F.R. Note No. 286/1956

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

JOINT FIRE RESEARCH ORGANIZATION RADIO TALK

# TWENTY FIVE MILLION POUNDS GO UP IN SMOKE

by

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Director of the Fire Research

(Broadcast: Thursday 20th December, 1956: 7.00-7.15 p.m.
Repeated: Saturday 22nd December, 1956: 9.00-9.15 a.m.)

January, 1957.

Fire Research Station,
Boreham Wood,
Herts.

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Ever since man started to use fire he has known that it is dangerous when it is out of control. For that reason he developed regulations such as Curfew (which was simply the 'covering of fire' before he retired to bed) and practically every large fire has prompted some new safety measure leading to our present day byelaws and factories acts. You get, outbreaks in homes, offices, shops, warehouses, factories, schools, ships, aircraft, and so on; they may involve ordinary materials such as clothing or furniture, or some of the potentially dangerous substances that are handled in industry; they may be caused in a thousand and one different ways, as it happens two of them are rarely alike.

Just how much there is to do, you appreciate when I tell you that each year the Fire Brigades of Great Britain and Northern Ireland attend more than a hundred thousand fires ... apart from chimney fires, seven hundred and fifty people lose their lives as a result of fire, the injured spend a quarter of a million man-days in hospital. More than twenty-five million pounds go up in smoke. Since the War something like three hundred million pounds of National assets have disappeared in this way, assets that particularly in these days, we cannot afford to lose.

How then does the scientist approach a problem so wide and diffuse in trying to provide a more scientific basis to our modern fire prevention requirements? As in any other type of research it is necessary to 'identify the problem' and break it down into a form in which it can be studied experimentally, and in which it is possible to examine separately the influence of every factor that can have a bearing on the subject.

Clearly the first thing is to get the problem into perspective, and to try to find where detailed research is likely to be of most help. This is done by what has come to be known as Operational Research, a name for the use of modern statistical method to unravel complicated situations as they are found in nature, and to provide grounds on which to base policy. The Fire Brigades co-operate in this work by sending a report of every fire which they attend. The figures we get in this country are the most comprehensive of their kind that have been collected anywhere, and they are the only ones that give an actual measure of the efficiency of fire protection.

Perhaps the best way of illustrating this point will be to give you an example.

After the War a number of departures from traditional methods of building construction were introduced. By operational research we were able to show that although these changes did not necessarily increase the number of fires to which the Fire Brigades had to go, with one or two of the new forms the probability of serious damage (which might involve rebuilding) was four or five times as great as with the traditional type of house. It was also demonstrated that improvements suggested by the Fire Research Station would reduce the hazard to the level encountered in traditional buildings.

Let us take another example, about half the annual fire damage is caused by some two hundred or so of the larger fires; the other half comes from the more numerous smaller ones. A number of factors have been recognized as contributing to large fires, but their combined effect is such that when the Fire Brigade arrives they are confronted by a difficult situation ... a very large fire. The inference is that perhaps the most effective single step that could be taken to reduce the number of large fires would be to provide reliable means of detecting them when they start.

You might think that these conclusions could have been guessed at least in a general kind of way. The same remark could be made of another conclusion, namely, that most fires must be attributed to carelessness or ignorance. What is new in the present approach is that for the first time we have, through Operational Research, an estimate in figures, and one that gives some guidance in considering the very difficult question of the extent to which improvement is likely to come from education on the one hand, or from trying to make everything foolproof on the other. Operational researches are beginning to help in planning fire precautions, and it is becoming increasingly clear that in the future, to be economic, these precautions must be more accurately designed for specific needs.

So setting the various problems in perspective is the first task of fire research. The next is to try to recognize factors that are common to a number of problems. When this has been done it is possible to undertake research to supply basic information that can be applied over a wide field of fire protection. In looking for such factors it may be worth pointing out that much of the work of the Fire Research Station ultimately goes into the development and maintenance of the standards that are needed in connection with fire protection regulations. For instance, tests to indicate the resistance of a wall, a floor, or a roof, in a large fire; or the effect that the surface materials in a room will have on the rate at which a fire develops; the value of treating a fabric to make it burn more slowly; the effectiveness of a foam-making compound; or the merits of a new type of extinguisher.

Of course testing of this kind is not new. Since the closing years of the last century tests have been carried out continuously to give Local Authorities information about the fire resistance of various types of building construction.

A common feature in all these tests is that a specimen of some kind is submitted to the effect of heat. And it is vitally important that the size of the experimental heat source should be appropriate to the specimen; it is not always realised, for instance, that a match applied to a small fragment of material may be a much more severe test than a blow-lamp applied to a specimen a foot square. In practice we are concerned with sources of heat that range from, say, a friction spark in an explosive atmosphere ... a coal mine for example; a cigarette end on a mattress or a thin layer of dust; a domestic fire with clothing near it; an accumulation of materials that are capable of spontaneous heating or even spontaneous ignition; or, at the other extreme, the heat from a building on fire in relation to a neighbouring building, or perhaps the heat from an atomic explosion. The crux of the problem is - Will the rate at which heat is transferred from the source to the combustible material be sufficiently greater than the rate at which it is lost by conduction or radiation for ignition to take place?

In many instances the processes involved are not well enough understood for the problems to be dealt with by reference to fundamental considerations, and there is a great need for more research. Most of the existing tests had to be developed by trial and error, and they are open it is true to the objection that they do not truly indicate how a material will behave in an actual fire. They may tell us which is the better of two materials, but not whether one or both is good enough for the job. For this very reason ... that we have not enough basic information ... some of the tests have to be carried out on a full-scale, a very expensive and time consuming business. It is not yet possible to rely on small scale tests as, for instance, one can with aircraft or ships in a wind tunnel, and one of the aims of experiments that are going on at the moment is to discover laws that will enable us to use scale models to a much greater extent.

In many of the problems of which the scientific background is fairly well understood the mathematical treatment is often very complicated. But we can sometimes short-circuit tedious calculations by using the fact that the laws governing the flow of heat through the body are analogous to those that apply to the flow of an electric charge through an appropriate circuit. We can make an electrical model of a wall, for instance, in which series of resistances and capacitors represent the heat resistance and capacity of successive thin layers of the wall; we can apply a pulse which corresponds to the application of heat to one side of the wall and it is then possible by means of a cathode ray tube to read immediately the temperature changes at any part of the wall. The electric analogue at the Fire Research Station has removed the need for many preliminary large scale tests, and it is proving useful in reducing the data from fire tests to a form in which they can be used by architects and engineers in future design. The device has proved so useful that other countries are adopting it.

As in all research laboratories as much use as possible is made of the results of work that is going on in other places. For instance, many laboratories are carrying out research on the sort of controlled combustion that you set in furnaces or engines. A lot is known about the way a flame moves through known mixtures of gas and air. Something is known, too, about the function of the wire gauzes in a miner's safety lamp. But our knowledge of these is not yet sufficient to enable us to design flame arresters for many industrial processes in which flammable vapour-air mixtures are used. But research is now being conducted in this field to assist the Factory Department of the Ministry of Labour and National Service.

So far I have only considered the starting of a fire, the way it grows, and the damage it can do; there is still the problem of putting it out. In this connection it is convenient to remember that for a fire you must have three things ... a combustible material, heat, and air; if you take away or reduce one of them the fire goes out. Broadly speaking the outstanding problems in this field are to find the most efficient ways of using various extinguishing agents, and just how some of the newer types work in putting out a fire. Among the newer materials the chemical substances like chloro-bromomethane, which is now on the market, and the so called 'dry powder' which is largely bicarbonate of soda. So far it is not known exactly how they act, but they can be very efficient for dealing with oil fires within their scope.

Fire research must constantly move on and it is not possible to do more than mention some of the very interesting practical problems posed by modern developments, such as the effect of fire on pre-stressed concrete, or the effect of fire in one compartment of a large building which is designed so that the maximum use is made of the strength of every part of the structure. There is, however, just one final thing that I would like to say, as it is nearly Christmas. It is this:- only a small proportion of the fatalities from fire involve ordinary adult people. Nearly a quarter are children, and nearly three quarters are elderly people. Most of the casualties begin to occur about this time of the year when winter fires are in full swing. A good deal could be done by greater care with the young and the old. Simple things like fireguards prevent an untold number of accidents.