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# Fire Research Note No 1049

## AN EVALUATION OF HAND PORTABLE FOAM TYPE FIRE EXTINGUISHERS

by

54006

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# FIRE RESEARCH STATION

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SUMMARY

Chemical and mechanical type foam extinguishers were compared using four different liquid fuels and six sizes of tray fires. Three different foam liquids were used in the mechanical type extinguishers.

Mechanical type extinguishers gave quicker fire control and extinction than did the chemical type. Using the mechanical type extinguishers significant differences in control and extinction times were obtained when different foam liquids were used.

KEY WORDS: Fire extinguisher, chemical foam, protein foam, fluoroprotein foam, fluorochemical foam.

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INTRODUCTION

The tests were devised to determine the relative efficiencies between Defence Standard type 9 litres chemical foam extinguisher and a 9 litre mechanical foam type extinguisher using standard protein foam liquid, fluoroprotein foam liquid, and fluorochemical foam liquid, on the following fuels:

- 1) Petrol - Avgas 100L.  
Specification D Eng RD 2485
- 2) Kerosine - Avtur F34  
Specification D Eng RD 2453
- 3) Solvent - White Spirit  
Specification BSS 245
- 4) Diesel - Navy 20 Pour (47/20 Dieso) NATO F76 -  
Specification Defence Standard 91-4/2 AMI

Tray fire sizes conforming to European Standard CEN (CENTRI 2-2) 313 E were used as the basis for standard test fires. The trays were circular and of the areas shown in the graphical results.

The chemical foam extinguisher was of the Dual Seal type conforming to Defence Standard 42-4 and the chemical charges conformed with Defence Standard 42-9 comprising 0.68 kg of sodium hydrogen carbonate with stabilizer and 0.85 kg aluminium sulphate.

The mechanical foam extinguisher was a converted Defence Standard water gas extinguisher equipped with a controllable discharge and a Minimax type foam branch. The expellant consisted of a seventy-four gramme CO<sub>2</sub> cartridge and the premix solution was 6 per cent V/V concentrate in tap water.

The requirement was to record and plot the 9/10 control and the extinction times for each of the fire tests.

The tests were conducted at the MEM4 fire test ground, RAF Cardington, Beds.

#### TEST PROCEDURE

The test procedures were based upon European Standard EN3 - Fire Fighting Portable Fire Extinguishers - Part 1.

Preburn time was thirty seconds after full ignition of the fire tray.

The chemical foam extinguisher charges were mixed and allowed to stand for a minimum period of twenty-four hours before use to allow for absorption and settling as would happen in service.

The mechanical foam extinguisher charges were pre-mixed immediately before use.

With the smaller size trays 21B and 34B care had to be taken not to blow the fuel from the tray or cause mixing of the foam and fuel. A stand-off position was adopted in the initial attack to counter this effect.

Each test was duplicated and the mean values used for the graphs.

Operation of the extinguisher and fire fighting were carried out by the same operator.

Control times were estimated by direct observation by experienced test personnel.

Each test was duplicated but if the results differed by more than 5 seconds a further test was carried out. The mean value of the two best results was used to produce the graphs.

#### TEST RESULTS

Tables 1-5 record the results obtained, and Figs 1-8 depict the results for each fuel. Figs 9 and 10 show the control and extinction times for all four fuels and foams when the 55B tray was used. This tray size was selected as being a representative one at which the performance of the extinguishers using different foams on each of the fuels can be fairly compared.

Observed extinguisher discharge times were:

- 1) Chemical foam - 76 s
- 2) Mechanical foam - 52 - 54 s

#### DISCUSSION AND CONCLUSIONS

From Figs 9 and 10 it can be seen that AVGAS was the most difficult fuel to extinguish, diesel and white spirit being the least difficult.

Figs 9 and 10 also illustrate that the mechanical foams had superior control and extinction times than those of the chemical foam.

The three foam liquids had various degrees of merit, the fluorochemical was the most effective, fluoroprotein not quite so effective, and protein still less so. This is not however a completely valid comparison between the foam liquids, because the performance of each might be improved if a nozzle designed as regards discharge rate and foam quality for each foam liquid was used.

TABLE 1  
TABLE OF 9/10 CONTROL AND EXTINCTION TIMES

FUEL: 100L AVGAS

		Chemical Foam		Standard Protein Foam		Fluoroprotein Foam		Fluorochemical Foam	
		Seconds		Seconds		Seconds		Seconds	
No	9/10 Control	Extinction	9/10 Control	Extinction	9/10 Control	Extinction	9/10 Control	Extinction	
Tray Size: 21B									
1	16	37	13	25	10	13	7	10	
2	16	30	17	28	13	20	8	11	
3									
Tray Size: 34B									
4	36	54	15	30	12	20	10	13	
5	31	48	20	35	14	23	9	12	
6									
Tray Size: 55B									
7	39	53	25	52	17	27	12	15	
8	Nil	Nil	32	54	17	27	12	17	
9	39	52							
Tray Size: 70B									
10	54	Nil	26	53	19	33	12	19	
11	38	Nil	28	52	19	31	11	17	
12	41	Nil							
Tray Size: 89B									
13	Nil	Nil	38	Nil	27	43	18	26	
14	Nil	Nil	47	Nil	25	36	23	31	
15	Nil	Nil	43	Nil					
Tray Size: 144B									
16			Nil	Nil	28	Nil	25	39	
17			Nil	Nil	34	Nil	24	37	
18			Nil	Nil					

TABLE 2  
TABLE OF 9/10 CONTROL AND EXTINCTION TIMES

FUEL: AVTUR

No	Chemical Foam		Standard Protein Foam		Fluoroprotein Foam		Fluorochemical Foam	
	9/10 Control	Extinction	9/10 Control	Extinction	9/10 Control	Extinction	9/10 Control	Extinction
Tray Size: 21B								
19	12	14.5	10	17	8	10	6	11
20	14	20	10	18	8	11	7	12
21								
Tray Size: 34B								
22	22	40	17	27	11	15	6	16
23	19	29	17	26	12	16	8	15
24	22	32						
Tray Size: 55B								
25	23.5	42	21	39	15	25	8	15
26	25	43	20	38	15	27	10	17
27								
Tray Size: 70B								
28	29	45	28	47	12	20	8	11
29	26	53	19	38	13	26	8	13
30	29	54	18	32				
Tray Size: 89B								
31	37	Nil	26	38.5	23	29	13	18
32	39	Nil	25	42	22	27	13	20
33	36	Nil	31	53				
Tray Size: 144B								
34	Nil	Nil	33	Nil	27	52	20	23
35	Nil	Nil	34	Nil	30	50	18	25
36	Nil	Nil						



TABLE 3  
TABLE OF 9/10 CONTROL AND EXTINCTION TIMES

FUEL: WHITE SPIRIT

No	Chemical Foam		Standard Protein Foam		Fluoroprotein Foam		Fluorochemical Foam	
	9/10 Control	Extinction	9/10 Control	Extinction	9/10 Control	Extinction	9/10 Control	Extinction
Tray Size: 21B								
37	13	26	8	10	8	15	6	10
38	10	23	9	12	7	12	7	10
39								
Tray Size: 34B								
40	12	21	10	20	7	16	10	17
41	12	21	11	18	9	14	9	14
42								
Tray Size: 55B								
43	14	31	12	27	13	22	10	18
44	14	35	14	24	10	18	11	18
45								
Tray Size: 70B								
46	15	32	21	45	10	17	9	16
47	17	31	21	44	11	19	9	15
48								
Tray Size: 89B								
49	36	Nil	28	52	19	31	12	21
50	28	Nil	26	48	22	36	12	24
51								
Tray Size: 144B								
52	31	Nil	26	Nil	19	49	24	39
53	27	Nil	26	Nil	22	47	29	44
54								

TABLE 4

## TABLE OF 9/10 CONTROL AND EXTINCTION TIMES

FUEL: DIESEL Navy 20 Pour (47/20 Dieso) NATO F76  
Specification DEF STAN 91-4/2 AMI

No	CHEMICAL FOAM		STANDARD PROTEIN FOAM		FLUOROPROTEIN FOAM		FLUORO-CHEMICAL FOAM	
	9/10 Control	Extinction	9/10 Control	Extinction	9/10 Control	Extinction	9/10 Control	Extinction
Tray Size: 21B								
1	13	20	6	10	7	11	4	7
2	11	14	7	10	6	10	4	7
Tray Size: 34B								
3	19	21	8	16	7	11	5	10
4	15	23	8	12	7	10	6	11
Tray Size: 55B								
5	21	29	12	18	14	18	6	10
6	26	31	13	20	11	16	8	15
Tray Size: 70B								
7	34	42	15	28	15	21	10	16
8	28	36	14	25	15	22	10	16
Tray Size: 89B								
9	30	45	15	30	17	30	13	18
10	27	42	17	27	17	30	14	18
Tray Size: 144B								
11	56	Nil	30	47	30	43	22	40
12	49	Nil	30	47	28	47	22	34

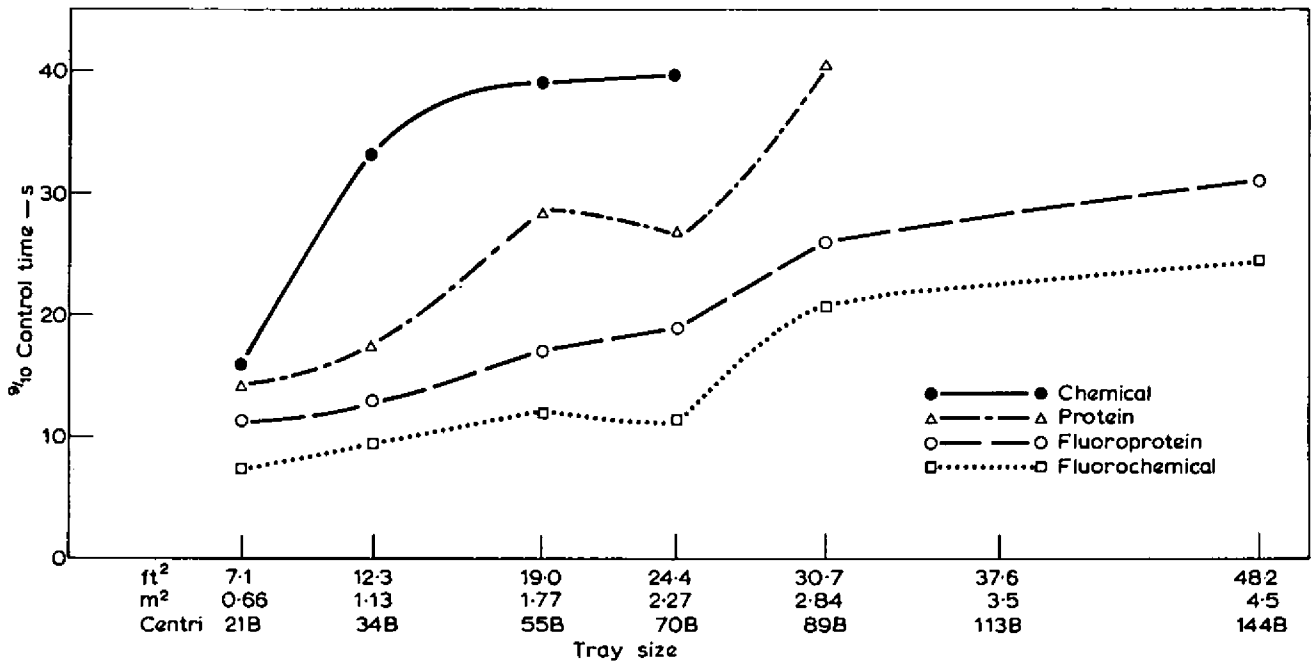


Figure 1 Control times with AVGAS fuel

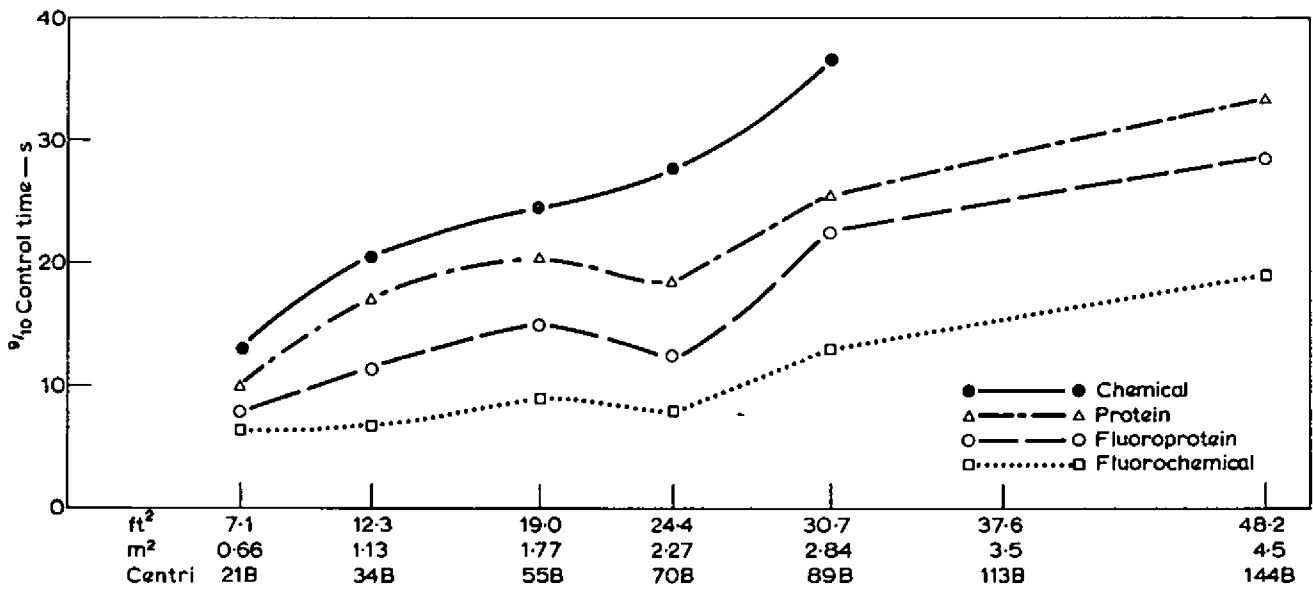


Figure 2 Control times with AVTUR fuel

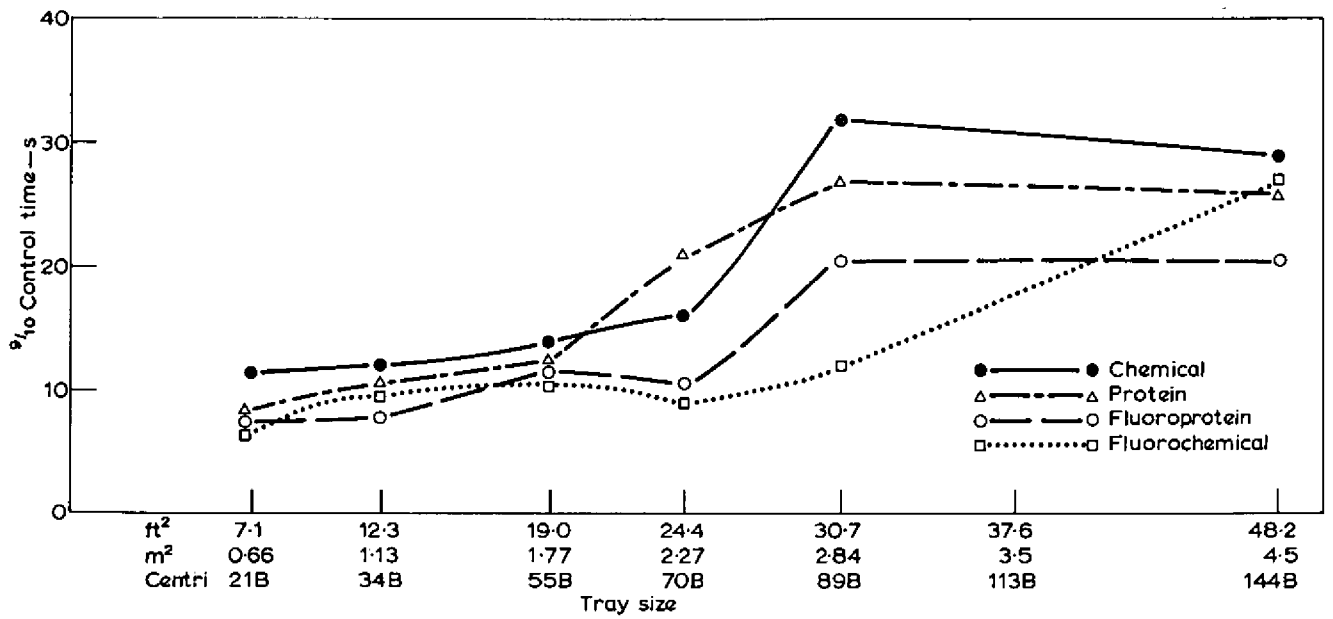


Figure 3 Control times with white spirit fuel

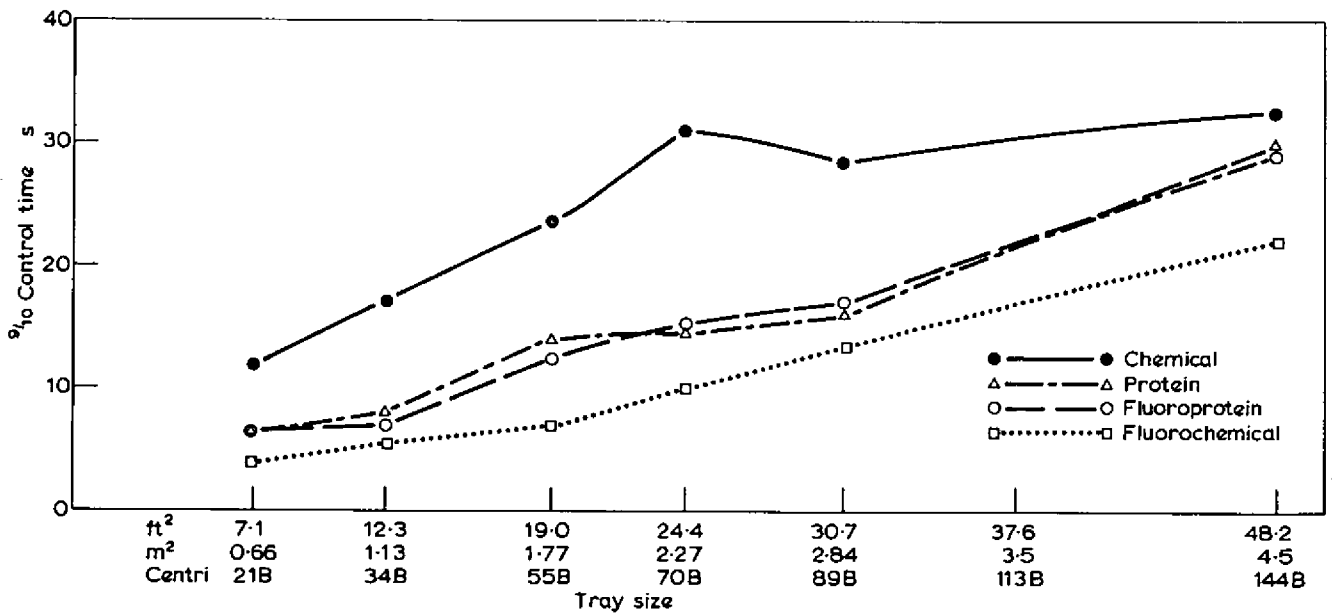


Figure 4 Control times with diesel fuel

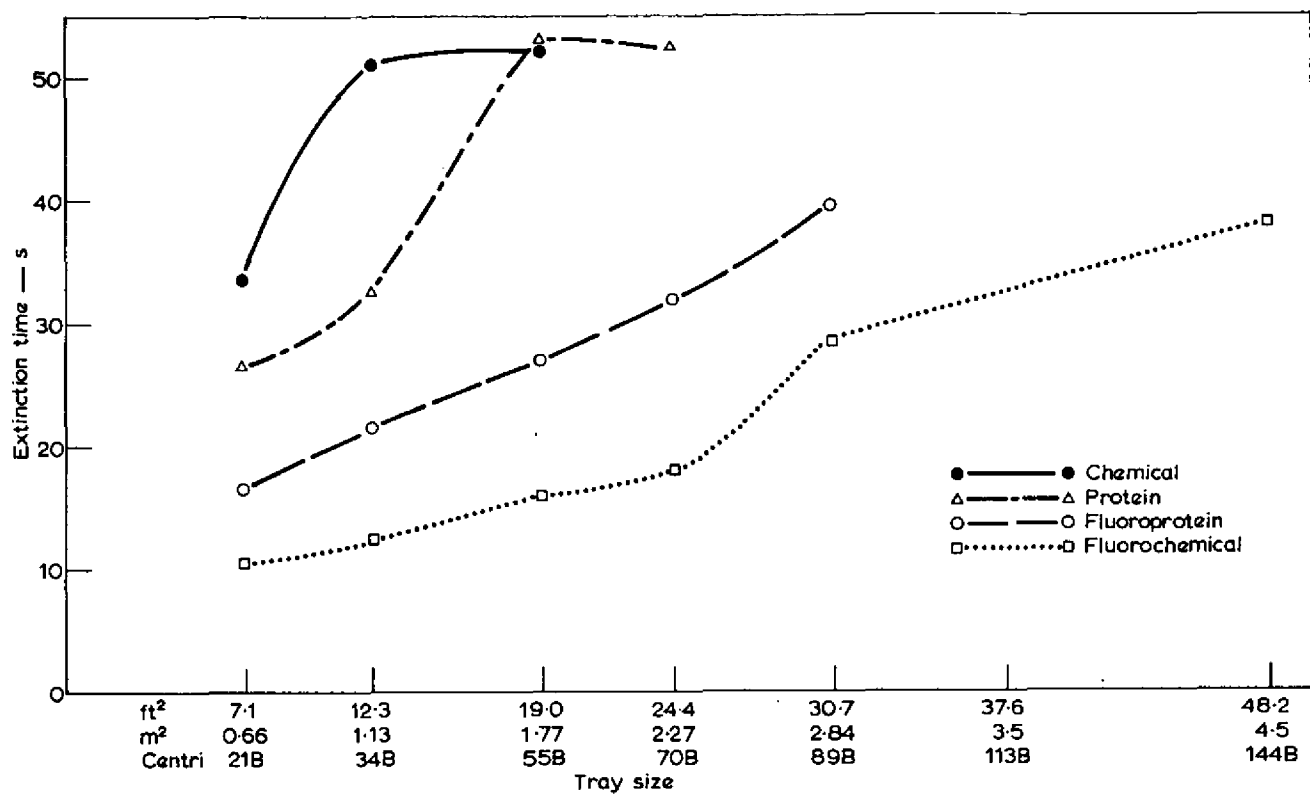


Figure 5 Extinction times with AVGAS fuel

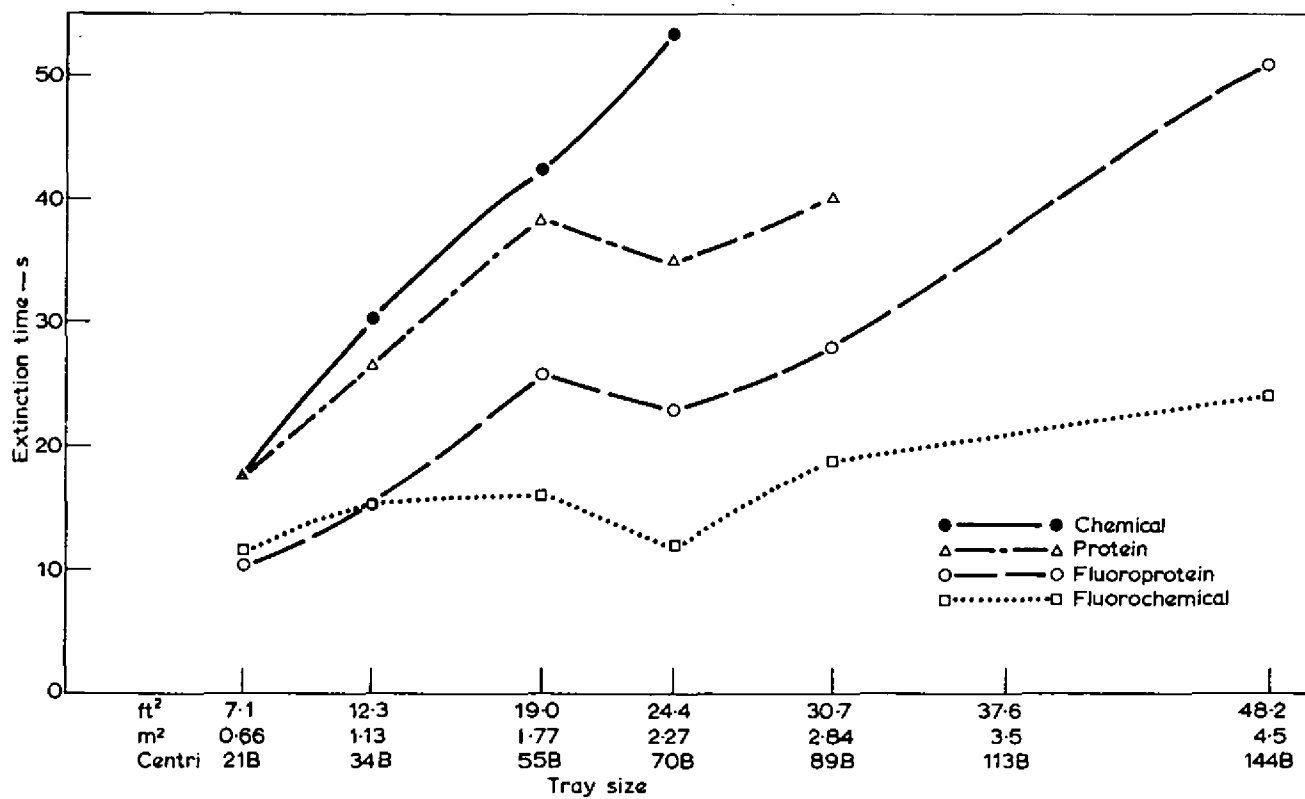


Figure 6 Extinction times with AVTUR fuel

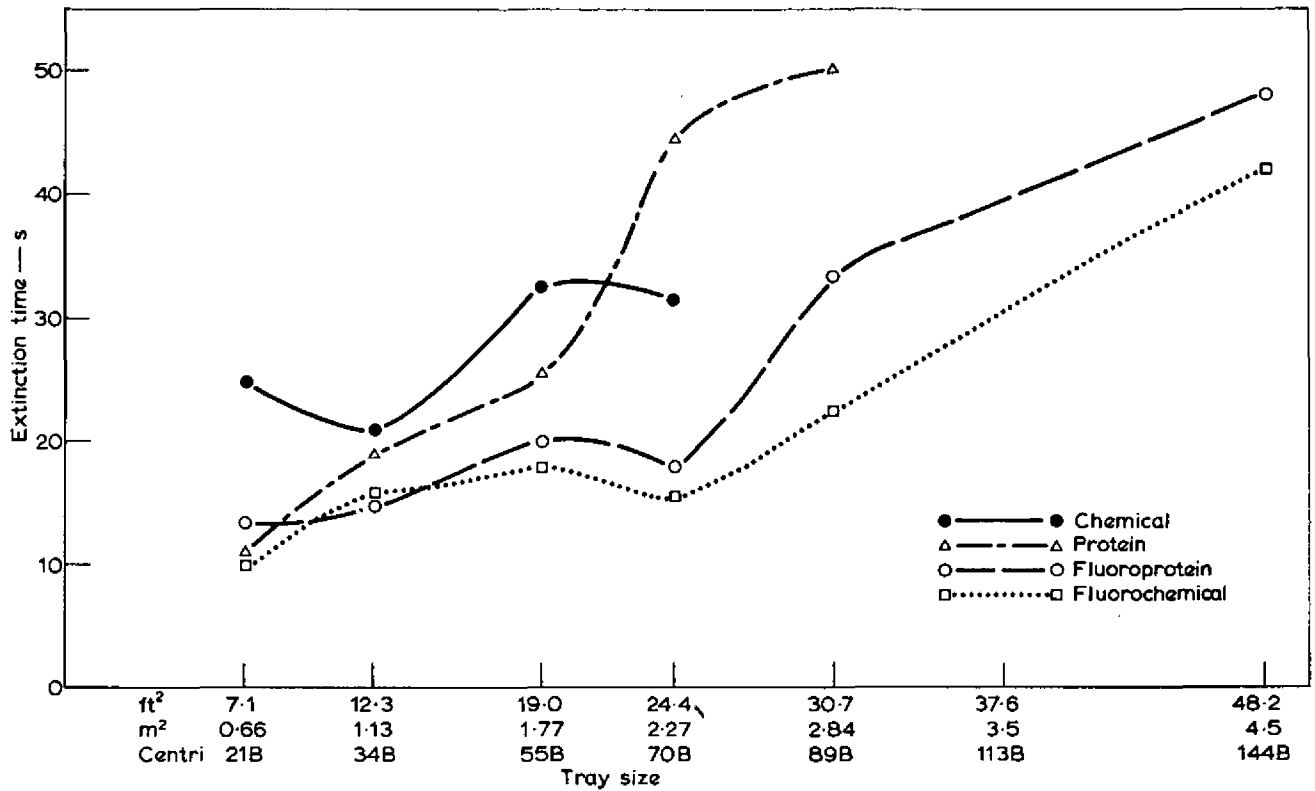


Figure 7 Extinction times with white spirit fuel

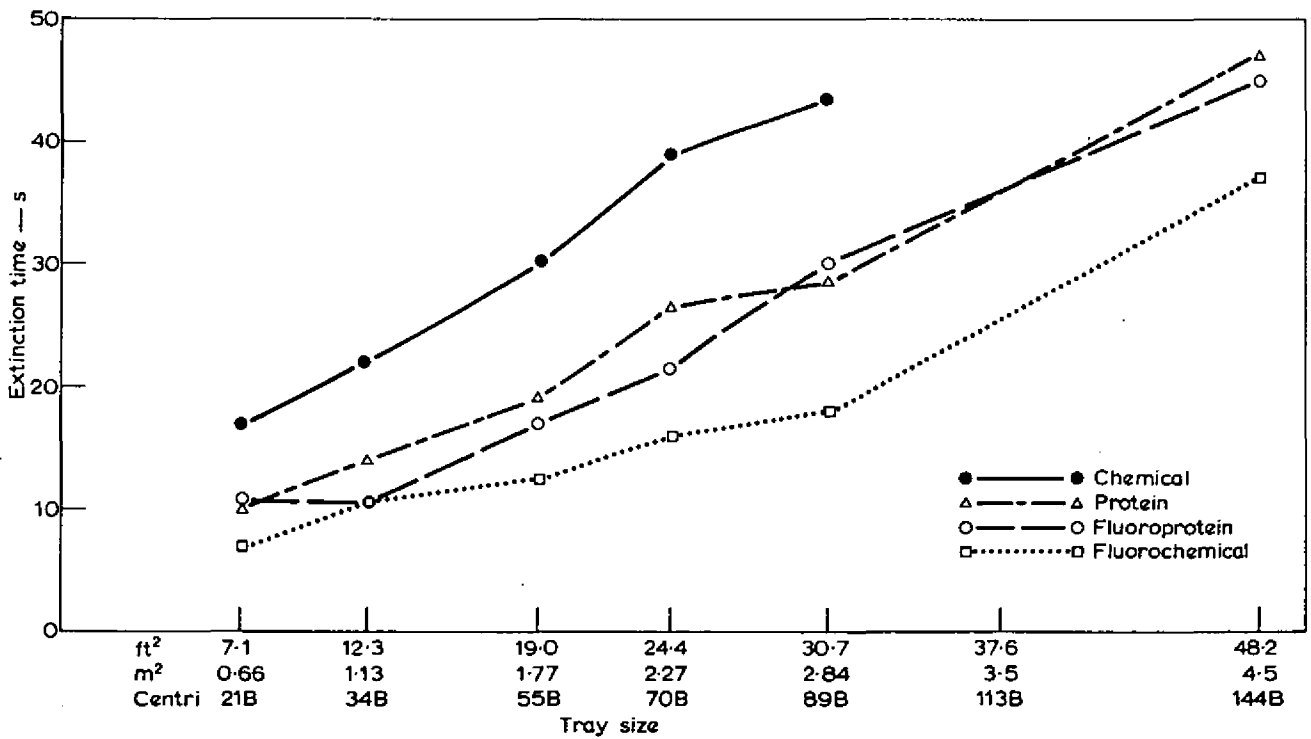


Figure 8 Extinction times with diesel fuel

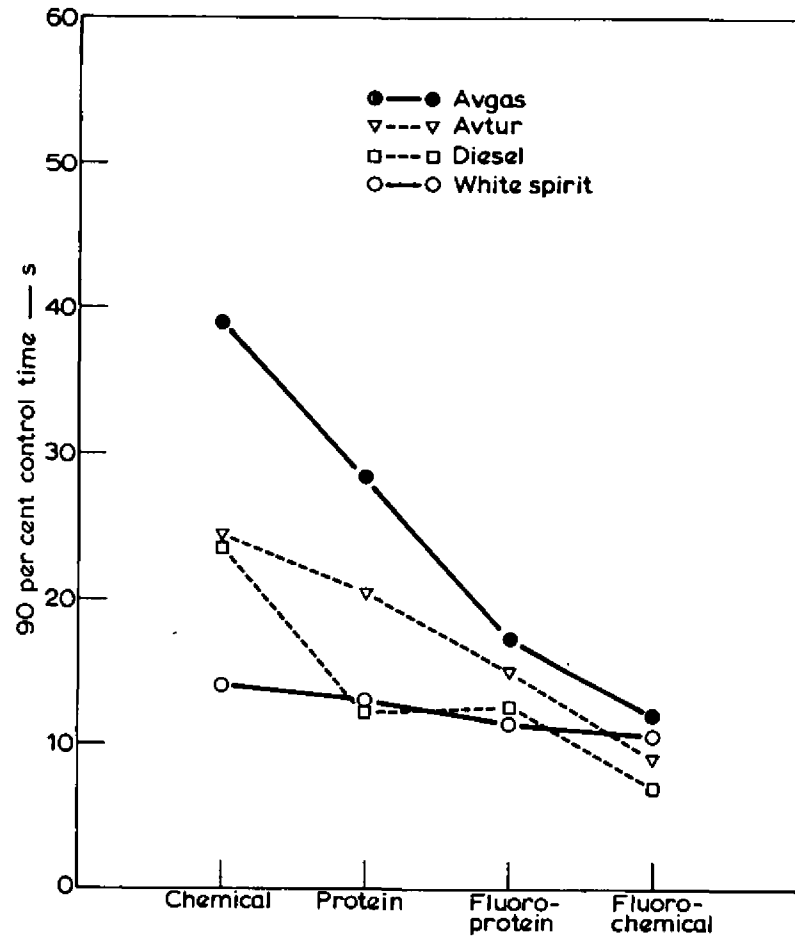


Figure 9 Control times with different fuels and foams using tray size 55B = 1.77m<sup>2</sup>

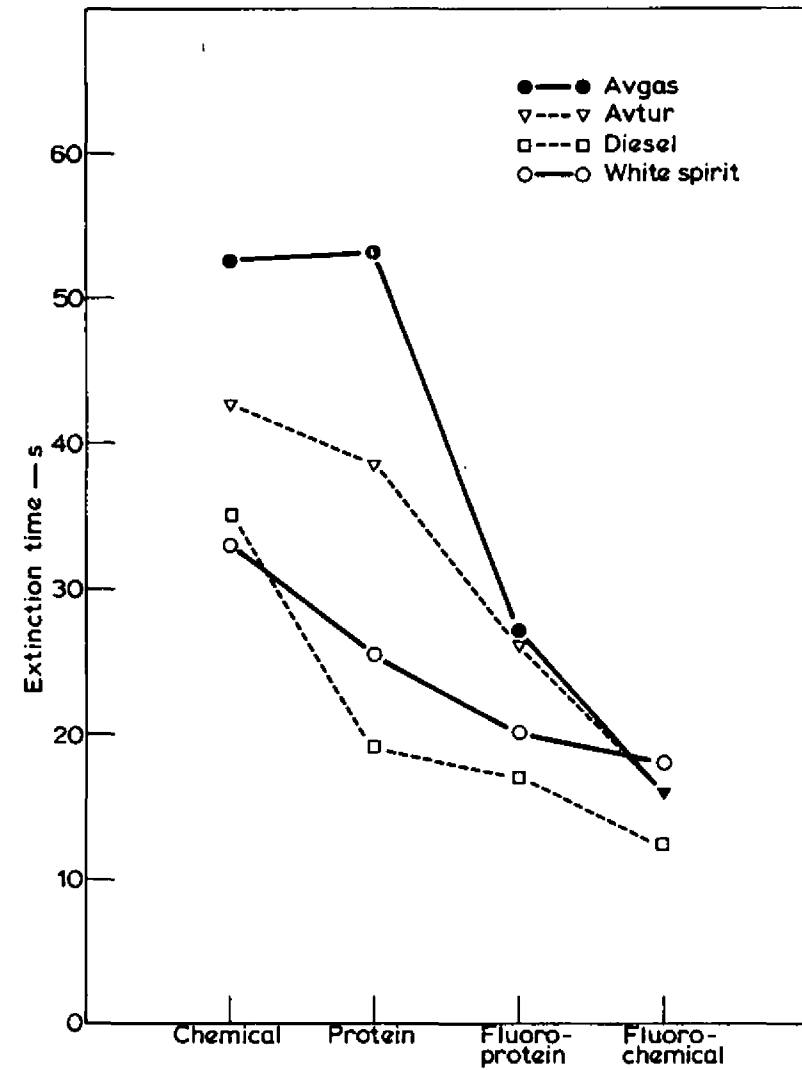


Figure 10 Extinction times with different fuels and foams using tray size 55B = 1.77m<sup>2</sup>

