Richt of Congress No. Agger. Ngi

F.R. Note No. 91/1954 Research Programme Objective C1/2

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

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THE DISTRIBUTION OF WATER BY IMPIRITIES SPRAYS

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# Summary

An analysis of the dimensions of, and the distribution of water in, the floor area wetted by impinging jet sprays projected horizontally has shown that pressure has little effect on the size of the area or the uniformity of distribution. Decreasing the size of the spray nozzles and increasing the angle at which the jets impinge produce a more even distribution of water.

January, 1954.

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### Introduction

In F.P.E. Note 42/1950 values of the effective width and length of the wetted area and the maximum concentration of water are given for spray nozzles of three sizes over a range of pressures and angles of impingement. By means of these data it is possible to show the effect on the distribution of water of varying the size of the nozzles, from 1/16 in. to 3/16 in. diameter, the angle of impingement from 20 in. to 90 in. and the pressure from 20 lb/sq.in. to 120 lb/sq.in.

#### The wetted area

An inspection of the results given in F.P.E. Note 42/1950 shows that there is no consistent variation with pressure in the length or width of the area wetted by the impinging-jet type spray nozzles tested, other than below 40 lb/sq.in. Below this pressure, an increase of pressure invariably increases the length of the vetted area, and usually decreases its width. These effects are not large and as an approximation an average has been taken over the whole experimental range of pressure. These average values of length, width and wetted area are shown in Figs. 1, 2 and 3 for angles of impingement up to 90° and for three sizes of nozzle. The area is calculated on the assumption that it is elliptical and is therefore given by the product "length x width x the shape factor 1/4". The length and the width of the wetted area both increase with the nozzle size but as the angle of impingement is increased the wetted length decreases and the width increases, the resulting effect being to increase the area slightly for sprays from 1/16 in. nozzles and more so for the larger nozzles.

#### The uniformity of the distribution of water

The existence of data on the maximum concentration of water suggests a method of comparing the degree of uniformity in the distribution of water. Since the total flow through a nozzle and the area wetted by it can be obtained a value can be found for the average concentration of water in the wetted area. This is approximate not only because the area is not necessarily elliptical, 'nor indeed, necessarily of any shape common to all the sprays, but also because the length and width of the wetted area had been defined '' by a "contour line" of 0.01 g.p.m./sq.ft. With these reservations the ratio of maximum concentration to average concentration is an indication of the unevenness of the distribution. This ratio has been calculated for all the experimental conditions. It does not vary significantly with pressure, and average values over the pressure range are shown in Fig. 4 for various spray conditions. For a completely uniform spray this ratio should be unity and it is seen that this value is approached as the angle of impingement is increased and as the nozzle size is decreased.

#### Discussion

In the range of spray conditions studied the effect of increasing the diameter of the nozzles is to make the distribution of water falling out of the spray less even. This effect is more pronounced at low angles of impingement.

Although the length of the wetted area is not necessarily a measure of the throw of the spray which must involve the position of the maximum concentration of water, it is of interest that pressure has no marked effect on the length and the width of the wetted area, nor on the uniformity of the water distribution above a certain pressure which for 1/16 in. and 1/8 in. jets is 40 lb/sq.in.

Increasing the angle of impingement increases the wetted area, and the uniformity of cover in that area.

As a result of the above considerations it is suggested that the quantity Maximum concentration x length x width (of wetted area) nozzle flow

or its reciprocal can be a basis for a measure of the uniformity distribution of water.

## Reference

(1) J. F. Fry and P. M. T. Smart. "The production of firefighting sprays by impinging jets". Department of Scientific and Industrial Research and Fire Offices' Committee Joint Fire Research Organization. F. P.E. Note 42/1950.

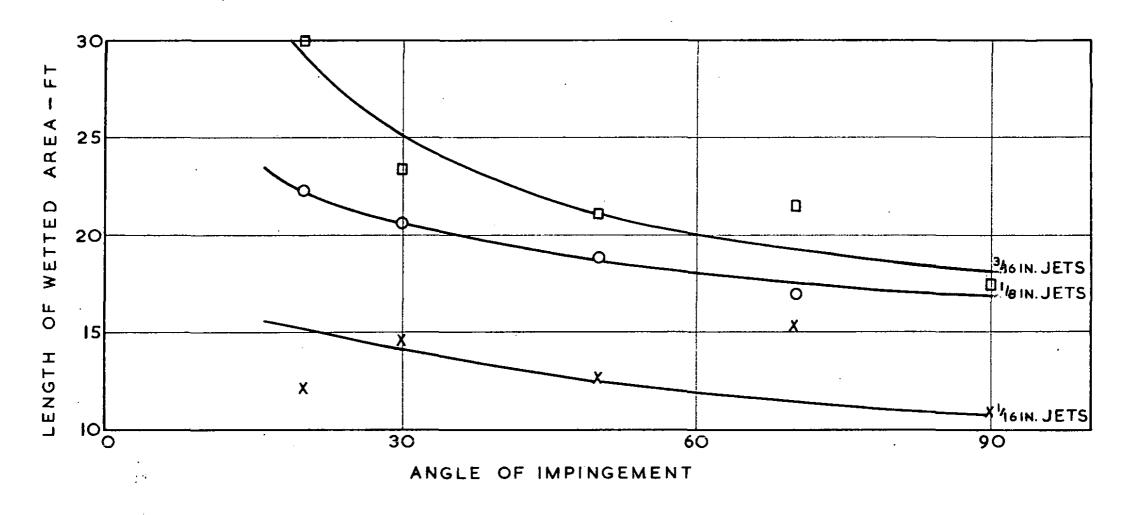


FIG. . THE VARIATION OF THE LENGTH OF THE WETTED AREA WITH THE IMPINGEMENT ANGLE AND THE NOZZLE SIZE

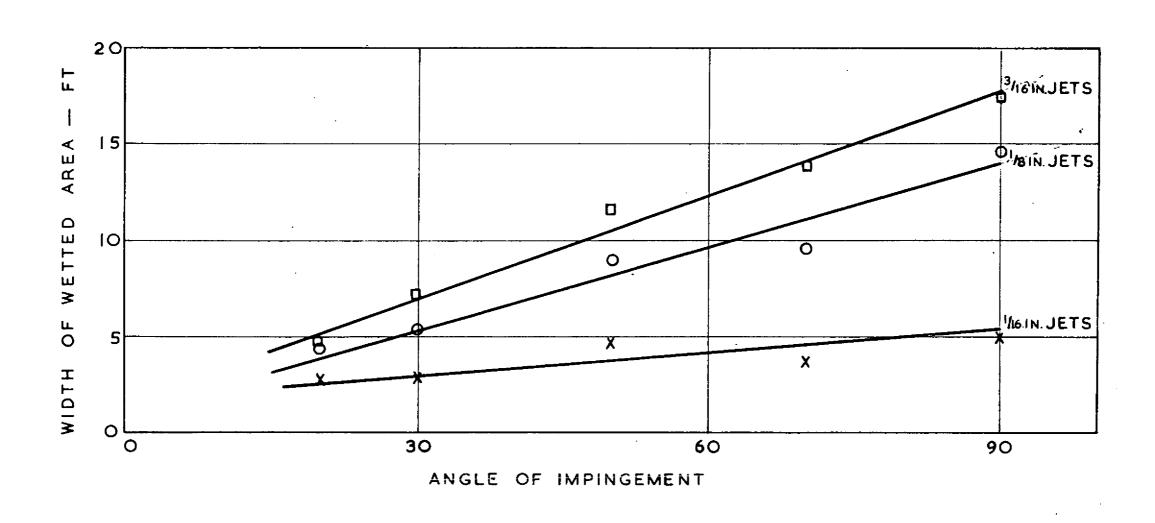
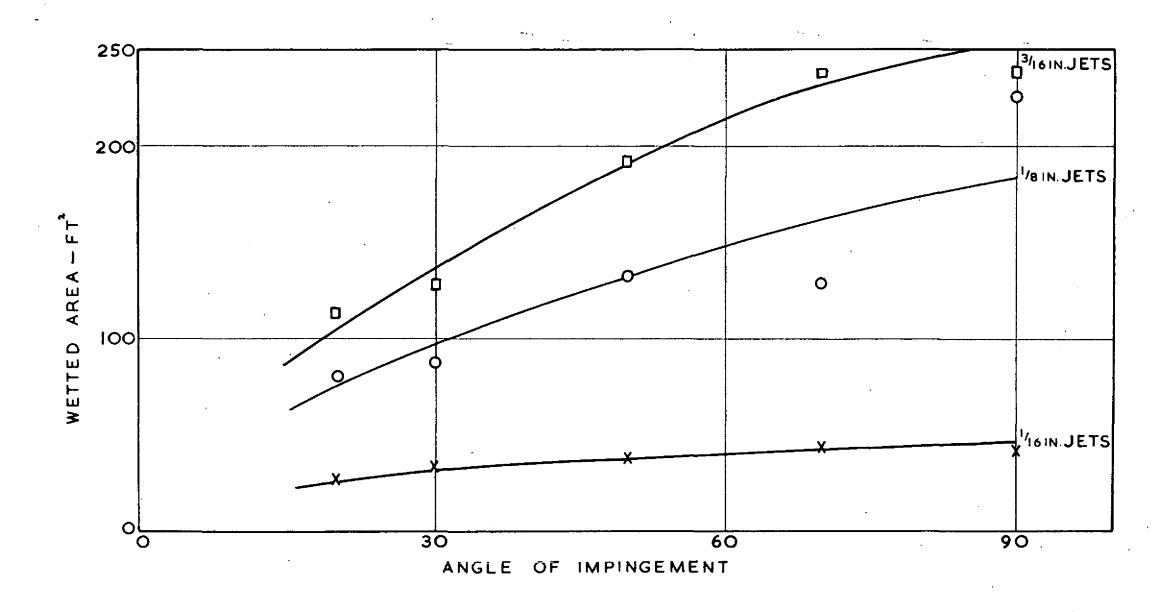


FIG. 2. THE VARIATION OF THE WIDTH OF THE WETTED AREA WITH THE IMPINGEMENT ANGLE AND THE NOZZLE SIZE



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FIG. 3. THE VARIATION OF THE WETTED AREA WITH IMPINGEMENT ANGLE AND THE NOZZLE SIZE

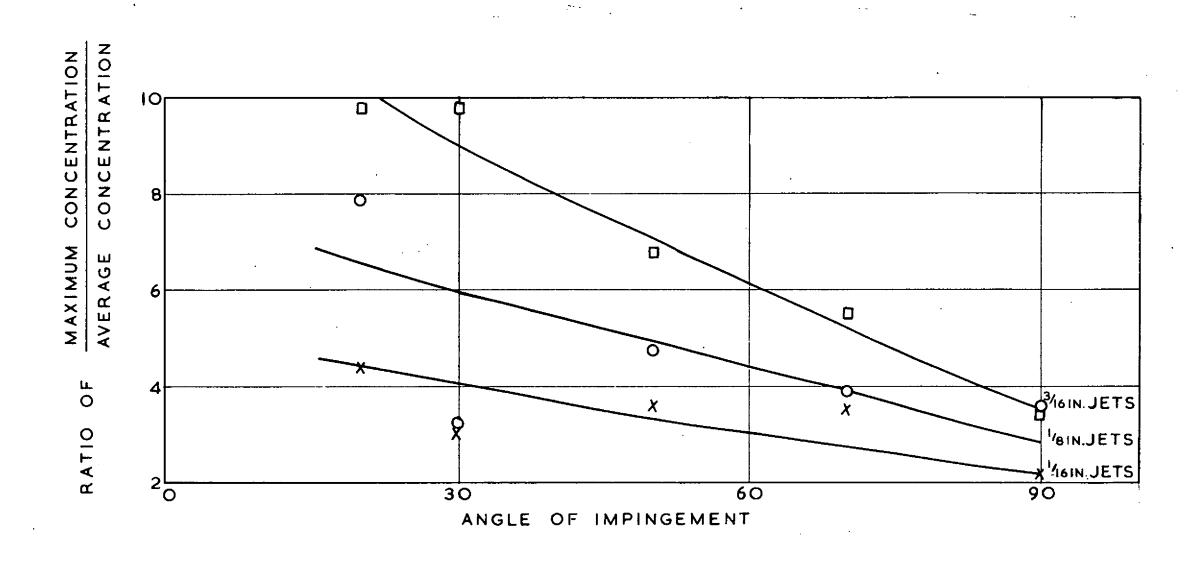


FIG. 4. THE VARIATION OF THE RATIO OF THE MAXIMUM TO AVERAGE CONCENTRATION WITH THE IMPINGEMENT ANGLE AND NOZZLE SIZE