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ANALYSIS OF INCIDENTS INVOLVING OPEN FIREPLACES AND SOLID FUEL HEATING APPLIANCES DURING THE WINTER OF 1987

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PREFACE

This report is an analysis of information collected on fire incidents involving open fireplaces and solid fuel heating appliances during the winter of 1987.

ACKNOWLEDGEMENT

The data presented in this Study Report were provided by the New Zealand Fire Service (through its Fire Safety Division), Local Authority Building Inspectors and BRANZ Technical Advisory Staff. Their co-operation and enthusiasm are gratefully acknowledged.

This report is intended primarily for use by Local Authority Building Inspectors and Fire Safety Officers of the New Zealand Fire Service. Parts of it will also prove useful to those engaged in design, construction and installation of open fireplaces and solid fuel heating appliances.

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REFERENCE

Woodside, A. 1988. Analysis of Incidents involving Open Fireplaces and Solid Fuel Heating Appliances during the Winter of 1987. Building Research Association of New Zealand, BRANZ Study Report SR11, Judgeford.

KEYWORDS

From Construction Industry Thesaurus, BRANZ edition:

Analysis; Chimneys; Fire; Fireplaces; Flues; Installing: New Zealand; Solid Fuel Heating; Statistical Data; Stoves; Workmanship.

ABSTRACT

An analysis is undertaken of data on domestic fire incidents reported during 1987 in New Zealand arising from the use of open fireplaces and solid fuel burning heating appliances. Such incidents resulted in the main from improperly constructed chimneys and fireplaces, poor practice in the installation of appliances, and inadequate maintenance measures. The Report is published with the aim of reinforcing the need for good construction, installation and inspection practices, thorough and regular maintenance procedures and a rigorous attention to detail in the reporting of fire incidents.

INTRODUCTION

A number of fire incidents involving solid fuel heating appliances designed for installation into existing fireplaces were reported by the New Zealand Fire Service (NZFS) over a short period during the winter of 1986. The Building Research Association of New Zealand (BRANZ) was asked to investigate the cause of these incidents in its role as a supplier of technical expertise to building related problems. This investigation resulted in a series of seminars, given jointly by the NZFS, BRANZ and the New Zealand Home Heating Association in the spring of 1986, which highlighted areas of poor construction and installation practice leading to fire hazard. It also became obvious that there was a need for data collection on a national scale and covering the wider area of domestic home heating installation and use.

This study, of fire incidents during 1987, was undertaken for the following reasons:

1. To quantify the hazards associated with open fireplaces in dwellings, primarily those where solid fuel heating appliances have been installed.

2. To identify the most common causes of such hazards and so recognise inappropriate means of construction, installation and usage.

3. To establish a sound basis for the continued collection and analysis of information on fire incidents of this type.

4. To provide input to a BRANZ research project concerned with modes of heat transfer and identification of risk associated with the design and construction of the typical New Zealand fireplace and chimney.

ANALYSIS OF DATA

The incidents comprising this analysis form an unknown fraction of the actual number occurring throughout New Zealand during the period of survey. This is a consequence of the fact that not all incidents are brought to the attention of New Zealand Fire Service personnel. Most information received has come via Fire Safety Division staff who will not themselves have been present at the scene of all incidents attended by operational Fire Officers. Some of the information reported is incomplete, for example in description of the material and means of construction of open fireplaces and chimneys, thus pointing out the need for more thorough investigation and reporting of the scene of a fire incident.

Detail is generally not available on fuel type and usage, though the large majority of appliances featuring in the data are known to be designed for use with timber fuel only.

As regards appliance models, most of those available in New Zealand are represented, but because the primary cause of incidents is rarely attributable to the model itself, the data have not been dissected further in this respect.

Property loss involved repair of damage ranging from replacement and redecoration of small areas of wall lining, to major renovation following collapse and/or demolition of fireplace, chimney, wall and roof framing. One incident led to demolition of the entire house.

It is interesting to note that no deaths were attributed by the New Zealand Fire Service to mishap involving the incidents reported. It was apparent in six cases that a real threat to life existed with respect to the alerting of occupants to the presence of fire and smoke in their home. Such incidents were usually discovered during the normal hours of sleep although in one case a householder returned, unexpectedly, in the early evening to find one of the occupants asleep in front of the fireplace with a smell of burning which turned out to be the smouldering beginnings of a fire incident. The risk to life indicated in this report is in no way overestimated. The construction and installation practices identified as being major contributors to fire hazard are universal. This is the justification for the analysis of data as published here.

Table 1: Fireplace Appliance Type

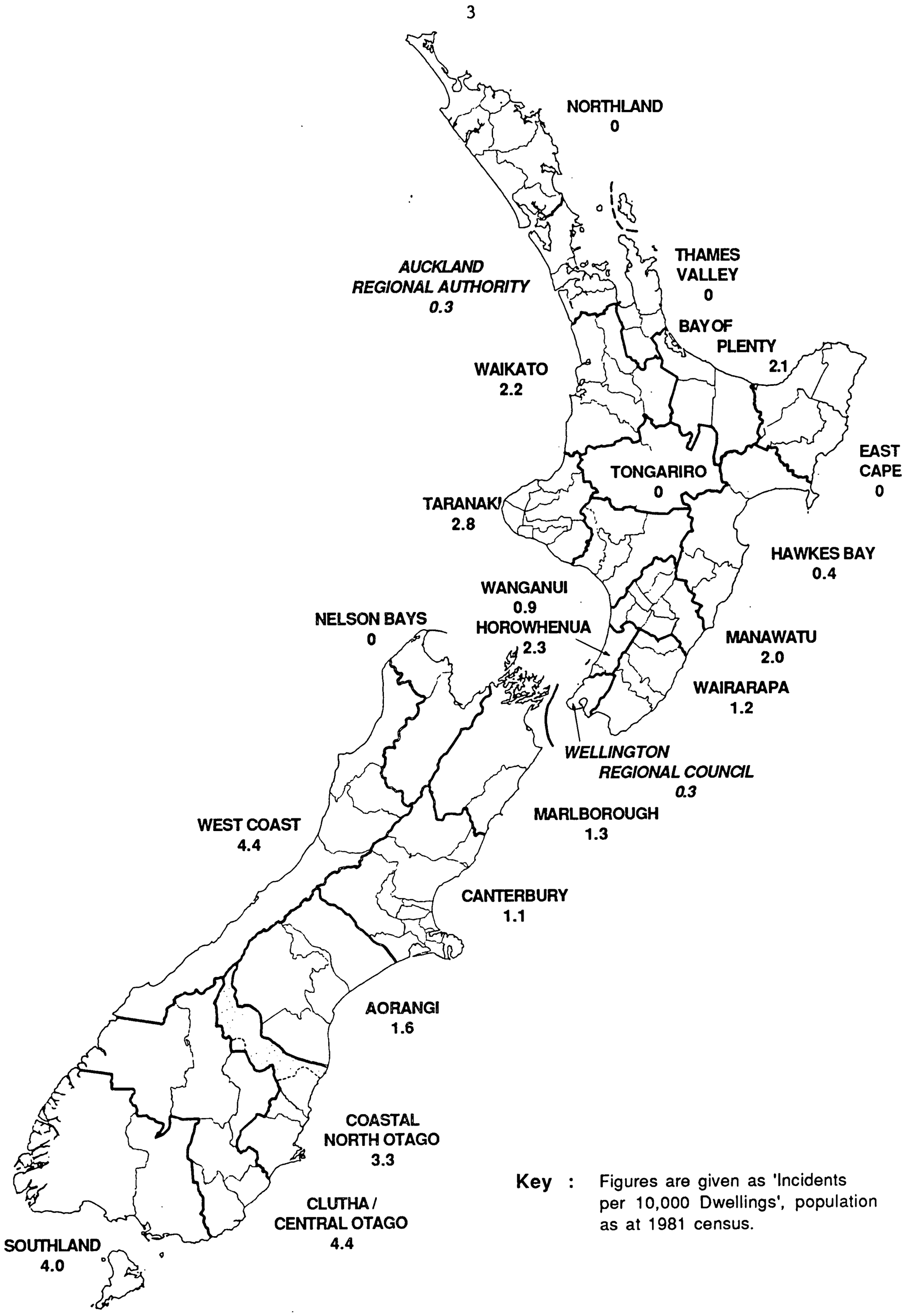
Category	Reported Incidents	% of Reported Incidents	% of the 'Population'	Incidents/ 10,000 installations
open fireplace	13	20	46	0.5
inbuilt heater	15	23	18	1.5
freestanding heater	29	45	36	1.5
other	8	12	-	-
Total	65	100	100	-

Comment on Table 1

'Other' includes incidents where the heating source was not identified or where the means of installation could not be classified according to the above system, e.g., a coal range, or through-wall heater.

The open fireplace category cannot be broken down further since in the majority of cases detail as to material of construction was not supplied. The 'population' of a given heating source is defined as its estimated occurrence in New Zealand dwellings. The values used, based on the 1981 Census of Population and Dwellings and information from the NZ Home Heating Association, were:

Open Fireplaces	250,000
Inbuilt Heaters	100,000
Freestanding Heaters	200,000
Population Total	550,000



Key : Figures are given as 'Incidents per 10,000 Dwellings', population as at 1981 census.

Figure 1 : Location of incidents

LOCATION OF INCIDENTS

The data in Figure 1 (opposite page) are derived from the New Zealand Census of Population and Dwellings 1981. Certain assumptions have been necessary:

All 'Occupied Permanent Private Dwellings' which have the use of solid fuel as one of their means of heating were taken as being 'potential' sites of fire incidents.

The changes in occupancy throughout the country since 1981 have been disregarded. There were no data collected on means of heating in the 1986 Census.

To limit the number of geographical locations, incidents were plotted on a Local Government regional basis.

The pattern of occurrence shown in Figure 1 may reflect a higher incidence of reporting from some areas rather than a real effect in terms of incident numbers. This may be due to a greater concentration of reporting personnel and/or a greater awareness of potential problems. For example, 1987 saw the reporting to BRANZ of about twice the number of incidents as in 1986, despite the generally held view that the winter of 1987 was comparatively mild throughout the country. Two thirds of the incidents did, however, take place during June and July.

Despite these potential anomalies, it is clear that from a regional viewpoint some areas of the country are much more likely to record incidents than others. It would be unwise to manipulate the data beyond a grouping into 'high risk' and 'low risk' categories. These would comprise:

<u>High risk</u>

West Coast; Clutha/Central Otago; Coastal/North Otago; Southland.

<u>Low Risk</u>

Northland; Auckland; Thames Valley; East Cape; Tongariro; Hawkes Bay; Wellington; Nelson Bays.

Age of Property/Installation at Time of Incident

For age of installation the range covers:

Open Fireplace	2 years - 80 years
Inbuilt Heater	2 months - 10 years
Freestanding Heater	2 months - 13 years

Table 2: Cause and Frequency of Incidents

Source of Heating	Primary Cause		Occurrence by % of Incidents
Open Fireplace	Construction	- inadequate clearance to combustibles	39
		- defective surround seal	31
	Maintenance	- cracks and mortar defects	39
Inbuilt Heater	Installation	- inadequate clearance to combustibles	47
		- damage to lintel	20
		- inadequate ventilation/ misuse of insulation	20
	Maintenance	- cracks and mortar defects	20
		- flue defect	7
Freestanding Heater	Installation	- inadequate clearance to combustibles at ceiling/floor level	41
		- inadequate clearance to framing timber	45
		- enclosed flue	10
		- misuse of insulation	7
	Maintenance	- flue defect	10

Comment on Table 2

It will be noted that in 39% of the incidents involving an open fireplace the primary cause has been identified as inadequate clearance of combustibles (framing timber) to the heat source.

For some incidents the primary source could not be identified. Thus, one incident may appear listed in more than one category. Conversely, a small number of incidents do not appear at all due to incomplete data.

One incident, occurring 2 months after installation of an inbuilt heater, followed 40 years usage as an open fireplace. Another, also involving an inbuilt heater, occurred 5 years after installation into a previously unused fireplace. The implication is that heat damage to framing timber may be well advanced during years of open fireplace usage; the installation of a fireplace heater without repairing such damage can result in a fire incident after a comparatively short period of further use. Both of the incidents described occurred due to the same primary cause, a defective seal of the fireplace surround to the fire box.

SUMMARY

Analysis of reports on fire incidents involving domestic heating sources in New Zealand (open fireplaces and solid fuel heaters) for 1987 revealed that:

1. Although heat damage to framing timber or structural damage to the fireplace or chimney may be present after many years of use of an open fireplace, a fire incident is more likely to occur as a result of subsequent faulty installation of an inbuilt heater. In other words, the use of a heater in a deficient open fireplace and chimney presents a considerable hazard.

2. The most common deficiencies in construction of the chimney and open fireplace lie in an incomplete seal of fireplace surround to the firebox and inadequate clearances between framing timber and the concrete or masonry of construction.

3. Incidents due to incompetent installation of free-standing appliances continue to be reported despite well-documented techniques for safe practices. Particular areas of concern are flue penetrations of ceilings and clearances of flues to framing timber.

4. It is clear that a much more conscientious approach to inspection and installation is required to avoid continued loss of property and the probable consequence of loss of life.

5. The continued collection of information on fire incidents of this type is essential in monitoring the effectiveness of education programmes in raising the level of awareness of safe practice among the building industry and the public. Such information also allows field experience to influence the depth and direction of research into the mechanisms of heat transfer within the building structure.

6. For this information to be useful in the long term it must be as complete as possible. This means a thorough approach to investigation at the scene of the fire and a recording of detail sufficient to break down the data to a level where trends can emerge. For example, in order to identify an unusually high risk associated with a particular building practice in the construction of an open fireplace and chimney, it is necessary to know the material and means of construction, its age and fuelling history. It is always better to secure this knowledge at the time of investigation - follow-up reporting is very much second best. It may require more time and more detail in form-filling, but the work is justified if it helps to reduce risk to life safety and to increase property protection.

STANDARDS

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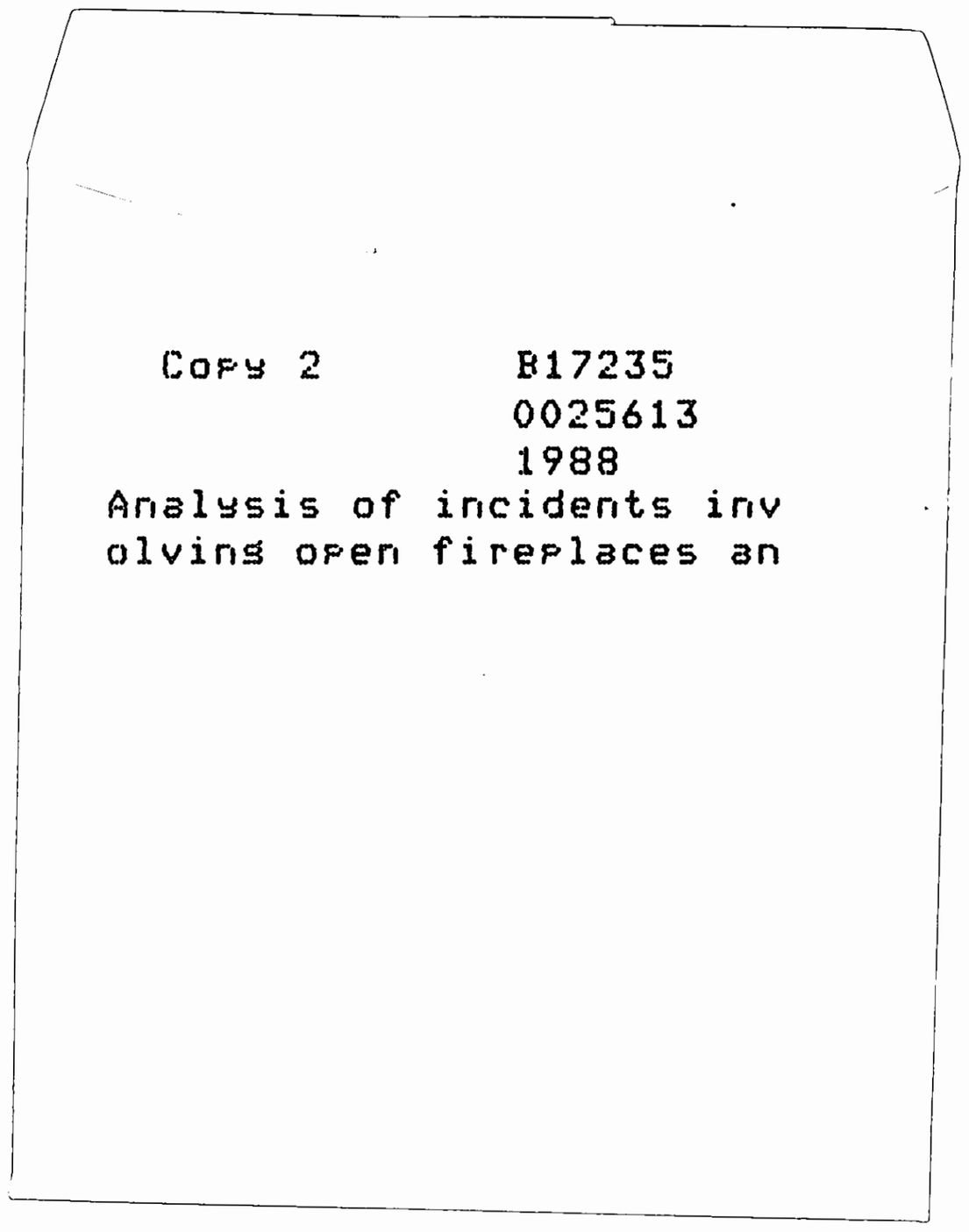
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