Electrical Wiring Systems and Fire Risk in Residential Dwellings

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Foreword

The Energy Safety Service (ESS) is responsible for ensuring safe production, supply, installation and use of electricity and gas. ESS and the Ministry of Consumer Affairs form the Consumer Affairs Branch of the Ministry of Economic Development.

New Zealand's residential dwelling supply is aging along with its wiring systems. Older wiring systems are not particularly well designed to handle increasing electrical demand and have often fallen short of today's electrical safety standards. Overseas research has raised concern of electrical safety in older residential dwellings.

This report provides findings of the research conducted during 2003/4 financial year to determine the fire risk, in New Zealand residential dwellings, from electrical wiring systems and especially the wiring system employed in the early 1940s and 1950s.

The author has worked for the Government for over 25 years in product quality, safe production, supply, installation and use of energy.

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Executive summary

New Zealand's residential dwelling supply is aging along with its wiring systems. Wiring systems of older dwellings are not particularly well designed to handle increasing electrical demand and have often fallen short of today's electrical safety standards. Overseas research has raised concern of electrical safety in older residential dwellings in Spain and another seven European Union nations.

In view of the European research, the Energy Safety Service conducted a research project during 2003/4 financial year. This sought to determine the safety risk in domestic premises (residential dwellings) from wiring systems in New Zealand, especially the wiring system employed in the early 1940s and 1950s (Vulcanised Indian Rubber (VIR) and Tough Rubber Sheathed (TRS) cable wiring), and whether any actions should be undertaken to address the replacement of older electric wiring.

Electrical fire data between 1986 and 2003 inclusive were analysed for this study. In New Zealand the overall risk of electrical fires over last few years to residential dwellings is 0.15%. The risk of heat related fires is estimated to be 0.10% and arc related fire is 0.048%. However, the risk of a fire caused by aging electrical wiring is a mere 0.019% and it was found to be generally stable for the analytical period of 18 years.

The fire risk from the 1940s and 1950s wiring was found to be 70% higher than more recent wiring in residential dwellings However, the overall risk of wiring employed in 1940s and 50s residential dwellings is relatively low as it stands at less than 2% of total electrical fires (about 30 additional fires per year) in residential dwellings.

Electrical wiring systems and fire* risk in residential dwellings

Background

New Zealand's residential dwelling supply is aging along with its wiring systems. Wiring systems of older dwellings are not particularly well designed to handle increasing electrical demand and have often fallen short of today's electrical safety standards. Technological advancements have made newer appliances smaller in size and comparatively more efficient in power consumption. But they are bigger in capacity – in terms of output and power consumption – and consumers are using a lot more appliances in their households than in the past, thus raising the stress on older electrical systems.

Research projects have been undertaken over three years (2000/03) to determine the electrical safety risk posed to residential dwellings by the European Copper Institute in the United Kingdom, Spain[1] and another seven European Union nations. Research has raised concern about electrical safety in their residential dwellings. This is primarily due to factors such as an increase in the number of fires, the age of housing wiring stock, and the level of maintenance, accidents, fatalities, and damage to properties resulting directly from inadequate electrical installations.

Introduction

In New Zealand, the Electricity Act covers the safe production, distribution and usage of electricity. The Energy Safety Service (ESS) is responsible for the administration the Act. ESS aims to bring a clear focus to safety, supply and measurement across the electricity sector. The safety of electricity supply in domestic dwellings fits within the work of ESS.

ESS conducted a research project during 2003/4 financial year to determine the safety risk in domestic premises or residential dwellings from wiring systems in New Zealand and especially the wiring system employed in the early 1940s and 1950s (VIR and TRS cable wiring).

According to New Zealand electrical industry experts, Vulcanised Indian Rubber (VIR) and Tough Rubber Sheathed (TRS) insulated cables are no longer used in residential dwellings (after the late 1950s), and have been replaced by Tough Plastic Sheathed (TPS) insulated cables.

This is not to say that all old wiring is necessarily a hazard. It depends on the condition of insulation protecting the wiring. Insulation can become damaged when it is rubbed or pierced, or even when a circuit is heavily loaded. When this happens, the wire becomes very hot and, over time, the insulation can crack or fray away.

Two most commonly know risks associated with electrical system are electrical shock casualties and electrical fires. However, there is no record of any electrical shock

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* Fires initiated by electrical arc or heat from electrical equipment which has resulted in damage to property.

injuries or fatalities caused by aged electrical wiring in the last eleven years.[†] Therefore, it is important to analyse electrical fire data and determine the leading cause of fires in residential dwellings.

Objectives

In view of the European research, the Energy Safety Service embarked on a research project which sought to determine whether the risks associated with older electrical wiring and whether any actions should be undertaken to address the replacement of older electric wiring. With this in mind, the objectives of this research were formulated as follows:

- to determine the leading type of electrical fires in residential dwellings;
- to explore any linkage between the cause of fire and the age of the residential dwelling; and
- to compare the fire risk of electrical wiring (VIR and TRS) fitted during the 1940s-1950s to current electrical wiring in residential dwellings.

Method

There is no information readily available that provides the number of residential dwellings that contains type of cables and age of wiring systems and especially the dwellings that have built in 1940s and 1950s.

Because electricity is an essential commodity, it can be assumed that almost all residential dwellings are connected to an electrical supply shortly after construction. Therefore, the wiring found in residential dwellings should be approximately as old as the age of building, unless it has been rewired, modified or altered.

To estimate the number of residential dwellings with the older wiring systems still in place, information regarding the number of residential dwellings constructed is required. The data is also useful for conducting a comparative risk analysis of electrical wiring in newer and older residential dwellings.

Residential dwellings data

Statistics New Zealand has a large archive of residential dwelling census data. Dwelling population data for the period between 1936 and 2001 has been obtained for this research.

Between 1936 and 2001, 13 censuses were carried out. Three main categories are provided to identify the type of residential dwelling: Ordinary private house (not sublet), private house (part of which is sublet), and flat.

[†] See Energy Safety Service's electrical shock accident records 1993-2003.

Fire data

The New Zealand Fire Service (NZFS) maintains a database of the fire incidents attended by their officers. The database is well constructed and contains valuable information regarding casualties, building age and causes of fires. For this project, NZFS have made available electrical fire data. Data between 1986 and 2003 inclusive were analysed for this study.

Electrical fires are identified by the following categories of ignition source (heat source) in the NZFS database:

Heat source code:

Arcing or overloaded electrical equipment (Fire initiated by short circuit arc)

	Short circuit arc	
31		Water cause
32		Mechanical damage
33		Defective or worn insulation
34		Unspecified
	Arc from	
35		Faulty, loose or broken conductor
36		Switch or electrical fence and operating equipment (excludes static discharges)
	Heat from overloaded equipment	
37		Heat from overloaded equipment
	Fluorescent light ballast	
38		Fluorescent light ballast

Hot objects (Fire initiated by heat from electrical equipment)

	Electrical lamps	
44		Electrical lamps
	Heat from electrical equipment	
46		Properly operating
47		Improperly operating

Limitations

Information for this research is gathered from two different authorities, Statistics New Zealand and NZFS, who collected that information for their own purposes over long period. This is the only relevant information available for this research and therefore it is inevitable to have some limitations on the findings.

Residential dwellings data

Earlier residential dwelling census data uses different classifications and terminology than the later data. Therefore, minor variations in residential population numbers exist. However, this has not greatly affected the analysis.

This report assumes that all residential properties were wired using electrical cables and installation practices available during or shortly after construction of the dwelling.

Fire data

NZFS may not necessarily establish the correct cause of every electrical fire they investigate due to their limited electrical expertise. For this reason, the analysed data may have minor uncertainties in the actual causes of fires. Nonetheless, the data is considered accurate enough for establishing general comparative trends.

The NZFS database is not complete due to an industrial stoppage in 1999-2000 which prevented the reporting of incidents during that period. However, the missing data has not affected the broader comparative trend analysis.

The electrical fire data does also not identify the age or type of wiring in residential dwellings. It is therefore difficult to determine the culpable cable type. A key assumption of this analysis is that all residential dwellings were wired using the most up-to-date type of electrical cable available at the time of construction. Fires caused by electrical wiring in these buildings are assumed to be the result of the original wiring used even though some dwellings might contain new, or mixtures of old and new wiring.

The objective of this research outlined in this report is to find the fire risk associated with aged wiring in residential dwellings. Fires initiated by short circuit arcs caused by defective or worn insulation, as well as short circuit arcs caused by faulty, loose or broken conductors, were found in the NZFS fire database. Both are closely associated with aged wiring fires. However, the NZFS categories also include fires initiated by appliance leads and internal defective, broken or worn insulation which are not related to residential dwelling wirings per se. This may somewhat overestimate the actual level of wiring related fires.

The NZFS differentiates properties affected by fire into five specific age groups in their data recording system. One particular age group is 1946-1969 which is slightly different to the 1940s – 1950s wiring group, a changeover from VIR and TRS insulation cable to TPS insulation cable, used in this report. This small variation should not make a significant difference to the findings reported here.

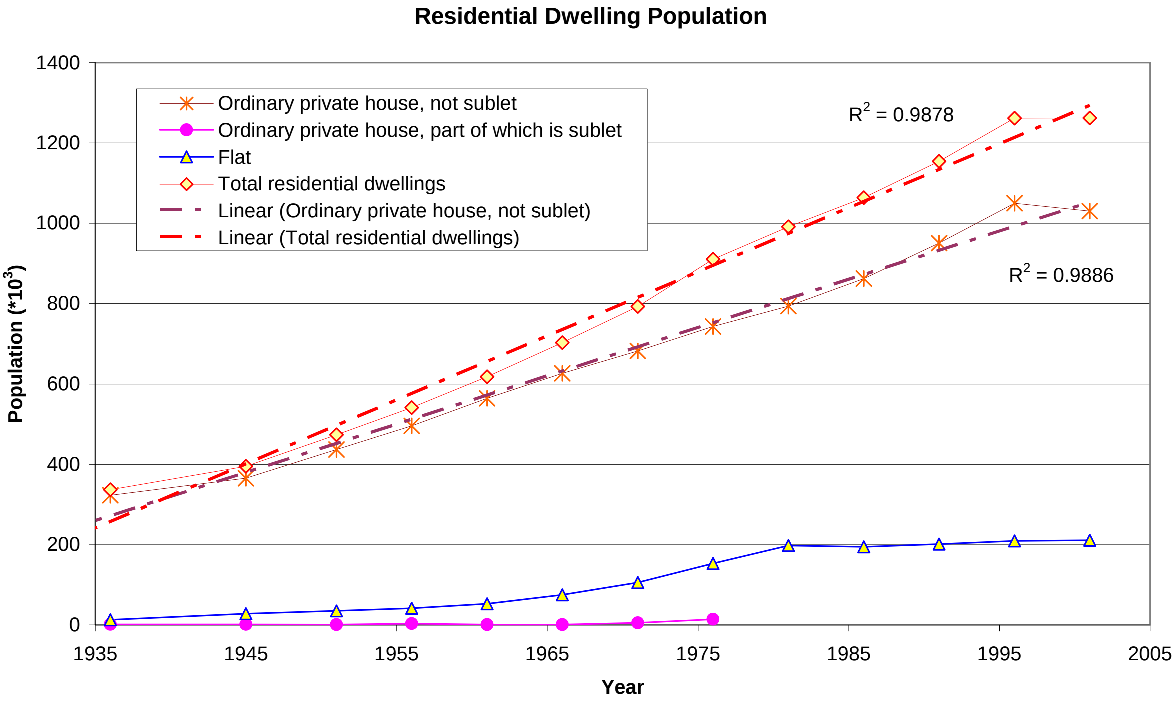
Analysis and discussion

At present, there is no information readily available to indicate the number of dwellings which have 1940s and 1950s wiring systems. Because electricity is an essential commodity, it can be assumed that almost all residential dwellings are connected to an electrical supply shortly after construction. Therefore, the wiring found in residential dwellings should be approximately the same age as the building, unless it has been rewired, modified or altered. To estimate the number of residential dwellings with 1940s and 1950s wiring systems still in place, information regarding the number of residential dwellings constructed is required. The data is also useful for conducting a comparative risk analysis of electrical wiring in newer and older residential dwellings.

Population of residential dwellings with electrical wiring systems (1936-2001)

A correlation coefficient R^2 in graph 1 measures the strength of association between two variables, in this case the population of residential dwellings and years. A value of zero for R^2 indicates that there is no association and value of either -1 or +1 indicates a perfect association.

Census data (graphs 1) indicates that residential dwellings have grown at a constant rate since 1936. The estimated population of the total number of residential dwellings in New Zealand was 1,262,000 by end of 2003.



Graph: 1

The population of total residential dwellings has been estimated using the above graph and used for the fire risk analysis.

Period	Estimated population
Pre 1946	395,000
1946 – 1969	362,000
1970 – 1991	398,000
1992 – 2003 (onwards)	108,000

Electrical fires (1986 – 2003)

The two most commonly known risks associated with electrical systems are electrical shocks and electrical fires. Typically, the risk from aged wiring is electrically initiated fires. ESS' electrical shock casualty accident database contains no records of electrical shock injuries caused by aged wiring in residential dwellings since 1993.

Generally there are two main types of electrical fires: arc-initiated fires and fires initiated by heat from electrical equipment. Generally, arc-initiated fires occur due to worn cables and damaged wiring in equipment. By contrast, fires initiated by heat from electrical equipment are normally due to operating error, installation error or lack of maintenance of the equipment.

According to New Zealand Fire Service (NZFS) data, around 59,000 electrical fire incidents occurred between 1986 and 2003. Over half of these fires, about 30,000, occurred in residential dwellings while 29,000 occurred in non-residential dwellings. The most recent fire data shows this trend continues to exist.

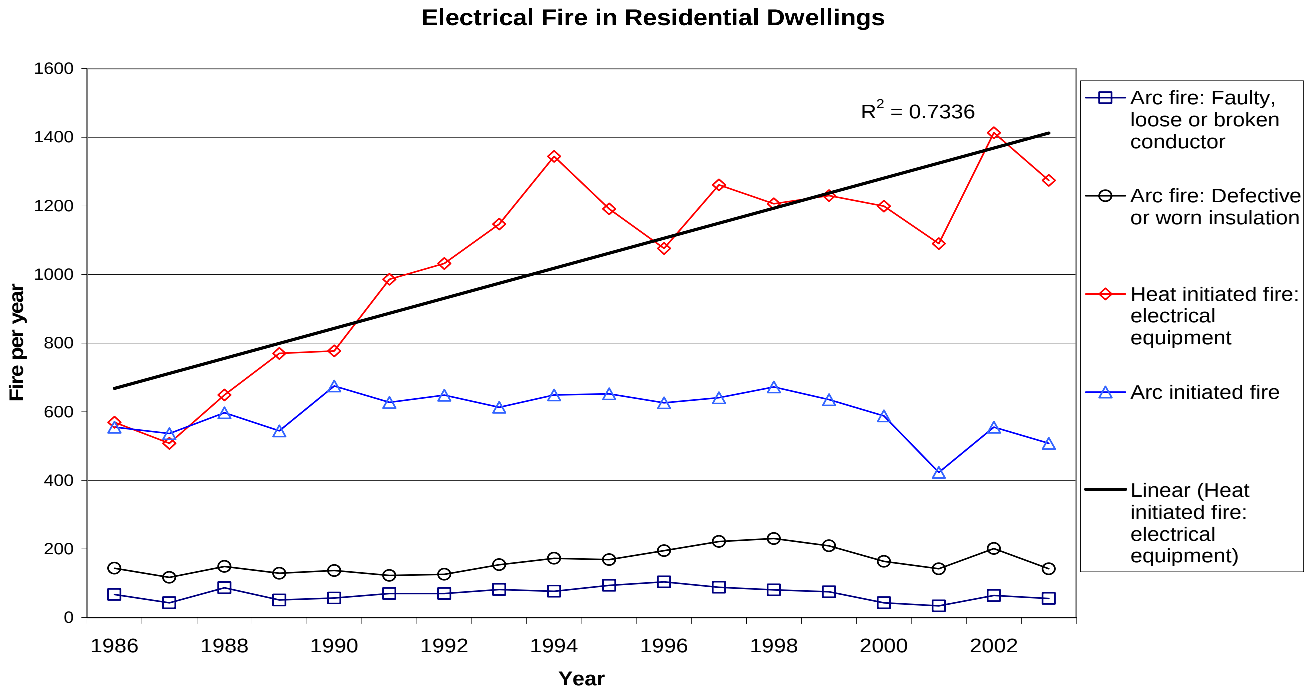
Around one-third of residential fires (about 11,000) were caused by an electrical arc. Two-thirds (about 19,000) were caused by heat from electrical equipment. However, the trend for non-residential dwelling such as commercial buildings, factories, vehicles fires presents the reverse. More than three-quarters (about 23,000) of non-residential dwelling fires are caused by an electrical arc and less than one quarter (about 7,000) are caused by heat from electrical equipment.

The dominance of heat-initiated fires in residential dwellings may possibly be explained by the higher use of heating appliances as compared to non-residential dwellings. However, the reasons for the relatively larger number of arc-initiated electrical fires in non-residential dwellings cannot be so easily deduced.

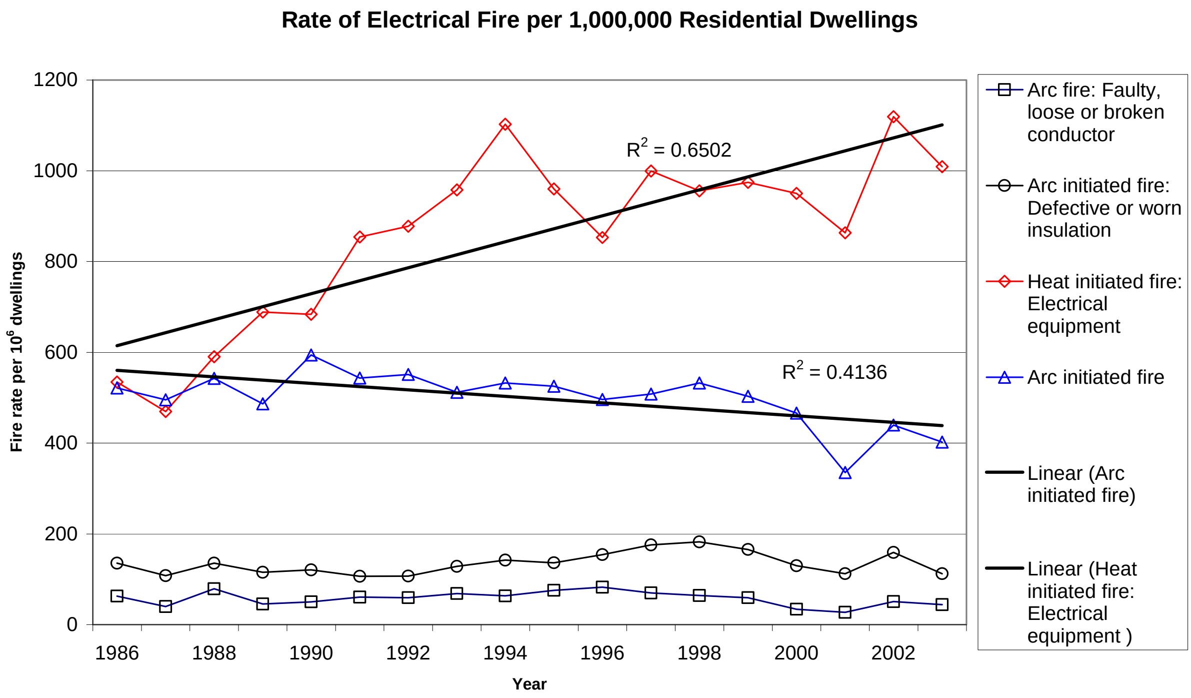
Electrical fires in residential dwellings

There are generally two main types of electrical fires occurring in residential dwellings: arc fires and fires initiated by heat from electrical equipment. Generally, arc-initiated fires occur due electrical short circuit by worn or damaged cable, on the contrary, heat-initiated fire are normally occur by heat from properly or improperly operating electrical equipment.

Faulty, loose or broken conductor fires and defective or worn insulation fires have been included in the arc-initiated fire data. The latter are presented separately, as these two categories are closely related to problems associated with aged wiring. This information is presented in Graphs 2 and 3 above. A correlation coefficient R^2 in the graph measures the strength of association between the number of fires and years.



Graph: 2



Graph: 3

Key findings:

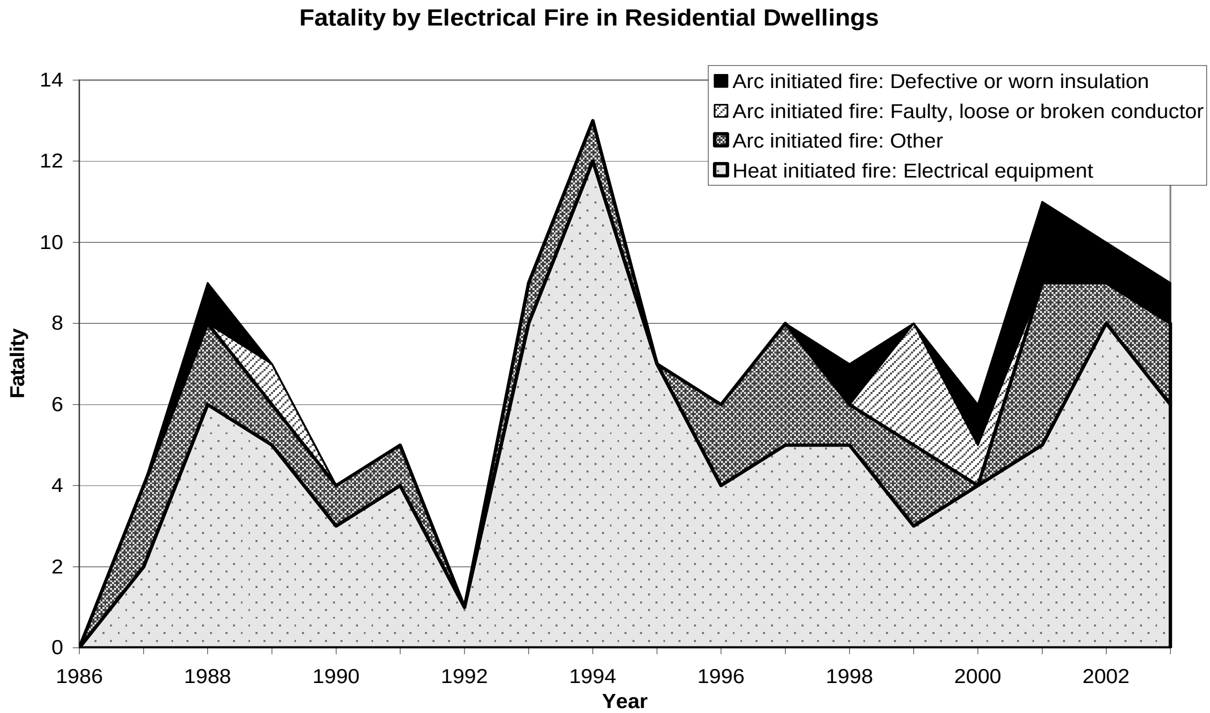
- Electrical fires have increased from 1,100 in 1986 to about 1,900 in 2003.
- The number of residential dwellings has constantly increased from about 1,000,000 dwellings in 1986 to about 1,263,000 dwellings in 2003. Even after applying the correction of this increase, the total number of electrical fires has increased at the same rate (graph 3).
- Heat-initiated fires have increased by over two and half times within the 18-year period. They have increased consistently from about 500 fires in 1986 to 1,300 fires by the year 2003.
- In 1986 heat-initiated fires contributed to 50% of the total of electrical fires. This figure increased to about 70% by 2003.
- The total number of fires caused by an electrical arc (arc-initiated fire) has remained unchanged (about 600 per year) since 1986. However, relative to the number of dwellings constructed - about 263,000 new buildings constructed since 1986 - arc-initiated fires have declined.
- Fires caused by defective or worn insulation were found to be closely related to old electrical wiring. It is the second largest sub-category in arc-initiated electrical fires. The actual number of fires per year has not significantly changed from 125 (±25) since 1986. It has contributed to an estimated 6% of total electrical fires in 2003. This is down from 10% in 1986. The defective, or worn, insulation fires category in the NZFS database also includes fires initiated by appliance cords or worn wires within appliances. This means that the actual number of fires caused by defective dwelling wiring, or worn insulation is less than 125 per year.
- Fire incidents which are caused by a short circuit arc caused by faulty, loose or broken conductors are also linked to aged wiring. This type of fire incident occurs about 50(±10) times per year. It contributed to a little over 2% of the total electrical fire incidents in 2003. The actual number has not significantly changed since 1986.
- Arc fires are classified according to the fire ignition heat source as identified by the fire investigator. When an investigator cannot distinguish the arc related fire any further, they are recorded as undefined short circuit arcs. This undefined category represents the largest number of arc related fires and it is therefore important to redistribute it among the appropriate categories. Accordingly, undefined short circuit arc fires were proportionally allocated to all defined arc fire.

As part of the research conducted by ESS, the number of defective or worn insulation fires per year was recalculated by reallocating undefined short circuit arc fires according to its contribution towards the total arc fires. The recalculated defective or worn insulation data shows an increase of an estimated 45 fires per year, from 125 (±25) to about 170 (±40), this contributed to about 10% of the total electrical fires in 2003. This is down from 13% in 1986. Even after the re-categorisation of the causal factors of fires, defective or worn insulation fires have remained static since 1986.

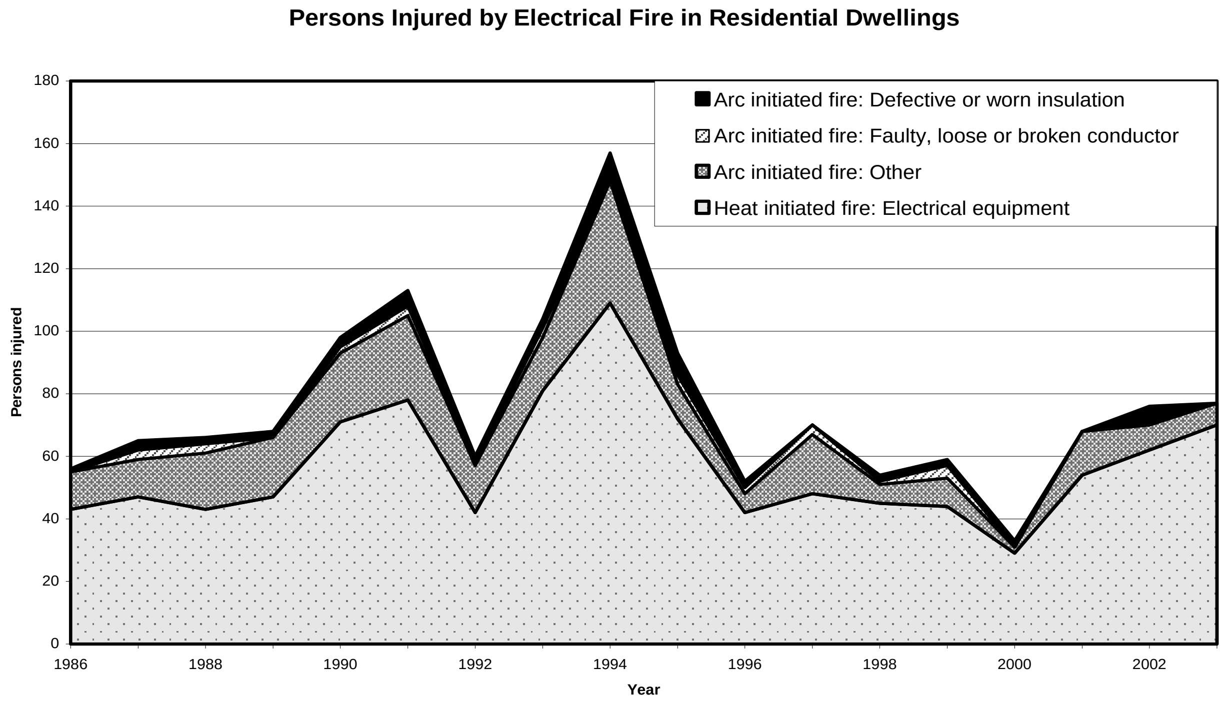
Recalculated data on short circuit arc fires caused by faulty, loose or broken conductors shows a small increase in the number of fires from 50 (±10) to about 65 (±15) per year. This contributed to about 3% of the total electrical fires in 2003. Even after re-categorisation of the causal factors of fires, the faulty, loose or broken conductor fires have remained static since 1986.

Fire casualty

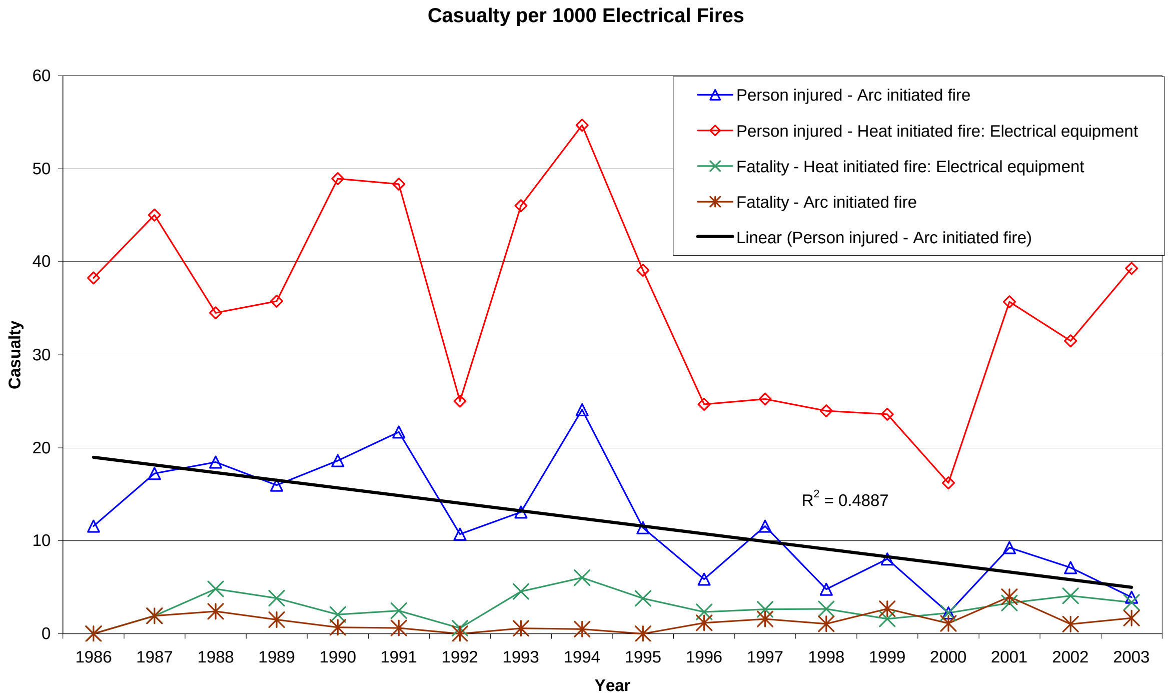
A large proportion of fires cause damage to properties only. However, in some situations both damage to properties and casualties occurred. There have been few fires that have caused multiple casualties. Only fatality and moderate to serious injury information has been used in the electrical fire casualty analysis and is presented in Graph 4, 5 and 6.



Graph: 4



Graph: 5



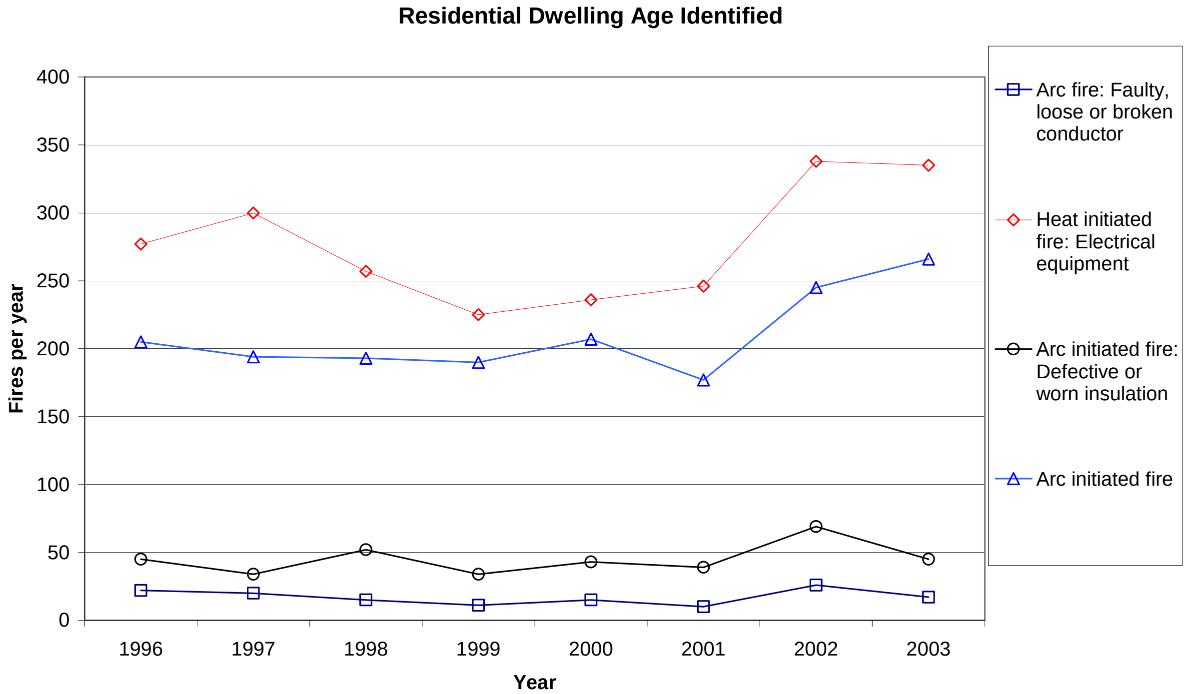
Graph: 6

Key findings:

- Over an 18 year period on average, seven fatalities (ranging from 0 – 13 per year) and 76 injuries (ranging from 33 –157 per year) occur per year from electrical fires.
- On average two fatalities (ranging from 1 – 6 per year) occur per year from arc-initiated fires and five fatalities (ranging from 1 – 12 per year) occur from heat-initiated fires. However, there is no general trend observable in the number of fatalities caused by electrical fires.
- On average 19 people (ranging from 4 – 48 persons per year) are injured by arc-initiated fires and 57 (ranging from 29 – 109 per year) are injured per year by equipment heat-initiated fires. Since 1986, there has been a significant reduction in the number of people injured per 1,000 electrical fires caused by short circuit arc fires.
- A very small number of fatalities, averaging to about one per year, and injuries to people, averaging to about four per year, have occurred by defective or worn insulation and faulty, loose or broken conductors. No long-term trend has been found.
- Heat-initiated fires have the same chance of causing fatalities or injuries to people as arc-initiated fires. Similarly, faulty, loose or broken conductors have an equal probability of causing injuries or fatalities to people as defective or worn insulation fires.

Electrical fires with dwelling age identified (1996-2003)

NZFS did not introduce a building age category into their database until 1994. Moreover, information on fire incidents related to building age was not adequately recorded until 1996. In this report, age related analysis was only carried out on electrical fires that occurred between 1996 and 2003.



Graph: 7

Key findings:

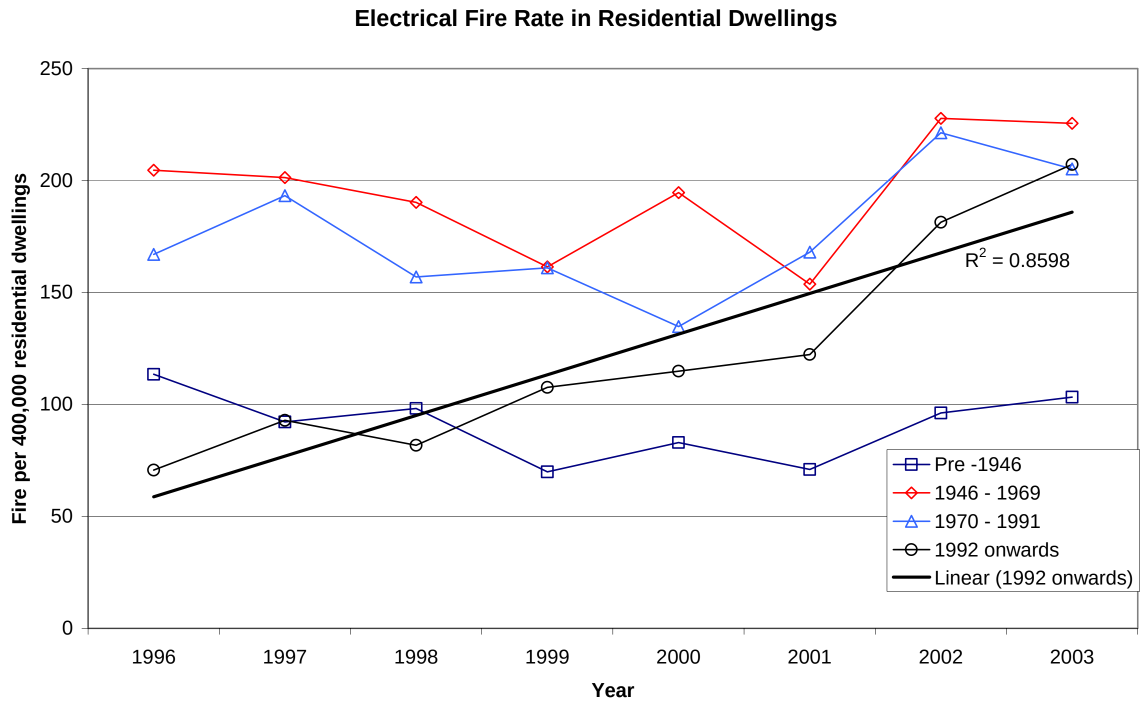
- Of the estimated 14,400 electrical fires in residential dwellings that occurred during 1996 and 2003, only 3,900 (27%) were identified with the building age.
- Arc-initiated fires were 20% more likely to be identified with building age than heat-initiated fires. An estimated 68% of all electrical fires are initiated by heat from electrical equipment, and 57% of these are identified with dwelling age. An estimated 32% of all electrical fires are caused by short circuit arcs, and 43% of these are identified with buildings age.

Electrical fire and dwellings age classification

NZFS classifies dwelling ages into five categories, pre-1900, 1900-1945, 1946-1969, 1970-1991 and 1992 onwards. As separate classification of pre-1900 and 1900-1945 is not essential for this project, the periods were combined into a single category. Four categories of dwelling ages, pre-1946, 1946 to 1969, 1970 to 1991 and 1992 onwards were used in the analysis.

Key findings:

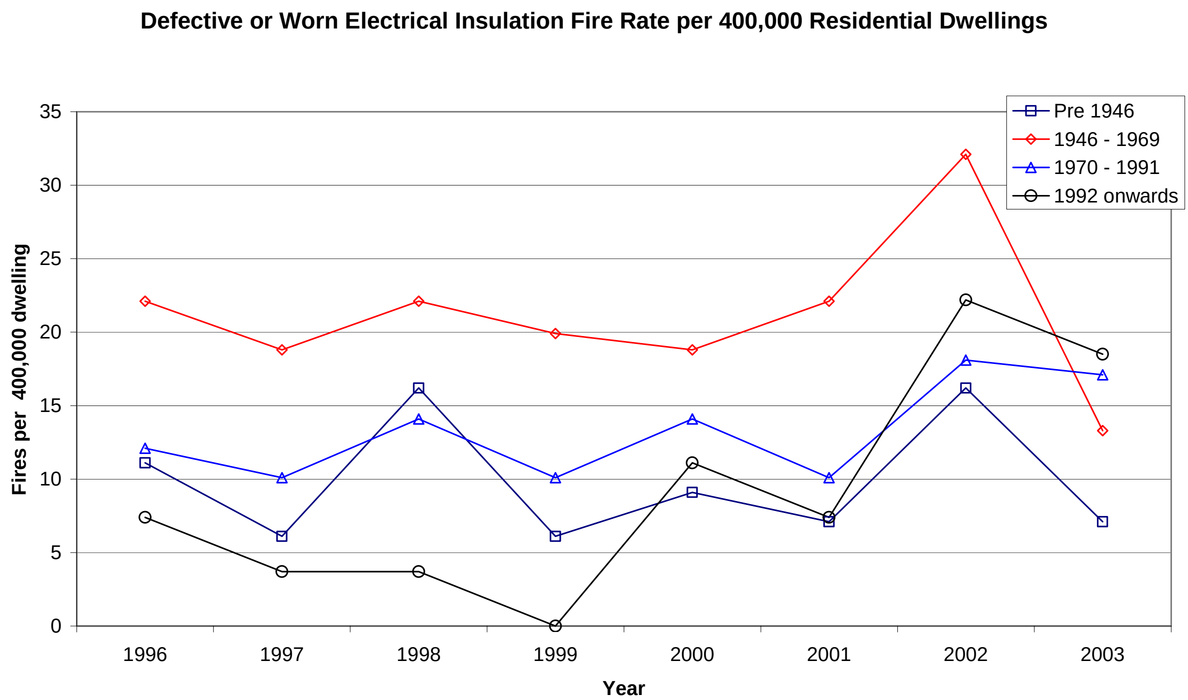
- Graph 8 shows that there is no significant difference in the electrical fire incident rate for the 1946-1969 and 1970-1991 periods.
- The fire incident rate per 400,000 dwellings for the pre-1946 residential properties is the lowest and is significantly different than the other three periods.
- The fire incident rate is stable for all periods except for new residential properties built since 1992. The fire rate per 400,000 residential dwellings is increasing at a constant rate for dwellings constructed after 1992 and will reach a similar level as 1946-1969 and 1970-1991 age group dwellings. It appears that, at this rate, it will become the top fire incident group within the next three to five years.



Graph: 8

Fire due to defective or worn insulation

Short circuit arc fire incidents caused by defective or worn insulation are closely related to aging wiring.



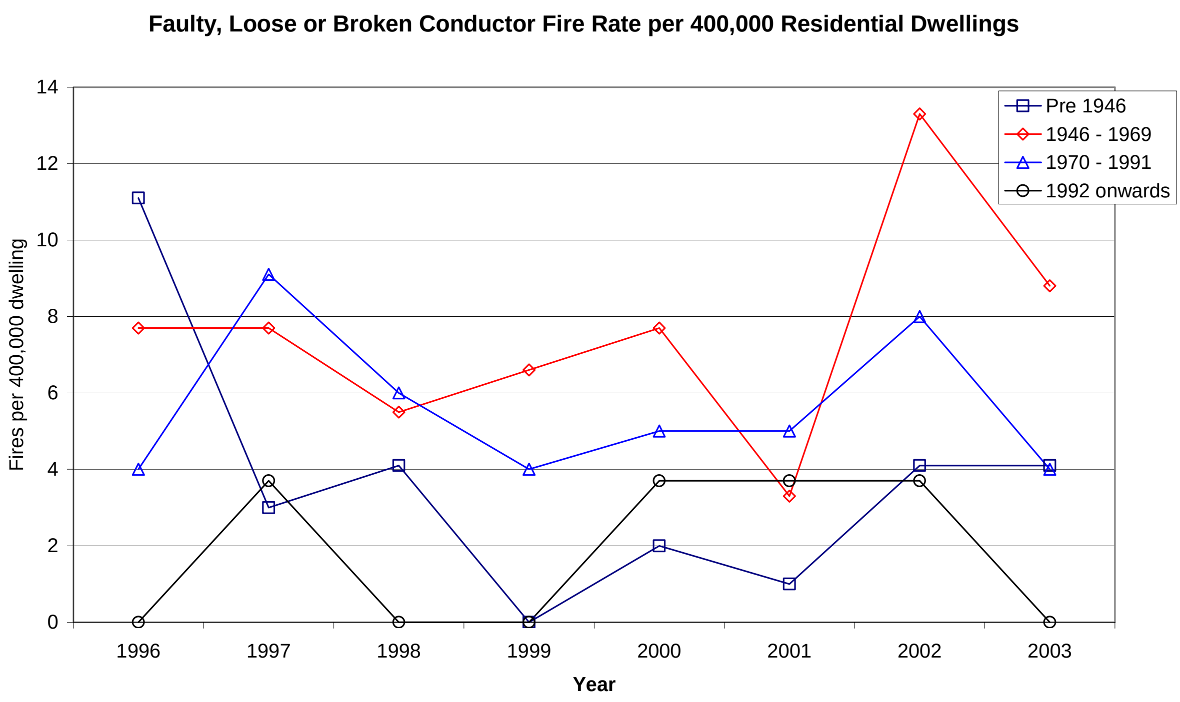
Graph: 9

Key findings:
- The total number of electrical fire incidents per year caused by defective or worn insulation have not significantly changed (125 (±25)) since 1986. These contributed towards 6% of total electrical fires in 2003. This is down from 10% in 1986. Only one-third of the fires since 1996 can be linked to the age of the dwelling.
- Graph 9 shows that the defective or worn insulation fire incident rate - per 400,000 residential dwelling - is stable for the four dwelling age periods, except for residential properties built since 1992. The fire incident rate has constantly increased in last four years for dwellings built since 1992.
- There is no significant difference in defective or worn insulation fire incident rates per 400,000 properties among the four age groups analysed except for dwellings built during 1946-1969.

On average 22 fires (variation of ±10 from the average) occur each year in buildings constructed in the period of 1946 to1969. By contrast, 13 fires (variation of ±4 from the average) occur in dwellings constructed in the period of 1970-1971. This indicates that an average of nine extra defective or worn insulation related fires occurred in dwellings constructed in 1946-1969.

Fire due to faulty, loose or broken conductor

Fire incidents caused by faulty, loose or broken conductors are also closely related to aged wiring.



Graph: 10

Key findings:
- Over an eight year period there were not a large number of electrical fires (about 50 per year) that occurred due to faulty, loose or broken conductors.
- A very small percentage contributed towards total electrical fires - about 2% of total electrical fire incidents in 2003.

- Graph 10 shows there is no significant difference in faulty, loose or broken conductor fire rates in residential dwellings built during 1946-1969 and 1970-1991.

Fire risk in residential dwellings

About 1,900 electrical fires, caused by a combination of electrical arc and heat from electrical equipment, occurred in residential dwellings, see graph 2. About 1,300 of these fires were initiated by heat from electrical equipment and the rest are arc fires. The estimated number of defective or worn insulation fires per year is about 170 (±40) and the estimated fires caused by faulty, loose or broken conductors are about 65 (±15) in recent years.

The overall risk of electrical fires in residential dwellings is about 0.15%[‡] i.e. the number of fires per 100 dwellings. The risk of heat related fires is about 0.10%[§] and arc related fires are about 0.048%[**]. The risk of defective or worn insulation electrical fires is about 0.014%[††] and the risk of fire from faulty, loose or broken conductors is 0.005%[‡‡]. No significant difference has been found in the faulty, loose or broken conductor fire rates between the1946-1969 and 1970-1991 age group dwellings.

14,400 electrical fires occurred in residential dwellings between 1996 and 2003. Only 27% (or approximately 3,900) of these fires could be identified with the building age. Graph 8 shows the lowest fire rate observed among the four age categories were for dwellings built prior to 1946. The fire rate for dwellings constructed from 1992 onwards has continued to increase at a constant rate and is expected to surpass the other age categories within three-five years.

Of the electrical fires that are identifiable with the building age (27% of total residential dwelling fires) electrical, no significant difference was found in the defective or worn insulation fire rate per 400,000 residential dwellings except for the 1946-1969 age category, see graph 9. In this category, an average of 22 (variation of ±10 from the average) fires per 400,000 dwellings has occurred each year. However, an average of only 13 (±4) fires per 400, 000 dwellings have occurred each year in dwellings built during the period of 1970-1991. This analysis shows that nine (22-13) extra defective or worn electrical insulation-related (aged wiring) fires have occurred in1946-1969 dwellings.

The nine additional aged wiring fires occurred in dwellings constructed during 1946-1969. The building age could only be identified for 27% of the total number of electrical fires. For comparative purposes, 400,000 dwellings were used to estimate the additional fires. However, approximately 362,000 dwellings were built during 1946-1969. This suggests that approximately 30[§§] more fires have occurred each year due to wiring fitted in 1946-1969 (VIR and TRS) when compared to the 1970-

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‡ =1900 total electrical fires per year*100/1,263,000 total residential dwellings.
§ =1300 heat initiated electrical fires per year*100/1,263,000 total residential dwellings.
** =600 total electrical fires per year*100/1,263,000 total residential dwellings.
†† =170 total electrical fires per year*100/1,263,000 total residential dwellings.
‡‡ =65 total electrical fires per year*100/1,263,000 total residential dwellings.
§§ ={9 extra fires*362,000 dwelling population in1946-69*100/(400,000*27 percentage dwelling age identified)}

1991 wiring (TPS). This represents about 1.8% [***]of the total number of electrical fires in residential dwellings that occur in any given year.

This also suggests that the wiring (Vulcanised Indian Rubber (VIR) and Tough Rubber Sheathed (TRS) insulated cables) risk of 1946-1969 dwellings is approximately 70%[†††] higher than the fire risk of wiring (Tough Plastic Sheathed (TPS) insulated cable) fitted in 1970-1991 dwellings. This risk is estimated on the assumption that all dwellings still have the original wiring. However, some dwellings might have been rewired or contain mixtures of new and old wiring. On this assumption, the actual risk of aged wiring is therefore underestimated. The accuracy of the estimated risk may be improved by applying the appropriate correction to the number of dwellings which were completely rewired with a newer type of cable.

There has been no measurable change in the casualty rate for each year since 1986. A very small number of fatalities, averaging about one per year, and serious to moderate injuries to people, averaging four per year, have occurred through defective or worn insulation, and faulty, loose or broken conductors. However, no long-term trend has been found.

The overall wiring related fire risk (0.019%[‡‡‡]) is low. For dwellings constructed in the 1940s and 1950s, the wiring related fire risk was not as significant as other types of electrical fire risks such as heat-initiated fire. Furthermore, it has contributed to only a small percentage of the total number of electrical fires. The wiring related fire risk was found to be generally consistent and stable for the analytical period of 18 years. The low percentage is possibly the result of an increase in the amount of rewiring work undertaken in older residential dwellings.

Number of electrical fires casualties relative to electrical shock casualties

Over 3,000 electrical fires occur every year, with over 50% taking place in residential dwellings. On average 10 deaths occur and over 100 people suffer moderate to serious injuries from electrical fires each year. Of these, an estimated seven fatalities and over 75 moderate to serious injuries occur in residential dwellings.

ESS's electrical shock injury accident database shows the trend for electrical shock casualties is quite opposite to those of fire casualties. Fewer casualties occur in residential dwellings compared to non-residential dwellings. On average, electrical shocks cause six deaths per year and an estimated 75 persons are injured. Of these, electrical shock causes less than three deaths per year and an estimated 15 general public injuries (in residential dwellings).

Not accounting for the costs associated with property loss, electrical fire casualties alone are costing New Zealand millions of dollars. This is considerably more than electrical shock casualties. This finding is not unique. The comparison of recently

[***] =30*8 years*100/14,400 fires in 8 years (1996-2003.
[†††] =(22-13)*100/13.
[‡‡‡] =0.01%+0.005%

published two papers[2,3] by the United States Consumer Product Safety Commission suggest that the costs associated with electrical fire in residential dwellings are much larger than cost associated with electrical shocks casualty.

Conclusions:

The following conclusions may be drawn from the data analysed for this research:

- The fire risk from older electrical wiring system used in 1940s and 1950s residential dwellings is very low compared to other types of electrical fire risks such as heat-initiated fire from electrical equipment. The aged wiring related risk has not significantly changed over the last 18 (1986-2003 inclusive) calendar years – the period analysed in this project.
- Heat-initiated fires in residential dwellings from electrical equipment have increased from about 500 to 1,300 during the last 18 years, while the arc related fires have remained stable.
- Electrical fire casualties in residential dwelling are far greater than casualties caused by electrical shocks.
- The low fire risk associated with wiring in residential dwellings does not justify a high level of legislative intervention such as the implementation of a dedicated ongoing electrical safety inspection system, rather like an electrical warrant of fitness. Dedicated safety inspection systems generally involve high compliance costs to consumers and may be even harder for the regulator to enforce or monitor.

Acknowledgements

The New Zealand Fire Service, Neil Challands especially, are thanked for supplying electrical fire information.

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