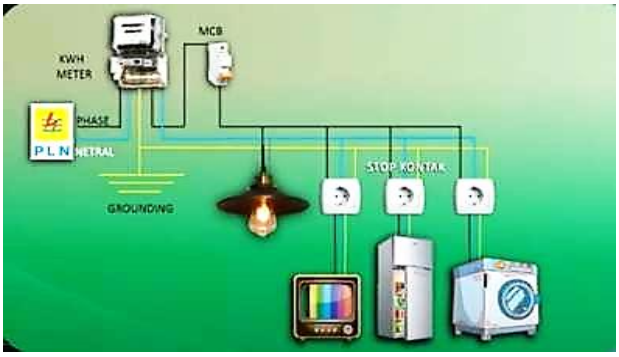

Figure 7. Educational Materials from PLN Officers and Public Relations

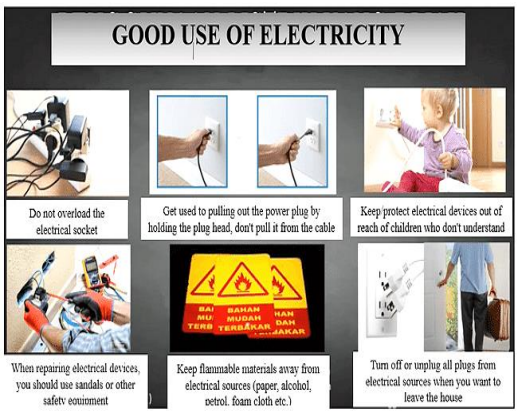

Figure 8. Poster About Using Sockets

Providing public education about the importance of using household electricity is an added value for the community in minimizing the danger of fire from an early age [12]. And also providing introduction and socialization about bad behavior in the use of electrical installations, it is better to provide an understanding of the model of the electrical installation system with integrated security, to prevent acts of misuse of electrical installations outside their intended use. With this step, it is hoped that electricity as the initial trigger of fire can be prevented [13].

Efforts to convey public understanding about handling and proper use of electricity are very important. This is to keep the electrical installation in a safe condition. Electrical installation safety can prevent short circuits and prevent fire hazards. In addition, poor handling and maintenance of electrical installations can pose a threat to human safety [14].

Utilization and use of electrical energy without knowing the electrical power consumption results in the amount of monthly electricity bills paid from PLN feeling expensive. With knowledge of the use of electrical energy in various conditions, residents can understand how electricity bills will increase and how to save [15]. Distributing flyers containing information about electrical hazards and preventive measures also helps strengthen understanding and provides references they can use at home [16].

Implementing the use of environmentally friendly household electricity is one method that can be applied by housewives for their electricity needs, to minimize the possibility of the risk of fire due to excessive use of electricity. And [17] the opportunity for savings that can be done is by replacing the type of lamp used, changing the temperature setpoint from 18ºC to 20ºC, reducing the shading coefficient by installing darker curtains, and reducing heat infiltration by reducing doors and windows that can be opened and closed.

The requirements and installation of cables, lights, sockets, switches, PHB, main lines, MCB and others are regulated in PUIL in household installations [18]. 1). Cable: As a conductor, double insulated cables (for example NYM) are used which consist of two or three solid copper cores with a minimum cross-section for each

core of 1.5 mm2. Cables are branched in branch boxes with good connections. The lamp cable should not be smaller than 0.5mm2. Electrical cables with copper conductors and PVC insulation that are permanently installed in the house must be a minimum size of 2.5 mm2, regardless of the amount of electrical power installed and must only carry a maximum of 10 A of electricity. 2). Lights: Lighting armatures, lampholders, lamps and rosettes must be made in such a way that all live parts and parts made of metal, when installing or replacing lamps, or when the lamp is installed, are properly secured from possible contact.

In hand lamps, protective cages, hanging hooks, and other parts made of metal must be isolated from the lamp holder. Lighting armatures must be isolated from live parts of lamps and lampholders. Lighting armatures must be isolated from metal hangers and supports, unless the transfer of stress to these parts is practically not dangerous.

Lighting armatures in damp, wet, very hot places, or containing corrosive materials, must be made of materials that meet the requirements for installation in that place and must be installed in such a way that water cannot enter or collect in the conductor lines, light fixtures, or other parts of electricity.

The entire exterior of lampholders installed in dusty, damp, very hot, containing flammable materials, or containing corrosive materials, must be made of porcelain or other equivalent insulating material. Regardless of the room conditions as mentioned above, the outside of lamp holders that have a voltage of more than 300 V to earth, must always be made of porcelain or other equivalent insulating material.

Lighting armatures installed near or over combustible materials must be constructed, installed or protected in such a way that parts subject to a temperature greater than 90 degrees are not in contact with the combustible material. Indoor lamps containing flammable or explosive materials or dust must be installed in dust-tight lighting armatures. Lamps for outdoor and indoor lighting with drip water must be drip-tight or installed in drip-tight lighting armatures.

Armatures must be made of metal, or other permitted materials and manufactured in such a way as to ensure mechanical strength and robustness. Pipes and entry points must be constructed in such a way that cables can be easily installed and removed without the possibility of damage to the insulating material or breaking of cable connections.

Embedded armature housing construction must not use solder. Low lamps and floor lamps may be connected with permitted rubber sheathed cables if the wiring is located free from heat from the lamp. 3). Socket: Installation height ± 150 cm above the floor, if less than 150 cm must be equipped with a cover, easy to reach by hand, installed in such a way that the neutral conductor is on the right or bottom. 4). Switch: Installation height ± 150 cm above the floor, Close to the door and easy to reach by hand/according to the conditions of the place. The direction of the contact position (lever) of the switch is uniform when more than one is installed. 5). PHB: The PHB must be arranged and installed in such a way that it looks neat and orderly, and must be placed in a fairly free space. PHB must be arranged and installed in such a way that maintenance and service is easy and safe, and important parts are easy to reach.

All components that require service during operation, such as measuring instruments, buttons and switches, must be serviced easily and safely from the front without the aid of ladders, tables or other unusual tools.

Connecting the inlet and outlet channels to the PHB must use terminals so that the connection to the components can be done easily and regularly and safely. This provision does not apply if the component is located near the outlet or inlet. The control cable terminals must be located separately from the power line terminals.

Figure 9. Example of a Terminal That Can be Assembled at Home

All bolt nuts and components that are made of metal and function as conductors must be coated with rust-preventing metal to ensure good electrical contact. The free space in low voltage PHBs must be at least 0.75 m wide, while the height must be at least 2 m. Its position is after PLN's KWH Meter

For a simple house with 450 VA power, generally a simple PHB is used, where the PHB component is only 1 fuse or it could also be an MCB (Miniature Circuit Breaker), If the house is large with a power of 2,200 VA and above, usually a complete PHB is used, where each MCB serves a different type of load.

IV. Conclusion

Based on the results of the study and discussion, it was concluded that the cause of frequent fires in this area was due to short circuits in electrical installation equipment, especially in the installation of electrical installations that did not comply with PUIL 2000 and SNI standards, simultaneous use of electricity and old electrical installations. Using quantitative methods, to identify respondents in collecting research data. During the study, the obstacle encountered by the researcher was the difficulty in convincing residents about the benefits of the study. So that the results show that the use, installation, and maintenance of electrical equipment that is not good will cause short circuits and placement of network

systems that can cause the risk of sparks around the installation of electrical outlets. So, the researcher considers it necessary to provide an overview of how to use electricity properly and correctly, especially to housewives.

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REFERENCES

[1] S. Lasuda, "Analisis Terjadinya Kebakaran Akibat Listrik pada Bangunan," p. 97, 2010.

[2] A. M. I. WR, "Kondisi Korban Kebakaran di Jl Tinumbu Makassar, Butuh Bantuan Bahan Material - Tribun-timur." 2021.

[3] Bagas, "Faktor Penyebab Kebakaran Apa Saja_ Cek Penjelasannya di Sini!"

[4] M. A. Novianta, "Penyuluhan Potensi Bahaya Listrik Di Rumah Tangga," *J. Dharma Bakti-LPPM IST AKPRIND*, vol. 1, no. 2, pp. 186–195, 2018.

[5] R. Hidayawanti, "Upaya Tertib Listrik terhadap Instalatir Kabel Di Daerah Padat Penduduk *Study kasus Kwcamatan Tambora)," *J. Kilat*, vol. 7, no. 1, pp. 24–29, 2018.

[6] I. Z and I. Kamil, "Analisis Sistem Instalasi Listrik Rumah Tinggal dan Gedung untuk Mencegah Bahaya Kebakaran," *Jurnal Ilmiah Elite Elektro*, vol. 2, no. 1. pp. 40–44, 2019.

[7] A. goleman, daniel; boyatzis, Richard; Mckee and Perdana, "Metode Penelitian Dengan Pendekatan Kuantitatif," *J. Chem. Inf. Model.*, vol. 53, no. 9, pp. 1689–1699, 2018.

[8] N. Nilamsari, "Memahami Studi Dokumen Dalam Penelitian Kualitatif," *J. Wacana*, vol. 13, no. 2, pp. 177–181, 2014.

[9] M. Riadi, "Metode Demonstrasi dalam Belajar," *KAJIAN PUSTAKA.COM*,2012. https://www.kajianpustaka.com/2012/10/metode-demonstrasi-dalam-belajar.html.

[10] G. T. Hadiyanto, D. A. Mardiono, B. Apriyanto, Nurhatisyah, and N. E. Effendy, "Instalasi Listrik Masjid Al-Ikhlas Kampung Karet-Batu Besar Kecamatan Nongsa Kota Batam," *J. Pendek. Nusant.*, vol. 1, no. 1, pp. 53–63, 2023.

[11] D. Fitriyah, Khoirotul. Widodo, "Karakteristik Sosial Budaya dan Ekonomi Nelayan Kecil Di Wilayah Pesisir Desa Puger Wetan Kecamatan Puger Kabupaten Jember Khoirotul Fitriyah & Djoko Widodo Pengembangan Model Pendidikan Pariwisata Berbasis Agrowisata Perkebunan Kopi di Kabupaten Jember," *J. Pendidik. Ekon.*, vol. XI, pp. 13–24, 2016.

[12] N. Paddiyatu, "Sosialisasi aisyiyah melalui edukasi penggunaan listrik rumah tangga," vol. 7, no. 5, pp. 1–9, 2023.

[13] K. T. Mauriraya *et al.*, "Edukasi Penggunaan Instalasi Listrik Yang Baik Untuk Menghindari Bahaya Kebakaran Akibat Listrik Di Kelurahan Gondrong Kecamatan Cipondoh Kota Tangerang," *Terang*, vol. 2, no. 2, pp. 83–89, 2020.

[14] Taryana et al, "Pemahaman Standar Pemasangan Instalasi Penerangan Rumah Tinggal," *J. Pengabdi. Mandiri*, vol. 2, no. 1, pp. 1–14, 2023.

[15] E. Yuniarti, M. Setiawati, and D. A. Majid, "Instalasi Listrik Yang Benar Dan Aman Dalam Upaya Mencegah Bahaya Kebakaran Akibat Konsleting Listrik Di Daerah Padat Penduduk Right And Secure Electrical Installation In Effort To Prevent Fire Hazards Due To Electrical Consleting In The Solid Population," *Pros. Semin. Nas. Penerapan IPTEKS*, vol. 4, pp. 146–154, 2018.

[16] S. S. Dewi *et al.*, "Edukasi keselamatan penggunaan listrik bagi kalangan ibu rumah tangga di Kelurahan Tombolo," *Volkatek*, vol. 02, no. 02, pp. 110–117, 2024.

[17] R. D. Yani, "Analisis Konsumsi Energi Listrik Pada Sistem Pendingin Ruangan (Air Conditioning) Di Gedung Direktorat Politeknik Negeri Pontianak," *Elkha*, vol. 9, no. 1, p. 13, 2017.

[18] PUIL, "PerPUIL. (2000). Persyaratan Umum Instalasi Listrik 2000 (PUIL 2000). Standar Nasional Indonesia DirJen Ketenagalistrikan, 2000(Puil), 562.syaratan Umum Instalasi Listrik 2000 (PUIL 2000)," *Standar Nas. Indones. DirJen Ketenagalistrikan*, vol. 2000, no. Puil, p. 562, 2000.