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DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH AND FIRE OFFICES' COMMITTEE
JOINT FIRE RESEARCH ORGANIZATION

NOTE ON THE WORK OF THE OPERATIONAL RESEARCH SECTION OF THE
JOINT FIRE RESEARCH ORGANIZATION

Summary

The note gives a brief indication of the type of work carried out in the Operational Research Section and includes some examples of past analyses.

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NOTE ON THE WORK OF THE OPERATIONAL RESEARCH SECTION OF THE
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The Operational Research Section devotes its attention largely to what may be described as "background" information to enable the various aspects of the fire picture to be seen in their proper perspective. It is able to do this because of the arrangement made through the Home Office with Local Authorities whereby a report is received on every fire attended by a Fire Brigade in the United Kingdom. The basic data thus obtained are used to produce annual tables of fire statistics. At present the Section is concerned with the cost of fire to the country, particularly the loss due to direct damage, the cost of fire protection measures in buildings and, linked with this, the provision of Fire Brigade cover.

It is generally believed that the cost of direct damage by fire in the United Kingdom is approximately £25 million per annum; this is estimated from the cost of "large" fires (i.e. those costing more than £10 000 each) and "medium" fires (i.e. those costing between £1 000 and £10 000 each) by adding 70 per cent to their aggregate cost to allow for the numerous small fires that occur. It has to be realised that the figure thus obtained takes account of direct damage only and does not include the cost of the loss of output, the cost of fire services (approximately £20 million per annum), the cost of meeting safety and fire resistance requirements in buildings, the cost of fire protection equipment such as sprinklers, alarms and extinguishers, or the administrative costs of fire insurance. Knowledge of the inter-relation between these items is of importance, as may be seen from a simple example: from a study of reports of fires causing more than £10 000 in direct damage it is clear that, in most of these, considerable damage has been done before the arrival of a Fire Brigade and there appears to be no relation between the loss sustained and the period that elapses between the call for assistance and the arrival of the Brigade. From this it would appear that the provision of automatic detectors and/or sprinklers might well reduce the cost of large fires, but whether this would be an economic proposition or not cannot be decided without the preparation of estimates of the cost of installing equipment, and some knowledge of its effectiveness. These are points to which some consideration is now being given.

The direct cost of fire and the numbers of fires causing more than £10 000 worth of damage each year have been increasing since the war, but it is interesting to note that, when allowance has been made for changes in the value of money, it appears that both the "real" value of the direct loss and the numbers of large fires have remained fairly constant since the war. There is some evidence that the total "real" annual cost of direct fire damage is now rather lower than it was in the inter-war period.

Although in economic terms fires in dwellings are less important than those in industrial premises, they number more than half of the fires in buildings attended by Fire Brigades each year and are important from other points of view. Statistical studies of the fire hazard of non-traditional houses built since the war have already been made and have been useful in drawing attention to particular danger points in certain types of houses; they have also provided information on the effectiveness of protective measures adopted to reduce the rate of spread of fire in one particular type of permanent non-traditional house.

From a scientific point of view, the study of fires in dwellings would be expected to be useful because they constitute a reasonably large and fairly homogeneous population and because there is available information about the numbers at risk. This, it is expected, will be of particular value in connexion with work now being undertaken on levels of fire brigade cover. Work already done on fires in dwellings has shown that the rate of incidence, i.e. the number of fires per 10 000 dwellings at risk per annum, is greater in Scotland than in England and Wales. At first it was thought that this might be connected with the known greater density of occupation in Scotland, but when figures were examined for different areas in England and Wales, no relationship between rate of incidence and density of occupation could be discerned. It is interesting to note that there appears to be a correlation between rate of incidence and the economic status of householders - the higher

rates of incidence being associated with the higher economic status. There is at present no explanation for this relationship.

The analyses referred to above are mainly items of research which are still in hand or still to be started. Numerous special analyses have been undertaken in the past ten years, the following are some examples:

Fires in the textile dyeing, printing, bleaching and finishing industry

This is one of the industries with the highest fire losses and was selected, after discussion with the Fire Offices' Committee, for a special study of fire incidence. It was found that the annual rate of incidence of fires in the industry was similar to the rate estimated for other branches of the textile industry. The major part of the financial loss was found to arise from a small number of large fires and, although machinery and buildings were damaged in nearly all of these, to have been generally due to damage to stocks of textiles. One of the major factors contributing to the incidence of fire was found to be the presence of textile fly and dust which are easily ignited and which were the materials ignited first in about 25 per cent of the fires. Generally ignition of these materials resulted from mechanical sparks, electric sparks, or heat in drying, singeing and other machinery. From the results of the survey it appears probable that losses could be reduced by wider use of sprinkler systems, by the sub-division of stored textile materials and by attention to sources of ignition such as overheating of machines, friction of machinery, and heat and sparks from electric motors.

Fires caused by sparks from locomotives

At the request of a Working Party of the Interdepartmental Fire Prevention Committee a study was made of reports of fires caused by sparks from locomotives. About 22 000 reports were examined, only 4 per cent of which were concerned with fires starting in buildings. It was noticed that there were peak periods for the occurrence of these fires during the four years covered by the study and attention was given to the relationship between these sudden increases in frequency and weather conditions in the London area. The results suggested that when the relative humidity fell below 48 per cent at 3 p.m. on any day between mid-May and mid-September, a peak period was imminent; once this started it tended to continue until at least 6 mm of rain had fallen in 3 or less consecutive days. Although this work has not been further extended it clearly has a bearing upon the occurrence of fires in vegetation of all kinds and a similar approach has been found useful in the United States and Canada, particularly in assessing the probability of the occurrence of danger periods in connection with forest fires.

Fires involving cinematograph film

A study of the fire incidence in commercial cinemas during the years 1946-52 showed that there was a decrease in the incidence of fires involving cinematograph film which was believed to be, in part at least, due to an increase in the attention given to fire precautions. During the period, the British film manufacturing industry turned to the manufacture of cellulose acetate safety film instead of the highly flammable cellulose nitrate film and by 1950 the safer product was in common use; from about this time the decrease in the incidence of fires in commercial cinemas became more marked than in the rest of the period, so that the value of changing from one type of film to the other was clearly demonstrated.

Casualties caused by the ignition of clothing

In conjunction with experimental work on the flammability of textiles used for clothing, a statistical study was undertaken in which a number of hospitals agreed to co-operate. Detailed reports of the injuries sustained and circumstances in which the accidents occurred were supplied, together with specimens of the fabrics involved. Study of these reports and the flammability of the fabrics is continuing, but the results so far obtained show clearly that the majority of casualties are female, mostly young children and old people, and that the fabrics most frequently involved are not those of very high flammability, but the cotton fabrics commonly used for making nightgowns, light weight skirts and light frocks and dresses. It is not yet known whether the flammability of the fabric is related to the seriousness of the burns sustained.