A REVIEW OF PRODUCT RELATED FIRES

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1 INTRODUCTION

The issue of product involvement in domestic fires involves a wide range of state and federal government departments and other organizations. The specific focuses in the collection of data, research and prevention of product related fires vary according to the perspective, responsibility, and interests of the organization.

1.1 Aim

This brief review was undertaken at the request of the Coroner, Mr Graeme Johnstone to determine the following:

- the status of national and state fire data collections in Australia
- the level of product detail available from these data sources
- the nature and value of overseas data bases
- recent advances in fire prevention research in Australia and overseas
- work in progress in fire prevention research and development in Australia and elsewhere
- responsibility for fire prevention
- potential for further developments in product related fire prevention

1.2 Caveat

It should be noted that this review was undertaken within a limited time-frame of approximately three weeks, and no resources were allocated specifically for the task. The methods used for the review are described below. Some of the information presented about recent developments and work in progress is necessarily from discussions with senior officials in fire and scientific organisations rather than from documented sources.

Because of these restraints this review is not necessarily a complete and comprehensive description, although the authors believe that it is at least indicative of the current status of product related fires in Victoria and elsewhere.
2 METHOD

The review was approached in a number of ways. The Australian and overseas literature was searched by on-line, bibliographical and specialist library searches. This was done in order to obtain information on relevant existing databases, and on research and prevention programs related to products involved in domestic fires. Local databases were accessed, or the nature and /or content of their output was reviewed where available. Faxed requests were made to two major overseas databases in early September, 1991 (the U.S National Electronic Injury Surveillance System (NEISS) and the Home and Leisure Accident Surveillance System (PORS) in The Netherlands) seeking information on product related fires. Unfortunately responses have not yet been received, which suggests that delays can be expected in the processing of such information requests.

In addition, discussions were held with key fire authorities and research organizations in Australia to determine the current status of the development of a national fire reporting system and database and other research and prevention work in progress.

A crude benefits cost analysis was undertaken some months ago by the Monash University Accident Research Centre. This, as yet unpublished, report is also included as an attachment to this document.

This document reviews product related fires in the wider context of deaths and serious injury as the result of all causes. It also focuses on those injuries caused by domestic fires, which may not have resulted in house fires as such. The final context is that of residential fires which may not have involved injury. The need to examine several contexts indicates the complexity of this task.
3 OVERSEAS DATABASES

Burn mortality data from fire or flames is the only worldwide data readily accessible that is published on a regular basis by the World Health Organisation. Although most deaths are due to residential structure fires, the WHO statistics do not provide a detailed breakdown of the aetiology of the fire incidents resulting in death.

Comprehensive international data on burn injuries, however, is either unavailable (especially in developing countries) or difficult to access because most statistical records are maintained by state or city authorities (Linares & Linares, 1990, p.281).

3.1 UNITED KINGDOM

There are two major accident databases in the U.K. which can provide information regarding consumer products associated with accidental death and injury. Information about non-fatal domestic accidents has been collected by the Department of Trade and Industry through the Home Accident Surveillance System since 1976 while information about fatal domestic accidents is recorded in the Home Accidents Deaths Database. Another source of information about accidents involving fire is the computer database operated by the Home Office's Fire Statistics Branch.

3.1.1 Department of Trade and Industry, Consumer Safety Unit

Home Accident Surveillance System (HASS)

HASS, a computerised data system, is operated by the Consumer Safety Unit of the Department of Trade & Industry, and collects data from a sample of 20 of the 250 hospitals in England and Wales which operate 24 hour Accident & Emergency departments (Moller & Vimpani, 1985, p.22).

The system collects data about home accidents which result in injury and is specifically designed to permit analysis of the products, articles, and features of the home involved in each accident (for which there are over 800 codes). Information about products involved are coded using a hierarchical system which allows easy access to data on groups of products e.g. nursery furniture. Age, sex, location of injury event, nature of injury, energy source, activity, accident type, employment status of adults and details of treatment and disposal are all collected. In addition an 80 character text description is also entered. (Hayward, 1988, p.400; Moller & Vimpani, 1985, p.23).

It has the advantage of allowing rapid access to either tables or case listings in an immediately readable form.

According to Hayward (1988, p.400), the inadequacy of the system lies in the fact that the patients who die in-hospital, or are recorded as dead on arrival, are not representative of fatal home accidents as a whole, since certain injuries (e.g. electrocutions and suffocations) cause death more quickly than others (e.g. falls and burns) so that the latter feature
disproportionately in those cases where hospital treatment is sought prior to death. Furthermore, because HASS uses only a sample of hospitals, the total number of fatal cases recorded in any year (about 250) is too small a database given the importance of accidents that result in death.

**Home Accident Death Database (HADD)**

This computer-based system was developed to permit analysis of the consumer products and articles or features of the home involved in fatal domestic accidents in England and Wales. It aims to include all cases rather than just a sample and is based on information derived from secondary sources. It combines records of fatal home accidents collected by different agencies for different purposes and giving varying degrees of detail which are either manually coded or converted to a standard format by computer.

The format of the data is, in most respects, identical to that of the HASS, since this has proved itself a very powerful system for analysing accidents involving consumer products. It also makes comparison of fatal home accidents with nonfatal cases treated in hospitals very straightforward. Certain fields of data in the HADD records are (for some cases) used to code information additional to that available in the standard HASS format. The items covered are:

1. Whether death occurred at a hospital.
2. Any mention of impairment affecting the victim at the time of the accident (e.g. drugs, senility, or restricted mobility).
3. When powered equipment was involved whether there was mention of any fault and, if so, whether in the supply, the appliance, or the exhaust.
4. Whether misuse of equipment was mentioned.

The vast majority of the records derive from death registration data which is collected by the Office of Population Censuses and Surveys (OPCS) from death registration forms completed by Coroners for every death they investigate. These are either automatically converted from OPCS computer records or manually coded from death registration forms, depending on whether manual coding is expected to yield considerable additional data on the products involved. For example, cases coded E850-858 (poisoning by medical products) are converted automatically while E860-869 (poisoning by other substances) are manually coded. "E-codes" used in this system are the External Cause of Injury codes from the International Classification of Diseases.

The Home Office computer records of fires are assumed to correspond to E890-894 and E898-899 (all uncontrolled fires), but the conversion program that interprets them into HASS format excludes fires igniting clothing and fires located in gardens, cars (in drives or garages), or caravans. Cases in these categories are manually selected and coded from death registration forms. Electrocutions (E925) are manually coded from death registration forms that have been matched with electrical fatality report forms (where available) to take advantage of the much greater detail available about the products involved and the chain of events.

HADD allows rapid access to data (requests can usually be dispatched within 24 hours) in an easily readable format and includes both tables and case listings (giving a textual
description of the accident where possible). It also allows comparison with data collected from non-fatal accidents through HASS. HADD is particularly valuable for comparing products that may be involved in accidents of more than one type. This is so with electrical products, some of which present, simultaneously, hazards of electrocution, fire, and burning from controlled heat. Data in HADD can be tabulated to show not merely the difference in the nature of the hazard posed by different electrical products, but also whether the accidents are due to faults within the appliance itself, the flexible wiring or the mains circuit, or due to external events.

The major inadequacy of the HADD system at present is the length of time it takes for data to appear in the database due to the use of secondary sources and to only updating once for each year. This means the most recent cases will be deaths that occurred at least 15 months ago and may be no more up to date than two years ago. (Hayward, 1988).

3.1.2 The Home Office, Fire Statistics Branch

Statistical information on all fires attended by local fire authorities in the U.K. are recorded in a computer database operated by the Home Office's Fire Statistics Branch.

From forms completed by local fire brigades a great many details are coded onto the database for each incident. These range from the source of ignition to the method of extinction and casualties and rescues. There is, however, no verbal description in free text and it is not possible to obtain output in the form of readable case listings. Data appear only as tables which require a coding manual for interpretation.

Information about products involved in fires is coded in the database but access is not as rapid as could be desired. Furthermore, since it covers only a specific type - fires attended by the local brigade - there are some cases such as the ignition of a person's clothing that will not always be recorded. (Hayward, 1988, p.400).

Statistics from this collection are published annually (e.g. Home Office, 1985).

3.2 UNITED STATES

In the United States there appears to be a great many organisations responsible for fire prevention and research. The most important sources of data regarding fires, fire deaths and injury and also product-related injury and deaths are outlined below.

Other organisations which play a significant role in fire and burn prevention and research in the U.S. are:

The American Burn Prevention Association which emphasizes teaching, research and support for public education in the area of burn and fire prevention;

The National Burn Information Exchange which collects demographic and epidemiological information on burn injuries.
3.2.1 Consumer Product Safety Commission

The U.S. Consumer Product Safety Commission operates four systems aimed at monitoring injuries related to consumer products. These are the National Electronic Injury Surveillance System (NEISS), the Medical Examiner Capture (MECAP) programme, a Consumer Complaint Hotline and a Newspaper Clipping Service. The NEISS and MECAP systems are similar in many respects to the HASS and HADD systems operating in the U.K. in that there is a focus on related consumer products, although the American systems are not solely based on injuries or deaths caused in the home. For the purposes of this report, we will confine our discussion to the NEISS and MECAP systems. The following information has been derived from Moller & Vimpani (1985).

National Electronic Injury Surveillance System (NEISS)

NEISS collects data from a stratified sample of 72 hospital Accident and Emergency departments chosen to represent the mainland United States. All cases where injury is associated with a consumer product and all ages are included, with approximately 250,000 cases processed each year.

Ordinary medical record forms have been modified in the participating hospitals to accommodate the additional information required about the accident sequence and product involvement. Staff are specifically employed in each hospital to abstract the medical records and enter the data into an online computer network. Data items collected are age, sex, location of event, nature of injury, up to three products involved and an 80 character description of the event. Again it should be noted that products coded into the NEISS collection are only related to the injury event and do not necessarily cause it.

NEISS data are used to produce national estimates of the frequency of product involvement with injuries and also to provide a basis for selecting priorities for preventive action.

Medical Examiner Capture Program (MECAP)

MECAP abstracts data from death certificates sent in by State authorities and also collects data from a number of medical examiners on deaths related to consumer products which have occurred in their jurisdiction.

This collection is handled centrally with information from medical examiners and state authorities provided directly to the CPSC head office. (15,250 death certificates were received in 1983.) Data is coded onto specially designed forms prior to computer entry and includes the same data items as the NEISS collection.

MECAP does not aim to include all injury deaths (as does the HADD collection in the U.K.) and it is not representative of any given population. However, the collection adds more detail and allows a better assessment of the risk to the community when used as an adjunct to the NEISS system.
3.2.2 Federal Emergency Management Agency (FEMA)

FEMA's U.S. Fire Administration (USFA) was mandated in 1974 to highlight the country's fire problem and to promote a comprehensive program to reduce loss of life and property from fire (Silverstein & Lack, 1987, p.2). The USFA established the National Fire Incidence Reporting System (NFIRS) to collect fire and casualty data nationwide. Department participation varies from state to state and the NFIRS captures about one-third of fires each year.

The NFIRS collects a comprehensive range of data about all aspects of a reported fire incident and results on the causes of fires are based on methodology developed by the USFA which essentially uses cause categories as a shorthand for aggregating complex factors describing heat sources, materials ignited and other ignition factors. (Karter, 1990, p.28).

3.2.3 National Fire Prevention Association (NFPA)

Annual Survey of Fire Departments for U.S. Fire Experience

The NFPA annual survey is based on a stratified random sample of public fire departments in the U.S. Sample selection is based on the size of the community protected by the department. All departments that protect communities of 100,000 or more are included in the sample, and departments that protect fewer than 100,000 people are selected by a stratified random sampling method. Survey returns from 2,800 to 3,000 departments are received annually. National projections of the fire problem can be made by weighting samples results according to population weighting factors. (Karter, 1990, p.28).

3.2.4 FIREDOC

FIREDOC is an on-line bibliographic database for the collection of fire research documents maintained by the Fire Research Information Services. The collection contains over 35,000 references which reflect the interests of the Fire Research Centre, a part of the National Institute of Standards and Technology (Jason, 1990, p.1).

It appears that direct access to this bibliographic data base is unavailable through the usual on-line systems (e.g. DIALOG, ORBIT, STN, etc.) in Australia at present. Searches of the database relating to specific issues could possibly be arranged by applying directly to the Fire Information Research Services.
OVERSEAS RESEARCH: 
THE AETIOLOGY OF HOUSE FIRES

It is clear that some major differences exist between developed countries in the annual rates of death due to fire. Universally, these deaths are largely associated with house fires.

The countries with the highest death rates are the U.S.A. and Canada, both with 29 deaths per million population annually. Great Britain and Japan both have rates that are about half that of the North American countries, but that are more than five times the rate of Switzerland.

The reasons for this variance are largely unknown although studies suggest that the patterns of injury by type, age, sex and season do not differ greatly between countries or between communities in a given country. Clearly there is a need for further research in this area. (McLoughlin & Crawford, 1985, p.66.)

4.1 UNITED KINGDOM

4.1.1 Home Office Fire Statistics

In 1987, the Home Office recorded 63,000 domestic fires in the United Kingdom and, although these accounted for less than a fifth of all fires they accounted for no less than three quarters of all deaths and injuries from this cause. Death occurred most commonly from the effects of gas and smoke.

The most common cause of house fires was the misuse of electric cookers (29%) followed by faulty appliances and wiring (19%). Other common causes of accidental fires in dwellings were misuse of gas cookers, smokers materials, misuse of equipment (other than cookers) and matches (see Figure 1).

FIGURE 1 
Causes of unintentional fires in dwellings (United Kingdom, 1987) 
(from Lowry, 1985, based on Home Office statistics)
4.1.2 Comparison of HASS and HADD statistics.

In an outline of the initial findings from HADD, Hayward (1988) compared some of the statistics regarding fatal home accidents generated by HADD with those of nonfatal domestic accidents generated by HASS.

It showed, for example, that falls were the main type of accident in the home resulting in both death (60.9%) and non-fatal injury (41.9%). Non-fatal accidents also include many cutting and striking accidents, while fires and poisonings are common causes of fatal accidents. Burning accidents involving uncontrolled fire were responsible for 11.9% of fatalities compared to only 0.3% of non-fatal injuries. However, burning accidents from a controlled heat source caused only 1.7% of fatalities compared to 4.5% of non-fatal injuries.

In a comparison of products and articles most frequently recorded in HADD and HASS, * steps and stairs top both lists since they are the most frequent source of falls. Other items for which falls are the principal hazard (e.g. beds, ladders, etc.) also figure prominently in these lists.

There are however, differences between the two lists with food (choking accidents), together with smokers' materials and controlled fires (i.e. gas, electric or solid fuel) featuring near the top of the list for fatal accidents and tin-openers and domestic knives (cutting accidents) and nails/screws/tacks being prominent on the non-fatal list. This reflects the fact that some of the most common types of accidents (e.g. cuts) are rarely fatal while others (e.g. suffocations and fires) are responsible for few injuries, but are, comparatively, more likely to be fatal.

Hayward concludes that the (absolute or relative) hazard presented by a product or article cannot be judged either from the number of fatal accidents or from the number of hospital-treated accidents involving it. Both measures must be taken into consideration. (In fact, of course, several other parameters should also be taken into account, such as the severity of the non-fatal accidents and the ages of the victims.)

Some products may be involved in more than one type of accident. Certain electrical products, for example, may simultaneously present hazards of electrocution, fire, and burning from controlled heat. This type of information may be accessed through HADD and, in the case of electrical products, information is also available as to whether the accident was due to faults within the appliance itself, the flexible wiring or the mains circuit, or due to external events. Table I shows examples of this data.

* Note: Articles or products recorded in these data bases have been involved in some way in the accident. However, this does not necessarily imply cause or fault.
TABLE I

Fatal home fires involving some electrical products (England & Wales, 1983)
(from Hayward, 1988, p. 410, Table 4.)

<table>
<thead>
<tr>
<th>Product</th>
<th>Total cases</th>
<th>Type of accident</th>
<th>Contributing electrical fault</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Electro-</td>
<td>Un-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>cution</td>
<td>controlled</td>
</tr>
<tr>
<td>Radio/tuner</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Television</td>
<td>11</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Cooker (stove)</td>
<td>19</td>
<td>2</td>
<td>16</td>
</tr>
<tr>
<td>Drill</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Other DIY</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>appliances</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hedge trimmer</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Lawnmower</td>
<td>7</td>
<td>7</td>
<td></td>
</tr>
</tbody>
</table>

4.1.3 British Crime Survey Data

Although the Home Office collects statistics regarding fires attended by fire brigades in Britain, the third British Crime Survey conducted in 1988 contained a number of questions related to domestic house fires and revealed that a large number of residential fires were not attended by fire brigades. In an analysis of this data by May, (1990), it was estimated from this survey that around half a million households in England and Wales were likely to have experienced a fire in 1987, compared with some 52,000 residential fires attended by fire brigades.

The survey revealed that more than half (56%) the household fires were caused by cooking accidents. Electrical appliances (other than heaters) were the next most common source, causing 11% of fires.
Although the United States is one of the wealthiest and most technologically advanced countries in the world, it also ranks first in deaths and property loss from fire (Silverstein & Lack, 1987).

House fires are the leading cause of death from unintentional injury in the home and responsible for around 5,000 deaths annually in the United States. This represents a death rate of 2 per 100,000 population, a rate which has remained almost constant for the last fifty years despite the fact that the rate of death from other fire and burns has fallen considerably over the same period (Mierly & Baker, 1983).

Although a great deal of medical research has been directed to the further development of the effective clinical treatment of burn injuries, the epidemiology of burns in well defined populations has not received the same attention (Chatterjee, Barancik & Fratianne et al., 1986). This is particularly true in the case of burn deaths and injuries resulting from house fires.

One reason for this is that data on burn, fire and injury frequency are extremely difficult to access because most statistics are kept (if at all) in various city or state files. Few national data are available (Silverstein & Lack, 1987, p. 13).

4.2.1 Causes of house fires

Estimates of the major cause of house fires by the Federal Emergency Management Agency (FEMA) for 1981 based on data from the National Fire Incidence Reporting System (FRIS) were reported by Silverstein & Lack (1987, pp. 4-5).

*All house fires*

The estimates indicate that heating unit failures were the largest single cause of all fires in the home accounting for 25% of ignitions. Of these, the largest number of failures involved chimneys and flue vents (24%), followed by fixed local heating units, fireplaces and central heating units.

Cooking was the next greatest source of ignition (17%) in all house fires followed by suspicious or intentionally-lit fires (12%). Smoking caused 9% of all residential fires, with faulty electrical distribution being responsible for 8%.

According to McLoughlin & Crawford (1985, p.69), malfunction in the household electrical circuit, frequently due to overloading is a common cause of house fires. Pennies used in fuseboxes allow overloaded circuits to continue functioning while wires, often hidden in the walls, heat and ignite the surrounding materials. (They also report that the CPSC established that extension cords were the ignition sources of fires causing burn injuries requiring hospitalization of 260 persons and 80 deaths in 1983.)
FEMA estimates suggest that appliances were responsible for a further 7% of house fires while children playing caused another 5%.

House fires resulting in death

In comparison, smoking was estimated to be the largest single cause of residential fires resulting in deaths (27%) followed by heating (11%), arson (10%), cooking (6%) and faulty electrical distribution (6%). Children playing were responsible for 4% of house fire deaths while appliances were implicated in only 2% of cases.

House fires resulting in injury

House fires resulting in injury were caused mainly by cooking (19%) and smoking (18%) followed by heating and arson (both 11%). Children playing were responsible for 8% of house fire injuries while faulty electrical distribution was responsible for 6%, and appliances 5%.

Further estimates: 1983 to 1987

Similar figures were reported by Karter (1990) and were derived from the same source (FEMA FRIS) for the period 1983 to 1987. Heating equipment was responsible for 27% of residential fires across the U.S. in that period, followed by cooking (17.7%) and arson (11.5%).

Although smoking accounted for only 7% of all house fires, it was responsible for 29.1% of all residential fire deaths. Heating equipment was another major cause of house fire deaths (16.3%).

The leading causes of fires that resulted in injuries were cooking equipment (21.8%), smoking materials (16.4%) and heating equipment (12.6%).

Appliances were not included separately in this analysis.

Smoking and house fire fatalities

Smoking materials are by far the leading cause of house fires resulting in death in the U.S.

In 1981 fires caused by lighted tobacco products were the leading cause of residential fire deaths (27%), and also accounted for 56% of the deaths that occurred in motel or hotel fires (Silverstein & Lack, 1987, p.8).

Similar rates were reported for 1988 (in an analysis of NFRIS and NFPA data), when almost 30% of all structure fire deaths were due to smoking materials. The death toll in home fires caused by lighted tobacco products was more than twice that for heating equipment, the next leading cause (Miller, 1991). Similar rates of cigarette-involvement have been found in a number of smaller population-based studies. For example:
In 1985 in New York State, smoking accidents accounted for 32% of all fatal fires recorded and were the leading cause of fatal incidents. (NYSJM, 1989)

Smoking was the second most common cause of housefire deaths (26%) in North Carolina in 1985. In 89% of these cases the fire was caused by the ignition of furniture. (Patetta & Cole, 1990)

In Baltimore between 1976 and 1978 cigarettes were the largest single cause of fires with 56% of deaths attributed to fires ignited by cigarettes. Typically the cigarette ignited upholstered furniture or bedding. (Mierly & Baker, 1983).

Most smoking-related fires in residential buildings resulting in deaths begin in furniture upholstery (50.3%), mattresses or bedding (28.3%) or trash (3.8%). The ignition of clothing on a person was responsible for only 2.6% of these deaths (Miller, Table 3, p. 91).

Most smoking-related fire deaths in residential structures are caused when lighted tobacco products are abandoned or carelessly discarded (58.3%) or by the related phenomenon of falling asleep while smoking (24.9%). (Miller, 1991, Table 2, p.90).

4.2.2 High Risk Groups

The two age groups most at risk of death in a residential fire are the very young and the very old. Developmentally, both groups are less able to assess risk and recognize danger, have less control of their environment and a limited ability to react quickly and appropriately to a fire situation (McLoughlin & Crawford, 1985, p.62). Not only are these groups less likely to be able to escape a fire, but for the very young (0-4 years) and the elderly, burns are life threatening sooner than in other age groups (van Rijn, Bouter & Meertens, 1989).

Children

Fire and/or burns rank third behind motor vehicle accidents and drownings as a major cause of unintentional injury deaths in children in the United States. They account for more than 1300 childhood deaths annually (McLoughlin & Crawford, 1985, p.61). House fires are responsible for 84% of these deaths, the primary cause of which is smoke inhalation as opposed to tissue damage from flames (McLoughlin & McGuire, 1990, p.677; Parish, p. 36). By way of comparison the major cause of non-fatal burns in children is scalds from hot liquids. Children under 5 have the highest risk of dying in a house fire and are also the most frequent victims of scalds (McLoughlin & Crawford, 1985, p. 61).

Cigarettes cause 14% of house fires which kill children younger than 15 years of age whereas playing with matches and cigarette lighters causes ignition in one third of fires that kill children younger than 5 years (McLoughlin & McGuire, 1990, p.678).

The U.S. Fire Administration has indicated that 200 deaths per year are associated with
fires started by cigarette lighters. About 140 of these were started by children playing with lighters and 125 of these deaths were among children under 5. As well as these deaths, the U.S. Consumer Product Safety Commission reports (based on NEISS data) that there were an estimated 2,250 emergency room visits in 1984 associated with thermal burns from cigarette lighters. Of these, 563 (25%) occurred in children under 5 and most occurred as a result of child playing with the lighter (Maley, 1988, p.423).

The Elderly

Adults over 65 years of age consistently stand out as one of the main high-risk groups in studies analysing house fire deaths (e.g. Mierly & Baker, 1983; Patetta & Cole, 1990, Petraglia, 1991). Of the high risk populations in the community, the elderly is the fastest growing group. They currently represent 12% of the U.S. population and this figure is expected to double by the year 2030.

A recent study by the National Fire Prevention Association in the U.S.A showed that, "among older adults, the rate of fire deaths relative to population continues to rise with age. For 65 years of age and older, the fire fatality rates are more than twice the national average. For those 75 years of age and older, these rates jump to three times the national average. And fire deaths for those 85 years of age and older are four times the national average." (Petraglia, 1991, p.37).

The study also showed that one of the reasons this group is so vulnerable to fire is that nearly one-fifth of them are either bedridden or suffer from an incapacity which makes them less able to escape. In addition to this, the study also revealed that around 30 percent of elderly fire victims were closely involved with the ignition of the fire that caused their deaths.

Fires ignited by smoking materials are the major cause of house fire deaths in elderly victims. According to Petraglia, the older a person is, the more at risk he or she is of dying in a smoking-related fire. Most of these fires begin in the victim's living room or bedroom when a cigarette ignites upholstery or bedding. In a study of burns in the elderly, Ostrow et al. (1987) found that cigarettes were thought to be responsible for almost half the 29 fatal bedroom fires recorded in the study.

Fires that begin with heating equipment are the second leading cause of house fire deaths in the elderly. In over 25% of these fires, flammable materials too close to the heat source were responsible. Most often ignited were soft goods, upholstery and bedding. Figures suggest that most deaths associated with heating equipment are caused by low-cost alternative heating sources such as portable electric or kerosene heaters.

Cooking-related fires are another important source of fire fatalities in the elderly. In 25% of these cases, the clothing of victims aged 75 years and older ignited when contacting the heat source.
5 PREVENTION

In an analysis of death rates caused by fire and flames for various countries from 1975 to 1986, Linares & Linares (1990) found that worldwide burn mortality has not decreased. After reviewing the current literature in the area of burns prevention they concluded that burn prevention campaigns aimed at public education have generally failed to provide the expected decrease in burn injuries. They argue for a reassessment of the approach to burn prevention and for education and legislation through campaigns that are directed at behaviour change motivated by perceived susceptibility to risk and environmental control and product modification.

Patetta & Cole (1990) concluded that "to escape housefire deaths, fires must be prevented or escaped". Their study showed that only 16 people who died in 1985 as a result of house fires in North Carolina left the scene alive. Therefore improvement in emergency treatment and transport of persons injured in house fires could prevent at most only 8% of housefire deaths.

Fire-related injuries associated with certain health risk behaviours such as smoking and drinking suggest the need for passive technology approaches to prevention such as fire-safe (self-extinguishing) cigarettes, smoke alarms and automatic sprinkler systems since they provide automatic protection rather than relying on behaviour change.

Product modification and environmental control measures can be very successful in reducing the incidence of injury and death. For example, legislation controlling the sale of fireworks, and that for flammability standards for children's nightwear have had demonstrated success in Australia.

5.1 Children's nightwear

Legislation proclaiming flammability standards for children's nightwear was instituted in 1967 in the U.S. Between 1968 and 1979, there was a decrease in deaths resulting from clothing ignitions of 71% for males and 82% for females with the largest reduction in the 0-14 year age group. Children now account for only 5% of clothing ignition deaths in the U.S. whereas the greatest risk is to the elderly. Three quarters of clothing ignition deaths occur among people aged 65 years and over (McLoughlin & Crawford, 1985, p.66).

5.2 Smoke detectors

McLoughlin & Crawford (1985, p. 63) point out three aspects of fatal fires which suggest that early warning is a means of reducing fires deaths:

(1) fatal residential fires most commonly occur when people are asleep;
(2) fatal fires burn for a long time before they are discovered and
(3) most deaths resulting from house fires are caused by smoke inhalation rather than burns.
Environmental control through the installation of smoke detectors has been shown to effectively decrease house fire deaths. Escape from house fires may be facilitated by early warning. The risk of death from housefire is estimated to be 2.5 times greater for persons living in homes without smoke detectors. For example, a 1984 study by the New York State Department of State, Office of Fire Prevention and Control which analyzed housefire fatalities and smoke detector use showed that twice as many deaths per 1,000 residential fires occurred in homes where smoke detectors were absent (4.0 per 1,000) as compared to where they were present and operating (1.8 per 1,000) (NYSJM, 1989).

Unfortunately, persons who are very young, very old or very drunk may not be able to respond to an alarm. Patetta & Cole (1990) estimated that these groups accounted for over half the deaths in their study.

5.3 Sprinkler systems

Those who are at greatest risk of dying in a house fire, the very young, the elderly and the incapacitated are generally unable to respond to an early warning system such as a smoke detector. In such cases residential sprinkler systems, which automatically douse the fire, would provide ideal protection for these high risk populations. It has been calculated that a home fitted with smoke alarms and residential sprinklers can be rated as 98% life-protected from fire. This means that a home with a properly functioning smoke alarm and system is unlikely to ever generate a fire which will kill the occupant (Craig, 1990, p.23).

5.4 Cigarettes

As noted earlier smoking is the largest single cause of house fire deaths in the United States.

The tobacco products which start fires are almost always cigarettes. Interestingly, the fire involvement of cigarettes compared to other smoking materials (e.g. cigarettes to cigars - over 100 : 1) appears to be much greater than product use would indicate (e.g. cigarettes to cigars - 15 : 1) (Miller, 1991, p.88). Such a result is consistent with what is known about the burning characteristics of these products. Commercial cigarettes tend to burn longer unattended (and are therefore more likely to start a fire) than other smoking materials such as pipes, cigars and self-rolled cigarettes which tend to go out if not actively smoked (McLoughlin & Crawford, 1985, p.65).

Despite long-standing evidence of the role of cigarettes in fatal fires and the fact that there were 50 patents registered in the U.S. for fire-safe cigarettes, it was not until 1984 that the cigarette manufacturing industry dropped its opposition to fire-safe cigarette legislation (Silverstein & Lack, 1987, pp.9-10).

Until that time, the cigarette was explicitly excluded from the jurisdiction of any federal regulatory agency, including the U.S. Consumer Product Safety Commission (CPSC) which has jurisdiction over the Flammable Fabrics Act and the Hazardous Substance Act (McLoughlin & Crawford, 1985, p.65).

By 1987 (Silverstein & Lack), the legal ramifications of product liability laws in relation to
cigarettes and house fires had yet to be tested although at least four such suits were pending at that time. The suits were based on two grounds:

(1) Failure to warn consumers of the risks of fire associated with cigarettes and,

(2) Defective design of cigarettes given that 50 patents exist in the U.S. for self-extinguishing cigarettes.

5.5 Cigarette Lighters

Butane lighters are the cause of a significant number of burn injuries and fire deaths in the under 5 age group. Maley (1988, p.424) reports that a review of the problem of cigarette lighters by the CPSC resulted in legislation requiring that lighters be made child resistant. He also argues that adults must also avoid the use of the lighter as a pacifier for babies and toddlers and keep lighters out of reach of children until they are old enough to understand that a lighter is not a toy.
6 AUSTRALIAN DATABASES & RESEARCH

6.1 FIRE STATISTICS

6.1.1 National fire statistics

The Australian Standard "Collection of Data on Fire Incidents: AS 2577-1983" (Standards Australia, 1983) was developed to assist firemen to collect data at the scene of fires and to enable computer analysis of the data. For this purpose it includes a model data collection form. Relevant coding for completion of the form is also contained in the Standard.

The Standard is based on the United States National Fire Incident Reporting System (NFIRS), with which it is compatible. It is also compatible with the New Zealand Fire Incident Reporting Scheme, which is also based on the U.S. system.

Within the coding system, products are grouped with varying levels of aggregation. For example "washing machines" are identified separately, while "portable appliance designed to produce controlled heat" may contain quite disparate products.

The Standard recommends that the following additional information be collected for products involved in the ignition sequence, but no provision is made for coding this information or recording it in a narrative field:

(a) Manufacturer's name
(b) Model designation
(c) Year of manufacture or serial number
(d) Brand or trade name
(e) If electrical, the current and voltage rating on the label.

Although information is also collected regarding casualties, these data are not currently entered into the national database.

This Standard is currently undergoing revision, and the new Standard is expected to be published shortly.

Strengths and limitations

Although the Australian Standard for fire data collection has been in existence since 1983, data collection forms have been developed separately in states and territories by multiple fire authorities, resulting in at least 29 different forms in 1991. Thus, as in the United States, data collection is fragmented and much of the relevant data remains in the various city and state files, often filed manually.

In order to progress the development of a national database, a joint project has been established between the CSIRO in Sydney and the Australian Assembly of Fire Associations. Currently, an attempt is underway to merge data, where compatible, from these various sources. It is envisaged that the resulting database will be a starting point from which to build an improved system. The nature of the data will reflect the research
interests of the CSIRO, which relate particularly to building design and building materials.

When the database becomes functional, there will be potential for linkage with additional databases (e.g. coroner's, or hospital admissions, and/or insurance company data) to provide a more complete picture of the chain of events leading to the fire and its outcome.

Clearly, national computerized data on fire casualties would be advantageous, as would the uniform collection of an agreed minimum data set for the national database. For the purposes of prevention, it would be particularly useful to include product information in the coded and computerized data.

Because of the nature of house fires, information about the ignition source and products involved may be lost, especially where there are no witnesses. This weakness in fire data does not appear to be overcome by the use of alternative data sources such as those operating in hospital emergency departments since these do not seem to represent the same population of fires. The VISS data presented in a later indicate that only 22% of domestic fire injuries involved actual house fires. Thus, strengthening the fire reporting system would seem to be the best option for obtaining reliable and comprehensive information on product involvement in house fires.

Further refinements to the national database might include skills training for volunteer and other "peripheral" fire-fighters in the completion of data collection forms, to improve the completeness and reliability of the collection. It may also be necessary to review whether data should be entered from original forms completed on site, and whether data entered should be altered by the availability of later information (or by filtering by more senior officers).

6.1.2 Melbourne Metropolitan Fire Brigade

Of the 7,575 fixed property fires attended by the MFB in the year ending June 30, 1989, 2,052 occurred in private dwellings. The MFB appears to collect fairly comprehensive information regarding each fire attended, which is collated in the Metropolitan Fire Brigades Board's Annual Report. The form in which this information is presented (MFBB Annual Report 1989, pp. 36-45) however, does not allow us to make any inferences about the extent to which particular types of consumer goods are involved in causing domestic house fires.

The MFB has reduced the proportion of unknown causes of fires from 30% to 4% by means of recent increase in resources to the fire investigation department.

6.1.3 Country Fire Authority

Of the 12,680 fires attended by the CFA in the year ending 30 June, 1989, 2,480 occurred in private dwellings. An analysis of the causes of fires presented in the CFA's Annual Report (Country Fire Authority 45th Annual Report for the Year Ended 30th. June, 1990) gives a comprehensive breakdown of the causes of all fires. Although there is a
comparison between urban and rural fires, no breakdown is provided exclusively for domestic fires. Of the major causes for all fires attended, 332 were caused by children playing with matches, 177 by a discarded cigarette, 261 by a domestic electrical appliances (implying a domestic fire), 225 by overheating of cooking fat or oil and 412 by short circuit.

6.1.4 State Electricity Commission

The SEC is involved in a limited way, through its Electrical Approvals section, in investigating fires involving electrical equipment. Much of their information in this regard is supplied by the MFB or the CFA. Although the SEC has a great deal of information in its files related to the performance and safety of electrical appliances and equipment, it has not been collected in any systematic way so is not readily accessible. Information is filed by make and model so information is available fairly readily on identified individual products. However, even to access information on a particular type of product such as, for example, fan heaters, would involve many hours of work. There appears to be little likelihood that this information will be available in a computer database in the future due to staff reductions and imminent changes in the structure of the SEC.

Electrical Approvals Scheme

The Electrical Approvals Scheme was instigated in 1934 to provide a uniform system of electrical approvals throughout Australia. Each state has its own independent Electrical Approvals Board which is responsible for regulating the safety of electrical products. Electric products are tested in a licensed testing laboratory and the Board is then responsible for interpreting and reviewing the test report and examining the product. Approval given in any state then applies Australia-wide.

It has been proposed that, in 1996, Standards Australia become the sole approvals authority for electrical appliances. This change will apparently involve licensing testing laboratories to do both the testing and the approval on behalf of Standards Australia. If this is the case there will be no separation of the testing and regulatory functions.

6.2 MORTALITY AND MORBIDITY STATISTICS

6.2.1 Australian Bureau of Statistics

The ABS also publishes annual mortality and morbidity data by cause for each state. These are essentially secondary data derived from the Coroner's Office and State Health Departments.

During the same period, an average of 359 Victorians were admitted to hospital (with an average stay of 12.4 days) as a result of injuries sustained in fires (ABS, Public Hospital Morbidity Victoria, 1986, 1987, 1988). The type of fire is not defined in this data so there is no indication as to the proportion of these injuries which were sustained in residential fires.

The Hospital Morbidity File does provide such information, which could be accessed for further analysis. Because the cause of injury is coded by ICD-9 E-codes the level of detail available is quite fine. Accidents caused by fire and flames (E890-E899) are defined in broad categories by three digit codes. For example: E890 - conflagration in private dwelling, E893 - accident caused by ignition of clothing, E894 - Ignition of highly flammable material. A fourth digit provides further information. For example, within E890 (conflagration in a private dwelling) the following sub-categories are defined: E890.0 - explosion caused by conflagration, E890.1 - fumes from combustion of PVC and similar material in conflagration, E890.2 Other smoke and fumes from conflagration, etc.

No information is provided as to the source of the fire and therefore no product-related information is available in either of these ABS data collections. The Hospital Morbidity File also does not provide such detail. However, the coronial data base which is discussed below has been established to provide this type of information.

6.2.2 Victorian Injury Surveillance System (VISS)

Injury surveillance data is collected in the Emergency Departments of the Royal Children's Hospital, Western Hospital (Footscray and Sunshine) and the Preston and Northcote Community Hospital, serving principally the north western suburbs of Melbourne. For children under 15 years of age all hospital admissions as the result of injury and greater than 90 percent of all injury presentations to the Emergency Department are recorded. The adult data collection, which has been operational for less than one year is less complete.

For the purposes of this report, analyses were undertaken on VISS data to determine the proportion of injuries which are due to fire and occur at residential properties. The involvement of products, and the extent to which fire related injuries in the domestic setting actually involved the building or contents of the building being on fire was also investigated.

In the under 15 years age group, 127 cases of residential injuries due to fire presented to the above-mentioned VISS hospitals between 1988 and 1991, and a further 17 cases (deaths) were included in the database from Coronial records. The total of 144 cases constituted approximately 0.3% of the total number of injury cases in this age group in the database.
Table II indicates the locations of occurrence of injury in residential fires for these 144 cases.

**TABLE II**

Locations of Residential Fires
Children under 15
(Victorian Injury Surveillance System)

<table>
<thead>
<tr>
<th>Location</th>
<th>Cases</th>
<th>%</th>
<th>Admissions</th>
<th>%</th>
<th>Deaths</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Own Home</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kitchen</td>
<td>16</td>
<td>11</td>
<td>4</td>
<td>25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Living/sleeping area</td>
<td>56</td>
<td>39</td>
<td>27</td>
<td>48</td>
<td>12</td>
<td>21</td>
</tr>
<tr>
<td>Garage/yard excl. driveway</td>
<td>48</td>
<td>33</td>
<td>30</td>
<td>63</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td><strong>Other Private Home</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Living/sleeping area</td>
<td>5</td>
<td>4</td>
<td>1</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Garage/yard excl. driveway</td>
<td>16</td>
<td>11</td>
<td>9</td>
<td>56</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Other (incl. tent, caravan)</strong></td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>33</td>
<td>1</td>
<td>33</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>144</td>
<td>100</td>
<td>72</td>
<td>50</td>
<td>17</td>
<td>12</td>
</tr>
</tbody>
</table>

Table III indicates the products which were most frequently identified as factors in residential fires which resulted in injuries to children less than 15 years of age. It should be noted that up to two factors may be identified for each case.

**TABLE III**

Products Identified as Factors in Residential Fires
Children under 15
(Victorian Injury Surveillance System)

<table>
<thead>
<tr>
<th>Product</th>
<th>Cases</th>
<th>Admissions</th>
<th>%</th>
<th>Deaths</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Petrol</td>
<td>25</td>
<td>21</td>
<td>84</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Matches</td>
<td>18</td>
<td>7</td>
<td>39</td>
<td>6</td>
<td>33</td>
</tr>
<tr>
<td>Cigarette Lighters</td>
<td>11</td>
<td>7</td>
<td>64</td>
<td>2</td>
<td>19</td>
</tr>
<tr>
<td>Outdoor BBQs, Grills &amp; Stoves</td>
<td>10</td>
<td>7</td>
<td>70</td>
<td>3</td>
<td>30</td>
</tr>
<tr>
<td>Heaters</td>
<td>9</td>
<td>5</td>
<td>56</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Petrol cans</td>
<td>8</td>
<td>7</td>
<td>88</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incinerators</td>
<td>5</td>
<td>3</td>
<td>80</td>
<td>1</td>
<td>33</td>
</tr>
<tr>
<td>Indoor Stoves</td>
<td>5</td>
<td>1</td>
<td>17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mattresses</td>
<td>4</td>
<td>1</td>
<td>25</td>
<td>3</td>
<td>75</td>
</tr>
<tr>
<td>Candles</td>
<td>4</td>
<td>1</td>
<td>25</td>
<td>2</td>
<td>50</td>
</tr>
<tr>
<td>Methyl alcohol</td>
<td>4</td>
<td>1</td>
<td>25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fireplaces</td>
<td>4</td>
<td>1</td>
<td>25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fans</td>
<td>3</td>
<td>1</td>
<td>33</td>
<td>2</td>
<td>66</td>
</tr>
<tr>
<td>Aerosol cans</td>
<td>3</td>
<td>1</td>
<td>33</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toy caps</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cigarettes</td>
<td>2</td>
<td>1</td>
<td>50</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
In this database, the only cases of electrical appliance failures causing ignition were three separate cases involving fans. At least two of these cases resulted in death. There were no cases related to television sets, electric blankets, clothes dryers, etc.

The building or contents of the building being on fire was reported in only 31 cases (21%) in this combined Emergency Department and Coronial dataset. Fourteen of the seventeen child deaths were in this house fire category, as were 12 of the 72 admissions to hospital.

Of the 19 domestic fire related injuries for persons aged 15 years or greater in the VISS database, only two involved the building or contents of the building being on fire, and no cases involved electrical appliance failures.

6.2.3 Victorian Coroner's Facilitation System

The following information regarding deaths involving fire for the period 1/7/89 - 30/6/90 has been extracted from the draft publication of the Victorian Coroner's Facilitation System. This publication was incomplete since 68 cases (of a total of 1701 unnatural deaths) have inquest results pending and therefore have not been included. In the future interrogation of the data base for such specific information will readily provide further details.

We found 43 cases involving fire and flames (excluding those resulting from vehicle collisions) which represents 2.5% of the 1701 deaths investigated by the Coroner. These are described in Table IV.

Unintentional deaths associated with domestic fires

Of the 32 cases of accidental death associated with fire at residential properties (including 3 cases at residential institutions) in the year 1989/90 which we were able to extract from the one line text descriptions, 23 died in house or caravan fires, 6 died when their clothing was ignited and 3 died in other fires on their own properties.

Of these 32 cases, 6 (19%) were children aged 5 years and under (2 males & 4 females), and 15 (47%) were aged 65 and above (8 males, 7 females).

House fires

Of the 23 deaths associated with house or caravan fires, 6 (26%) were children aged 5 and under and 10 (43%) were elderly people aged 65 and over. Three of the children died in 2 separate incidents involving the misuse of cigarette lighters by pre-schoolers. In both cases the lighter ignited a mattress. Two other children died when they were left alone sleeping and the house caught fire. The other child died in a fire started by a lighted candle.

In four other cases some form of heater was described as the ignition source. Cigarettes were implicated in three other cases and other sources of fire described were faulty electric wiring and an electricity meter.
<table>
<thead>
<tr>
<th>No.</th>
<th>Age</th>
<th>Sex</th>
<th>Source of ignition</th>
<th>Material ignited</th>
<th>Location</th>
<th>Other factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>73</td>
<td>male</td>
<td>radiator</td>
<td>not stated</td>
<td>bedroom</td>
<td>BAC 0.163%</td>
</tr>
<tr>
<td>2</td>
<td>83</td>
<td>female</td>
<td>not stated</td>
<td>not stated</td>
<td>lounge room</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>70</td>
<td>male</td>
<td>kerosene heater</td>
<td>not stated</td>
<td>caravan</td>
<td>sleeping/resting</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>male</td>
<td>lighter</td>
<td>mattress</td>
<td>bedroom</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>3</td>
<td>male</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>3</td>
<td>female</td>
<td>not stated</td>
<td>not stated</td>
<td>own home</td>
<td>children asleep left alone</td>
</tr>
<tr>
<td>7</td>
<td>58</td>
<td>male</td>
<td>not determined</td>
<td>not determined</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>female</td>
<td>lighter</td>
<td>foam mattress</td>
<td>bedroom</td>
<td>ignited by 2 1/2 y.o. brother</td>
</tr>
<tr>
<td>9</td>
<td>83</td>
<td>male</td>
<td>cigarette butt</td>
<td>not stated</td>
<td>bedroom</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>22</td>
<td>male</td>
<td>probably heater</td>
<td>not stated</td>
<td></td>
<td>sleeping/resting</td>
</tr>
<tr>
<td>11</td>
<td>22</td>
<td>male</td>
<td>not stated</td>
<td>not stated</td>
<td></td>
<td>sleeping/resting</td>
</tr>
<tr>
<td>12</td>
<td>60</td>
<td>male</td>
<td>cigarette</td>
<td>bedding</td>
<td></td>
<td>BAC 0.163%</td>
</tr>
<tr>
<td>13</td>
<td>66</td>
<td>female</td>
<td>not stated</td>
<td>not stated</td>
<td>own home</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>79</td>
<td>female</td>
<td>prob. pot belly stove</td>
<td>not stated</td>
<td>converted railway carriage</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>3</td>
<td>female</td>
<td>lit candle</td>
<td>not stated</td>
<td>converted railway carriage</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>64</td>
<td>female</td>
<td>prob. faulty electrical wiring</td>
<td>not stated</td>
<td>own home</td>
<td>sleeping/resting</td>
</tr>
<tr>
<td>17</td>
<td>75</td>
<td>male</td>
<td>unknown</td>
<td>unknown</td>
<td>caravan</td>
<td>lived alone</td>
</tr>
<tr>
<td>18</td>
<td>72</td>
<td>male</td>
<td>electricity meter</td>
<td>not stated</td>
<td>own home</td>
<td>alcoholic, lived alone</td>
</tr>
<tr>
<td>19</td>
<td>35</td>
<td>male</td>
<td>prob. cigarette butt</td>
<td>not stated</td>
<td>bedroom</td>
<td>BAC 0.190%/sleeping</td>
</tr>
<tr>
<td>20</td>
<td>66</td>
<td>male</td>
<td>not determined</td>
<td>not determined</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>not stated</td>
<td>not stated</td>
<td>not stated</td>
<td>not stated</td>
<td>own home</td>
<td></td>
</tr>
</tbody>
</table>
### TABLE IV (cont.)
DEATHS INVOLVING FIRE
1/7/89 - 30/6/90
Coroners' Facilitation System.
Victoria

#### CLOTHING IGNITED

<table>
<thead>
<tr>
<th>No.</th>
<th>Age</th>
<th>Sex</th>
<th>Source of ignition</th>
<th>Material ignited</th>
<th>Location</th>
<th>Other factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>72</td>
<td>female</td>
<td>gas stove</td>
<td>coat</td>
<td>kitchen</td>
<td>cooking</td>
</tr>
<tr>
<td>25</td>
<td>48</td>
<td>male</td>
<td>cigarette</td>
<td>clothes</td>
<td>residential institution</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>94</td>
<td>male</td>
<td>fan heater</td>
<td>pyjamas</td>
<td>special accommodation home</td>
<td>prob. fell asleep</td>
</tr>
<tr>
<td>27</td>
<td>82</td>
<td>female</td>
<td>electric radiator</td>
<td>clothing</td>
<td>own home</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>55</td>
<td>male</td>
<td>lighted match/cigarette</td>
<td>not stated</td>
<td>sitting under tree outside hospital ward</td>
<td>smoker</td>
</tr>
<tr>
<td>29</td>
<td>29</td>
<td>male</td>
<td>cigarette</td>
<td>clothing</td>
<td>not stated</td>
<td></td>
</tr>
</tbody>
</table>

#### OTHER FIRES

<table>
<thead>
<tr>
<th>No.</th>
<th>Age</th>
<th>Sex</th>
<th>Source of ignition</th>
<th>Material ignited</th>
<th>Location</th>
<th>Other factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>79</td>
<td>male</td>
<td>petrol to light incinerator</td>
<td></td>
<td></td>
<td>tried to extinguish fire when out of control, collapsed &amp; fell into flames</td>
</tr>
<tr>
<td>31</td>
<td>64</td>
<td>male</td>
<td>controlled fire</td>
<td>rubbish</td>
<td>paddock</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>66</td>
<td>male</td>
<td>not stated</td>
<td>not stated</td>
<td>shed</td>
<td>trying to extinguish fire</td>
</tr>
</tbody>
</table>
# TABLE IV (cont.)
## DEATHS INVOLVING FIRE
1/7/89 - 30/6/90
Coroners' Facilitation System.
Victoria

### SUICIDE

<table>
<thead>
<tr>
<th>No.</th>
<th>Age</th>
<th>Sex</th>
<th>Source of ignition</th>
<th>Material ignited</th>
<th>Location</th>
<th>Other factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>33</td>
<td>46</td>
<td>male</td>
<td>poured petrol over self &amp; ignited</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>38</td>
<td>male</td>
<td>incinerated self</td>
<td></td>
<td>motor vehicle</td>
<td>public road</td>
</tr>
<tr>
<td>35</td>
<td>29</td>
<td>female</td>
<td>set fire to self</td>
<td></td>
<td></td>
<td>emotionally disturbed</td>
</tr>
<tr>
<td>36</td>
<td>66</td>
<td>male</td>
<td>set himself on fire</td>
<td></td>
<td>National Park</td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>69</td>
<td>male</td>
<td>poured two-stroke fuel over self &amp; set alight</td>
<td>own home-garden</td>
<td></td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>37</td>
<td>male</td>
<td>wrapped herself in toilet paper &amp; ignited it</td>
<td>Hospital</td>
<td></td>
<td>inpatient</td>
</tr>
<tr>
<td>39</td>
<td>38</td>
<td>male</td>
<td>set himself on fire</td>
<td></td>
<td>paddock</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>51</td>
<td>male</td>
<td>poured thinners over himself and set alight</td>
<td>public road</td>
<td></td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>63</td>
<td>female</td>
<td>set herself alight</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### INTENT UNKNOWN

<table>
<thead>
<tr>
<th>No.</th>
<th>Source of ignition</th>
<th>Material ignited</th>
<th>Location</th>
<th>Other factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>42</td>
<td>19 male</td>
<td>became dowsed with petrol &amp; ignited</td>
<td>Service Station</td>
<td>service station operator</td>
</tr>
<tr>
<td>43</td>
<td>50 male</td>
<td>clothing &amp; room doused with petrol prob. set himself alight</td>
<td>own home</td>
<td>schizophrenic</td>
</tr>
</tbody>
</table>
In at least nine cases (39\%), the victims were asleep at the time of the fire outbreak. These included the two young girls described above, 3 young people (female aged 18 and 2 males aged 22) and a 58 year old man who had a BAC of 0.292\% and a 35 year-old man who had a BAC of 0.190\% at the time of the fire. Alcohol was also a factor in at least 2 other cases (all males). In at least two of the cases of intoxication the fire was caused through smoking.

*Ignition of Clothing*

Of the six deaths involving the ignition of clothing, 4 were males and 2 females.

In 3 cases (all males aged 29, 48 & 55) a cigarette or, in one case, possibly a lighted match, was thought to have caused the fire. Both the older men were residents of a hospital or institution at the time of their deaths.

The remaining cases were all aged over 65. In two of these cases a heater was described as the source of ignition. In one case, an elderly man (94), resident in a special accommodation home, was thought to have fallen asleep next to a fan heater which ignited his pyjamas. In the other, an 82 year old woman's clothing was ignited by an electric radiator. In the final case of clothing ignition in the elderly, a 72 year old woman's coat was ignited by the gas stove as she was cooking a meal.

*Other fires*

In one of these cases a 79 year old man died of a heart attack after suffering burns to his face, neck, hands and back after attempting to light an incinerator with petrol. In the other cases, two men (aged 64 and 66 years) were killed when they tried to extinguish fires: one in a shed and the other a rubbish fire which went out of control.

*Intentional deaths by fire - suicide*

There were nine cases (6 males, 3 females) in which individuals were found to have intentionally set themselves on fire. They ranged in age from 29 to 69 years.

Petrol was evident in two cases, and paint thinners in another. One woman, an inpatient at a hospital wrapped herself in toilet paper and ignited it. In the remaining five cases the mechanism by which the person ignited themselves was not described.

*Fire deaths of unknown intent*

Two other cases, where intent was not established were described. These both involved males (aged 19 and 50) who were known to suffer from schizophrenia. In separate incidents, both men became doused with petrol which was ignited.

*Summary of products involved in accidental fire deaths*

The two most commonly defined ignition sources were heaters and cigarettes.
Heaters were described as the source of ignition in six cases but the type of heater was identified in only two cases where the victims' clothing was ignited: one was a fan heater and the other an electric radiator.

In another six cases cigarettes (or possibly a lighted match in one of these cases) was identified as the source of ignition.

Other identified ignition sources were: faulty electrical wiring, an electric meter, a lit candle, petrol in lighting an incinerator and a gas hot plate.

6.3 CONSUMER PROTECTION AGENCIES

6.3.1 Ministry of Consumer Affairs

The Victorian Ministry of Consumer Affairs does not keep statistics in any systematic or accessible form. Their files consist of individual cases of unsafe or poorly performing products brought to their attention by complainants (usually members of the general public).

6.3.2 Australian Consumers' Association

The ACA does not keep statistics regarding the safety of consumer products in an accessible form although they do collect information about individual cases which are brought to their attention by consumers.

Examples of case studies are provided as an appendix to the publication, An Arm and a Leg (Australian Consumers' Association, 1989). Two of these are of particular interest.

In the first (Case 1), a video cassette recorder caught fire and, although the fire did not spread beyond the VCR unit, enough smoke was produced to kill the occupant of the house through smoke inhalation.

In the other case (Case 21), an electric room heater which could be programmed to operate automatically, came on when the house was unoccupied and caused heat damage to a door. About a month later the heater suddenly threw sparks and flames onto the carpet causing $500 damage. Although no-one was injured in either incident, there was potential for a serious house fire.

The ACA also conducts tests of performance and safety on a wide range of consumer products, the results of which are made available to the general public through their monthly publication, Choice. Approximately 50 unsafe products are identified annually, even though ACA tests only a minute proportion of the products available on the market (ACA, 1989, p.vii). A summary of their safety findings for tests conducted between 1978
and 1988 is provided as an appendix to the publication, *An Arm and a Leg*.

6.4 **RESEARCH**

Fire prevention research which relates, to some extent, to domestic fire safety is undertaken in several universities and scientific organisations in Australia. These include Victoria University of Technology, Sydney University, and the CSIRO. All of these groups focus on building design and building materials. An indication of the range of research undertaken at Victoria University of Technology, for example, is shown in Attachment 2.

Professor Robert Adler at the Royal Children's Hospital is currently undertaking research on fire-lighting behaviour in young children, including their ability to manipulate matches and cigarette lighters.

It was the common view of all fire officials and researchers interviewed that there is very little other product-related fire research currently in progress in Australia.
7 PRODUCT SAFETY

The general principles of product safety as they relate to injury prevention can also be related to fire prevention.

The categorisation provided by the Australian Consumer's Association (1989) is useful in this context:

- Injury (or fire) related to physical failure of the product
- Injury (or fire) related to inadequate design of the product
- Injury (or fire) related to inadequate instructions
- Injury (or fire) not influenced by any shortcomings of the product (e.g. misuse)

It should be noted that product failure is not the only preventable aspect of product involved fires or injuries.

A recent paper outlining a systematic approach to the reduction of product related hazards (Ozanne-Smith, 1991) recommends the following:

- Identify product related injuries
- Create public awareness of the involvement of products in injury causation
- Inform the community and manufacturers/importers that regulations set only minimum standards
- Encourage compliance with minimum standards where these apply
- Enforce mandatory standards
- Promote safe products
- Provide instructions with products detailing safe methods for use
- Increase the demand for safe products
- Monitor changes in product related injuries

Although these recommendations refer specifically to injuries, they are again applicable to fire prevention. An additional recommendation which follows from the above is that when Standards are established they should take into account the safety of the whole product, rather than only that of one component, such as electrical safety.

Australian Standards are available for many products, including several relating to fans and other electrical appliances (Standards Australia, 1990). It is beyond the scope of this review to this review to include a description of individual Standards and their status in regulations.
8 RECOMMENDATIONS

That the Australian Fire Incident Reporting System (AFIRS) database be further developed to include product and injury details, as in overseas databases.

That a structured narrative field be included in the AFIRS database to provide a textual description of the incident.

That data linkage be explored where available between AFIRS and injury, fire insurance, and other appropriate databases.

That improved methods be developed for the co-ordination and dissemination of information on product related fires e.g. improved documentation and more ready access to internal reports, and on-line access to the FIREDOC database.

That the Government Departments or agencies responsible for fire prevention should be clearly defined for Victoria and elsewhere.

That domestic fire epidemiology and prevention be targeted for research and development by the responsible bodies. This should extend beyond the current focuses.

That building codes and other relevant regulatory bodies include fire safety in regulations pro-actively and in consultation with relevant bodies such as fire-brigades relevant research organizations.

That product standards should encompass all aspects of product safety, not only that, for example, of the electrical components. These standards should become mandatory where voluntary compliance is unsatisfactory.

That effective public reporting and recall mechanisms be established for products where safety and fire hazards are identified.

That the possibility of dumping products elsewhere when they have been identified as unsafe in one state or territory be removed by legislation.

That recommendations for domestic fire prevention in Victoria be formulated into a comprehensive strategy.

That an inter-organisational body be established to oversee the development and implementation of the strategy.
9 CONCLUSION

A limited amount of information is available from existing databases about product related fires. Fire prevention research, except in the area of building design and building materials appears to be extremely limited in Australia and elsewhere. Only one research project was identified in Australia which is based on the preventive aspects of persons and/or products involved in domestic fire injuries or house fires. A series of recommendations are made as a result of this review.
REFERENCES


Burn injuries and deaths  New York State Journal of Medicine, 89 (5),1989, 229-300.


Craig, J. Smoke alarms are not enough  Fire Prevention, Oct. 1990, 22-23.

Jason, NH, FIREDOC Vocabulary List, 3rd Edition NIST Special Publication 779. NIST, Gaithersburg, Maryland, 1990.


Mierly,MC & Baker, SP. Fatal house fires in an urban population.  Journal of the

Miller, AL. Where there's smoking there's fire. NFPA Journal, Jan/Feb 1991, 87-93.


ATTACHMENT 1

COST/BENEFITS OF SMOKE DETECTORS

The Melbourne Metropolitan Fire Brigade and the Country Fire Authority attended a total of 4,532 residential fires in Victoria in the year ending June, 1989. This represents a rate of 3.25 per 1,000 households (based on ABS estimates of 1,392,700 households in Victoria at June 30, 1989).

The Insurance Council of Australia estimated that, for this period, residential property losses in Victoria, due to fire, were valued at approximately $67.2 million. On the basis of this figure and the number of residential fires attended, the average cost of damage to a single dwelling is approximately $14,830. However, since the Insurance Council's estimate does not include the cost of uninsured property, this figure represents a minimum value, the true average being somewhat higher.

In the years 1986-1988 an average of 36 people died annually in fires in Victoria (ABS, Mortality Tabulations). Of these, over half (19) perished in residential property fires (see Table I). The Bureau of Transport and Communications Economics (1987) estimates that the average cost to the community of a road accident fatality is approximately $450,000 per fatality. This figure represents the loss of the victim's potential ability to contribute at work, at home and in the community, a measure of the cost of pain and suffering as well costs generated by the accident such as emergency and health care services, legal and court proceedings, insurance procedures, police investigation and so on. The only cost which is obviously irrelevant in other forms of accidental death is the cost of vehicle damage which, for a fatal crash, might average almost $30,000. If we deduct this amount from the total we arrive at an average cost of $420,000 per fatality for other accident victims. Applying this figure to deaths incurred through residential property fires the annual cost to the Victorian community is almost $8 million dollars.

During the same period (1986 - 1988), an average of 359 Victorians were admitted to hospital (each for an average stay of 12.4 days) as the result of injuries sustained in fires (ABS, Public Hospital Morbidity, Victoria, 1986, 1987, 1988). If we assume that the same ratio of residential : non-residential fires applies in these cases as in deaths (1.12 : 1) then approximately 189 of these injuries could be attributed to residential property fires. Based on 1988/89 estimates of the cost per in-patient bed-day at one of the principal teaching hospitals in Melbourne (e.g. The Alfred Hospital: $512.40 per day; Health Department, Victoria, 1989) the total cost of hospitalisations due to residential property fires is around $1.2 million annually. This figure applies solely to the cost of hospital care and does not take into account other medical and rehabilitation costs, loss of earnings or any other costs associated with incident.

Based on the figures given above, it is conservatively estimated that residential property fires cost the Victorian community at least $76.4 million annually. The actual cost is probably much higher.

Given the potential for loss of life or injury and the cost of property damage associated with fires in private dwellings, the need for fire prevention and protection measures for residential properties cannot be over-emphasized.

A simple and relatively inexpensive protective measure favoured by the Melbourne Metropolitan Fire Brigade is the installation of self-contained smoke detectors in domestic situations.

Such a device should comply with the Australian Standard 3786-1990 (or the British Standard 5446 or United Nations Standards UL219, UL268 or S531). Since the Australian
Standard was only introduced in 1990; it is unlikely that a smoke detector is yet available on the Australian market which has been tested against this Standard. However, a smoke alarm which complies with the British Standard currently retails for around $40 (Black & Decker Smoke Alarm sold through McEwan's stores). Another brand is available for around $30, but there is no indication on the packaging or advertising leaflets that it complies with any of the abovementioned standards.

Important requirements of the Australian Standard are that the smoke alarm have a visual 'power on' indicator, such as a pulsing LED, flashing at least once every 60 secs. to indicate that it is working and, where the primary power supply is from the 240V mains supply, the unit must have a battery back-up since many domestic fires occur due to electrical faults.

The MFB recommends that the detector be located between areas of risk (e.g. kitchen/living areas) and the bedrooms since the main value of a smoke detector is in providing a warning to sleeping occupants.

Smoke detectors are particularly sensitive in comparison to heat detectors and sprinklers. Given that over half (54%) of the deaths incurred in residential property fires in Victoria are in the elderly (65 years +) and pre-school (0 - 5 years) age-groups, early detection to allow the evacuation of persons who may have difficulty in removing themselves from proximity to the fire is vital. It is for this reason that the Building Code of Australia (1990) specifies (among other measures) that all health care facilities "must...have smoke detectors installed in patient care areas and the path of egress from each such area to a public space" (Section E1.7). As pointed out by the CSIRO (1990, p.111):

> Automatic fire and smoke detection and alarm systems are required in buildings where evacuation of the occupants may take a long time or require special organisation. They are essential in warning occupants remote from the fire. Sprinkler systems that automatically signal the fire alarm on activation are an alternative to heat detectors. However, they are not an acceptable alternative to smoke detectors which give the earliest possible warning of fire development.

Research suggests that smoke detectors are indeed effective in reducing serious injuries and saving lives. In the United States, where the unit cost of a basic smoke detector is much lower than in Australia, a number of smoke detector giveaway programs have been implemented and evaluated. The relative risk of being killed by a fire in a home without a smoke detector installed compared with the risk in a home with a smoke detector is 2.5:1 i.e. a 60% reduction (Federal Emergency Management Agency, U.S.A., cited in Gorman et al., 1985 p.14). Between 1984 and 1988 an intensive, community-based program undertaken in Dade County, Florida resulted in a decrease in fire-related deaths from 26 in 1985 and 27 in 1986 to 17 in 1987. In the city of Miami, the county's inner core, fire-related deaths decreased by half from 1985 to 1987, in spite of an increase in high-risk population groups and sub-standard housing (Hammond & Varas, 1990).

In the case of property losses it would seem to follow that early warning of a fire, with consequent action to extinguish it, should result in less damage. A study by Hygge (1989) which compared compensation pay-outs for property losses before and after the distribution of 21,000 free smoke detectors by a Swedish insurance company concluded that smoke alarms reduce the average property loss in heavy fires.

Victoria will adopt the Building Code of Australia (BCA) on April 1st, 1991. As mentioned earlier, the BCA currently requires the installation of smoke detectors in all health care facilities. The Victorian Department of Building Control (Ministry for Planning and Urban Growth) has prepared an addendum to the Victorian BCA Variations relating to the installation of self-contained smoke alarms in residential buildings. This will come into force at the same time and will require that smoke alarms, designed in accordance with the Australian Standard (AS 3786-1990), be installed in every dwelling on which building work is being carried out. This will affect not only new buildings but as much of the existing
housing stock as possible since it will be mandatory that any building work relating to existing dwellings and residential buildings also includes the installation of smoke alarms. It is expected that most of the alarms installed will be of the battery-operated type which are relatively inexpensive. However, in the case of new buildings the required self-contained smoke alarm must be connected directly to the mains power supply.

Based on the 1989-90 figures relating to building activity in Victoria (ABS, 1990) it can be expected that at least 46,000 smoke detectors will be installed in new and existing homes in the first twelve months from the introduction of the legislation. To coincide with the introduction of the new legislation the Fire Authorities have indicated that they will conduct an education campaign to ensure that the public is fully informed of the benefits of installing self-contained smoke alarms. This should result in further installations of smoke detectors in existing homes not covered by the new building regulations.

The cost of installing a self-contained battery-operated smoke detector in every existing household in Victoria would be approximately $55.7 million at the current retail price of $40 per unit. If the minimum cost to the Victorian community of residential fires is, as calculated earlier, around $76.4 million annually, a 73% reduction in deaths, injury and property damage would be required to cover this cost in twelve months. However, a 15% reduction in the first twelve months and maintained over the estimated 5 year life of a smoke detector would cover the initial cost in this period. These figures represents maximum costs since an unknown number of households already have smoke detectors installed and the unit cost of approved detectors could be expected to decrease given the large increase in demand. Given also that the actual cost to the community of residential house fires is greater than the estimated minimum of $76.4 million, then a smaller reduction in losses due to death, injury and property damage would be required to cover the cost of the smoke detectors. If, for example, the cost per unit was $30, it would cost $41.8 million to install smoke detectors in every household in Victoria. Based on the same annual cost to the community of $76.4 million for residential fires, a reduction of 55% in deaths, injuries and and property damage would be required to cover this cost in twelve months. In this case, an 11% reduction maintained over 5 years would cover the initial costs over this period. Given the estimated 60% reduction in risk of death due to installation of a smoke detector, previously discussed, it is clear that the installation of a smoke detector in every home could have benefits considerably in excess of costs over the 5 year life of a detector.

References:

Australian Bureau of Statistics
Building Activity, Victoria, September Quarter, 1990. (Cat no. 8752.2)
 Dwelling Unit Commencements Reported by Approving Authorities, Victoria, October, 1990. (Cat no. 8741.2)


CSIRO Division of Building & Construction Commentary on the Building Code of Australia 1990.

Department of Building Control Addendum to the Victoria BCA Variations 1990.


Health Department, Victoria Hospital Comparative Data Set 1988/1989.


Insurance Council of Australia: personal communication with Mr. Ian Shearer, Technical Manager, 3/1/91.


Standards Australia Self-contained smoke alarms AS 3786-1990.
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Exciting Research Opportunities

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Undertake research on catastrophic hazards which affect people and the natural environment.

The Centre for Environmental Safety and Risk Engineering has been established by Victoria University of Technology to develop cost-effective designs and management for those hazards in the built environment which have the potential for catastrophic consequences. Such hazards represent a threat to the safety of urban communities, property and the natural environment. Examples of hazards being investigated by the Centre include:

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(b) Hazardous Industrial Complexes - Fire, Explosion and Release of Hazardous Substances
(c) Transport of Hazardous Goods through Residential Areas.

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As a result there are exciting opportunities to undertake research projects at Masters and PhD levels. Many of these projects will be jointly supervised by research staff from industry. A listing of areas of research is given below:

Applied Science
• Environmental Monitoring and Modelling of Fires and Other Hazards
• Quantifying Hazards to Life Safety

Biomechanics
• Movement of People during Emergencies

Engineering
• Computational Fluid Dynamics
• Fire Suppression
• Fire Growth and Spread Modelling
• Risk Assessment Modelling
• Structural Response to Fire Exposure
• Transport Route Planning

Mathematics
• System Modelling and Reliability Studies

Psychology
• Organisational Communication during Emergencies
• Decision Making during Emergencies

Urban Planning
• Impact of Planning Control Mechanisms on Hazard Amelioration

We invite expressions of interest and applications from (prospective) honours graduates, in any of the above areas who are interested in this dynamic area of research. For further information please contact, in the first instance, Professor V. Beck, Director, Centre for Environmental Safety and Risk Engineering on 688 4230. Graduates can apply for a range of postgraduate scholarships available through the University.

Closing Date: Submit completed application forms by 31 October 1991 with the Assistant Registrar, Academic, Victoria University of Technology, PO Box 64, Footscray, Victoria 3011.