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THE COMPATIBILITY OF FLUORO-CHEMICAL  
AND FLUOROPROTEIN FOAMS

by

S P BENSON, D J GRIFFITHS and J G CORRIE

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FIRE  
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STATION

**Building Research Establishment  
Fire Research Station  
Borehamwood  
Hertfordshire WD6 2BL  
Tel 01-953 6177**

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SUMMARY

This note describes a measurement of the compatibility between fluorochemical and fluoroprotein foams, by means of burn-back resistance.

KEY WORDS: Foam, Compatibility, Burn-back

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## THE COMPATIBILITY OF FLUORO-CHEMICAL AND FLUOROPROTEIN FOAMS

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### INTRODUCTION

Previous work, (F.R. Notes 975 and 925) involving the use of fluorochemical and fluoroprotein foams, has indicated that there is a certain amount of incompatibility between the two. The conclusion from these reports is that burn-back and re-ignition protection are reduced when the two foams are used together.

The compatibility of the two foams is of practical interest, particularly to Airport Authorities. A case could be foreseen where the first attendance vehicle at an aircraft fire carried fluorochemical foam and the back-up vehicle fluoroprotein foam.

Small laboratory fires were used in the previous tests; in this case it was decided that a larger burn-back test ( $2 \text{ m}^2$ ) be used, to ascertain the compatibility of the two foams.

### EQUIPMENT AND MATERIALS USED

- Tray : made from welded 10 gauge steel sheet  
1 m wide x 2 m long x 10 cm deep
- Sparge pipe  
and hydrogen : A normal commercial grade of hydrogen supplied  
a sparge pipe which was fitted across one end of  
the tray, to give a re-ignition source for burn-back.  
The sparge pipe had ten 2.4 mm holes along it and the  
hydrogen was used at  $17.2 \text{ kN/m}^2$  pressure.
- 5 l/min branchpipe (as described in F.R. Note 971) fitted by means of  
hose to a pressurized 9 litre extinguisher of foam solution.
- Fuel : Avtur Quantity : 45 litres/test  
An aviation turbine fuel  
( Avgas 80  
( Initial ignition source
- Foam : Fluorochemical (L.W. FC 200)  
A synthetic foam liquid based on fluorinated hydrocarbons.  
Used as a 6 per cent solution.
- Fluoroprotein  
A commercially available fluorinated protein-based foam.  
Used as a 4 per cent solution.

## EXPERIMENTAL PROCEDURE

Preliminary tests were carried out on the two foam liquids separately, using 45 litres of fuel per test in the 1 m x 2 m tray.

The fuel was allowed to preburn for one minute, then foam was applied from the 5 l/min branchpipe for a period of 100 s using 690 kPa pressure, (extinction being completed during this time). After a further minute the fuel was reignited by means of the hydrogen jets and the time for the tray to become completely full of flame, i.e. the burn-back time, was noted. Three burn-back times were obtained for each foam liquid separately.

On completion of these tests various model tests designated A, B, C and C<sub>1</sub> were tried. Model A simulated the situation where a fire is extinguished with fluorochemical foam and becomes re-ignited 10 minutes later and is extinguished with fluoroprotein foam. Model B, where the fluorochemical foam does not completely extinguish and fluoroprotein foam is used immediately. Models C and C<sub>1</sub>, where each foam is applied for the same period of time, (50 s) with only a 35 s wait in between applications.

The method for each model is described in Appendix 1, 45 litres of fuel (Avtur) was used per test and the foam application in every case was with the 5 l/min branchpipe. Burn-back times were obtained for each model and the results are shown in Table 1, together with the times for each foam used alone.

## DISCUSSION

In Fire Research Note 975, the burn-back time given by fluorochemical foam on a 0.15 m<sup>2</sup> Avtur fire was 50 per cent of that given by fluoroprotein foam.

The results obtained from Table 1 in this series of tests, using a 2 m<sup>2</sup> Avtur fire, showed that, when fluorochemical foam alone was applied to extinguish the fire its burn-back time was 72 per cent of that obtained when fluoroprotein foam was used alone.

Models A, B, C and C<sub>1</sub> all gave burn-back times which were very similar to that of fluorochemical foam alone and between 67 per cent to 81 per cent of that for fluoroprotein foam alone.

The results obtained in these tests are considered more meaningful than those reported in the earlier Fire Research Notes 975 and 925. A larger fire was used and the experiments were conducted outside, where there was some wind effect, which simulated practical conditions. The foam was also applied by a branchpipe to give forceful rather than gentle surface application.

## CONCLUSIONS

1. Fluorochemical foam used on a 2 m<sup>2</sup> Avtur fire gave a burn-back time of 72 per cent of that obtained with fluoroprotein foam on the same size fire.
2. When the two foams were applied together on the fire the burn-back time varied between 67 and 81 per cent of the time for fluoroprotein foam alone.
3. While there was a definite decrease in the burn-back times obtained when the two foams were used together, it was not sufficient to warrant a strict avoidance of using the two foams together in practice.

## APPENDIX 1

### Methods for the model fires

#### Model A

Preburn time : 1 min  
1st application : fluorochemical foam applied to extinguish  
Waiting time : 10 min  
Re-ignition : with petrol  
Burning time : 2 min  
2nd application : fluoroprotein foam applied for 100 s  
Waiting time : 1 min  
Re-ignition for burn-back : hydrogen jets

#### Model B

Preburn time : 1 min  
1st application : fluorochemical foam applied for 10 s  
Waiting time : 1 min  
2nd application : fluoroprotein foam applied for 100 s  
Waiting time : 1 min  
Re-ignition for burn-back : hydrogen jets

#### Model C

Preburn time : 1 min  
1st application : fluorochemical foam applied for 50 s  
Waiting time : 35 s  
2nd application : fluoroprotein foam applied for 50 s  
Waiting time : 1 min  
Re-ignition for burn-back : hydrogen jets

#### Model C1

Preburn time : 1 min  
1st application : fluoroprotein foam applied for 50 s  
Waiting time : 35 s  
2nd application : fluorochemical foam applied for 50 s  
Waiting time : 1 min  
Re-ignition for burn-back : hydrogen jets

Table 7

Summary of results of burn-back times

	Fluoroprotein alone		Fluorochemical alone		Model A		Model B		Model C		Model C1	
	m	s	m	s	m	s	m	s	m	s	m	s
	6	32	5	52	6	42	6	27	6	19	5	30
	10	25	5	49	4	29	4	15	7	34	6	43
	8	53	6	55	7	48	6	30				
Av.	8	37	6	12	6	20	5	44	6	57	6	7