MASTER

UR-532

AEC RESEARCH AND
DEVELOPMENT REPORT

STUDIES ON LARGE AREA SUB-FABRIC BURNS.
THE EFFECT OF (1) REFLECTANCE AND SEPARATION OF FABRIC,
AND (2) TREATMENT WITH FIRE-RETARDANT MATERIAL.

by

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ROCHESTER, NEW YORK

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U N C L A S S I F I E D

UR-532

Biology and Medicine

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Rochester 20, New York

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Contract W-7401-eng-49 between the U. S. Atomic
Energy Commission and the University of Rochester,
administered by the Department of Radiation Biology
of the School of Medicine and Dentistry.

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Date Completed: 8/7/58

Date of Issue: 10/13/58

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ABSTRACT

A series of cutaneous burns $3\frac{3}{4}$ " in diameter was produced by exploding 150 mgm. of magnesium powder at distances of 20 and 25 cm. from the animal; this provided 20 cal/cm^2 at exposure times of 0.7 and 2-3 sec. and 16 cal/cm^2 at an exposure time of 0.7 sec. respectively. The effect of placing green and khaki poplin fabrics untreated and treated with fire-retardant material L-S 123P, in contact with and separated 5 and 10 mm. from skin was studied. Burns were evaluated both by surface appearance and by microscopic examination.

All the fabrics reduced the severity of the burns. As the amount of separation increased, the severity of the burns decreased if the fabric remained intact. The khaki fabric with its higher reflectance gave more protection than the green fabric at 16 cal/cm^2 at 0.7 sec. exposure time and 20 cal/cm^2 at 2-3 sec. exposure time, but not at 20 cal/cm^2 at 0.7 sec. exposure.

The fire-retardant treated material gave more protection than the untreated material if it persisted longer during the exposure. If both persisted during the exposure but flaming or flaring occurred, the untreated fabric gave more protection than the treated.

1

2

3

4

INTRODUCTION

That clothing will significantly reduce the severity of cutaneous burns has been observed in Japan (5) and in this (1,2,3,9,10,11,12) and other laboratories (14,15). Fabric weight, reflectance, transmittance, composition, air spacing, and multiple layers modify this effect.

Recent studies with a small area source (2 1/4 inch carbon arc searchlight) on poplin fabrics of interest to the Quartermaster Research and Engineering Center, Natick, Massachusetts, have shown that burns produced beneath fabrics treated with fire-retardant material L-S 123P separated 2 or 5 mm. from skin, are in some circumstances more severe than those made behind untreated fabric (2). Since a small piece of fabric may not accurately reflect the value of fire-retardant treatment, it seemed desirable to study these same fabrics with a large area source. At the same time the factors of reflectance, air spacing, and exposure time could be investigated, and the mechanisms by which fabric provides protection studied.

Two experiments were done. In the first, burns were produced at 16 cal/cm² at 0.7 sec. exposure time. In the second, burns were made at 20 cal/cm² at 0.7 and 2-3 sec. exposures.

METHODS

Physical

A charge of 150 gms. of magnesium powder was ignited as described by Roth et al. (16). A shielded container with a circular port 3 3/4 inches in diameter housed the animal. A 6" x 6" frame held the cloth tightly. Figure 1 demonstrates the physical setup.

Biological

Young Chester White and Yorkshire pigs weighing 8 to 15 kg. were anesthetized with Dial in urea-urethane (Ciba) in dosage of 60 mgm/kg by

intraperitoneal injection. The hair was closely clipped and the skin sponged gently with detergent and water.

Materials

Four poplin fabrics furnished by the Quartermaster Research and Engineering Center, Natick, Massachusetts, were tested. These fabrics were two shades, khaki No. 1 and green (shade 116). The same fabrics were impregnated with a fire-retardant material designated L-S 123P. Their physical characteristics are given in the following table:

Table 1

Material	Designation	Physical Constants		
		Weight (oz/sq.yd.)	Reflectance*	Transmittance*
Green Poplin (shade 116)	(Gr)	5.4	.20	.03
Green Poplin Fire- Retardant Treated	(Gr,FR)	6.6	.24	.03
Khaki No. I	(Kh)	5.4	.35	.08
Khaki Fire- Retardant Treated	(Kh,FR)	6.5	.35	.06

*These measurements were done with a universal spectrophotometer and reflectometer constructed by Krolak and Davis (8).

Experiment 1

Experimental Design

Four burns were made on 13 sides of seven animals in a systematically randomized manner to give four replications by the Youdon square method (4). The fabrics were placed either in contact with the skin or separated by 5 and 10 mm. from the skin. In addition, burns were produced on bare skin. The cloth was removed within one or two seconds after the exposure to minimize the effect of flaming.

Burns were made by exploding 150 gm. of magnesium powder having an exposure time of 0.7 sec. at a constant distance of 25 cm. from the animal. This charge provides 16 cal/cm² at this distance. When the fabric is separated 5 and 10 mm. from the skin, the cloth would receive a somewhat greater amount of radiation.

Evaluation

The burns were assessed 24 hours after burning by the following criteria (13):

- 0 - No burn
- 1+ - Erythema
- 2+ - Patchy whiteness
- 3+ - Uniform whiteness
- 4+ - Steam bleb

The percentage of any grade of burn was estimated in increments of 25%. A scoring system considering only the most severe burn was used as follows:

Grade	Percentage of Exposed area Burned	Score
1+	25	1
	50	2
	75	3
	100	4
2+	25	5
	50	6
	75	7
	100	8
3+	25	9
	50	10
	75	11
	100	12
4+	100	16

A biopsy of the most severe area was taken and fixed in 10% formalin. Sections were stained by hematoxylin and eosin. They were evaluated for the depth of damage in the epidermis and dermis as described previously (6,13).

Experiment 2

Experimental Design

Four burns were replicated six times on 27 sides of 14 animals in a systematically randomized manner. The fabrics were placed in contact with skin or separated 10 mm. from the skin. In addition, burns were produced on bare skin. The cloth was removed within one or two seconds after the exposure to minimize the effect of flaming.

Exposures were made by exploding 150 gm. of magnesium powder at a distance of 20 cm. from the animal. Two types of powder were used, one having an exposure time of 0.7 sec., the other of 2-3 sec. Both provided radiant energy of about 20 cal/cm².

Evaluation

The burns were graded in the same fashion as in Experiment 1. However, the burns were divided into the three categories, mild, moderate and severe, and scored as follows:

Grade	Score
2+ mild	1
moderate	2
severe	3
3+ mild	4
moderate	5
severe	6
4+ mild	7
moderate	8
severe	9
5+ mild	10

The evaluation of depth of damage was made by the same method used in Experiment 1. The histological sections were stained by Hinshaw's modification of the Verhoeff method (7) in addition to hematoxylin and eosin preparations.

RESULTS

Experiment 1

Observations

Flaming or flaring (non-sustained combustion) with the untreated and treated fabric respectively occurred consistently with all fabrics and separation combinations with one exception: the untreated khaki poplin, when it was in contact with the skin, did not flame.

Evaluation by Surface Appearance

Appendix 1 shows the evaluation by surface appearance of the burns produced under the specified condition. The last column scores the severity of each burn. Table 2 and Figure 2 summarize the findings.

Table 2

Fabric	Space	Total Score
Khaki No. I	0	30
	5	6
	10	0
Khaki, FR	0	35
	5	18
	10	6
Green	0	45
	5	22
	10	27
Green, FR	0	46
	5	23
	10	16
Bare Skin	---	64

This shows the total scores of the burns produced by exploding 150 mgm. of magnesium powder at a distance of 25 cm. from the animal's skin. This provides 16 cal/cm² at an exposure time of 0.7 sec.

The severity of the burns as observed on exposed skin is considerably reduced by the interposition of fabric. It is reduced further by the separation of the fabric from the skin. The khaki fabric either treated or untreated protects the skin more than the green fabric. This is most striking when the two untreated fabrics separated 10 mm. from the skin are compared. Here there are 1+, 2+ and 3+ burns beneath the green fabric, but no burns beneath the khaki fabric.

The burns produced behind the untreated khaki poplin were consistently less severe than those under the treated fabric at each of the distances of separation. However, comparing the green poplin, treated and untreated, no consistent differences are noted when the fabrics are in contact with or separated 5 mm. from the skin. But, at 10 mm. separation the burns produced behind the untreated fabric were more severe than those behind the treated fabric.

Evaluation by depth of damage determined microscopically

Table 3 summarizes the results of microscopic evaluation. It can be seen that the trends regarding separation and color, are the same as observed by the surface appearance evaluation. No significant effect of fire-retardant treatment is seen.

Table 3

Fabric	Separation		
	0	5	10
Green	Superficial Dermal (4)	Complete Epidermal (4)	Complete Epidermal (4)
Green, FR	Superficial Dermal (4)	Partial Epidermal (4)	Complete Epidermal (2) No burn (2)
Khaki	Superficial Dermal (2)	Partial Epidermal (2)	Partial Epidermal (2)
	Complete Epidermal (2)	Superficial Dermal (1) No burn (1)	No burn (2)
Khaki, FR	Superficial Dermal (2)	Superficial Dermal (1)	Complete Epidermal (1)
	Complete Epidermal (2)	Complete Epidermal (1) No burn (2)	No burn (3)
Bare Skin		Mid Dermal Damage (4)	

This table shows the results of the microscopic evaluation. The number of burns showing the stated damage is in parenthesis.

Experiment 2

Observations

The green poplin tended to show more damage than the khaki fabrics. At the 0.7 sec. exposure time the untreated green fabric had frequently disintegrated by the end of the exposure while the khaki fabric continued to burn. At 2-3 sec. exposure a similar but less frequent trend was noted.

The treated fabrics flared with the explosion, were charred and cracked at the end of the exposure. In most instances some of it remained as a barrier. At 0.7 sec. the treated khaki fabric separated 10 mm. from the skin was completely intact for four of the six exposures, while the green fabric remained intact for only one exposure.

Evaluation by Surface Appearance and Depth of Damage

Appendices 2 to 6 show the severity of the burns as evaluated by surface appearance. Table 4 and figures 3 and 4 summarize the findings. Table 5 and figures 5 and 6 show the results of evaluation of the burns by depth of damage.

Table 4

Fabric	Space (mm)	Exposure Time (sec)	Total Score
Green	0	2-3	39
Green	10	2-3	34
Green, FR	0	2-3	38
Green, FR	10	2-3	37
Green	0	0.7	31
Green	10	0.7	30
Green, FR	0	0.7	28
Green, FR	10	0.7	21
Khaki	0	2-3	35
Khaki	10	2-3	29
Khaki, FR	0	2-3	34
Khaki, FR	10	2-3	31
Khaki	0	0.7	32
Khaki	10	0.7	32
Khaki, FR	0	0.7	28
Khaki, FR	10	0.7	21
Bare Skin		0.7	45
		2-3	47

This summarizes the results (scores) of evaluation of the burns produced at 20 cal/cm² by exploding magnesium powder at a distance of 20 cm. from the skin under the designated conditions.

Table 5

Source	Separation (mm)	Exposure Time (sec)	Depth of Damage	Average
Khaki	0	2-3	0.3,0.5,0.5,0.5,0.6,0.7	.51
	10	2-3	0.3,0.4,0.4,0.5,0.5,0.6	.45
Khaki,FR	0	2-3	0.2,0.4,0.5,0.6,0.6,0.8	.51
	10	2-3	0.2,0.2,0.3,0.3,0.4,0.4	.30
Khaki	0	0.7	0.2,0.2,0.4,0.5,0.5,0.6	.40
	10	0.7	0.2,0.3,0.3,0.8,0.9,1.2	.60
Khaki,FR	0	0.7	0, 0, 0, 0.2,0.2,0.2	.1
	10	0.7	0, 0, 0, 0.2,0.2,0.2	.1
Green	0	2-3	0.3,0.4,0.5,0.5,0.6,0.8	.52
	10	2-3	0.2,0.2,0.2,0.4,0.5,0.8	.38
Green,FR	0	2-3	0.2,0.2,0.2,0.3,0.4,0.6	.32
	10	2-3	0.2,0.2,0.4,0.4,0.5,0.8	.42
Green	0	0.7	0.2,0.3,0.3,0.4,0.4,0.8	.40
	10	0.7	0.2,0.2,0.2,0.2,0.4,0.4	.27
Green,FR	0	0.7	0, 0.1,0.1,0.2,0.2,0.2	.13
	10	0.7	0, 0, 0.1,0.2,0.2,0.2	.12
Bare		0.7	0.5,0.5,0.5,0.8,0.8,0.9	.67
Bare		2-3	0.6,0.6,0.8,0.8,1.2,1.2	.87

This shows the depth of damage of burns produced at 20 cal/cm² by exploding magnesium powder at a distance of 20 cm. from the skin under the designated conditions.

The effect of reflectance (color)

At 0.7 sec. exposures, there is very little difference in the severity of burns, as evaluated by surface appearance, produced beneath either green or khaki fabrics under otherwise similar conditions. At 2-3 sec. exposures the burns produced beneath the khaki fabrics are slightly less severe than those produced beneath green fabrics.

Under otherwise similar conditions the depth of damage of burns produced beneath the khaki fabric is greater than that beneath the green fabric three times, less severe once, and of equal depth four times. From the results of these two methods of evaluation, it is concluded that the factor of reflectance has little effect at this energy level.

The effect of fire-retardant treatment

At 0.7 sec. exposure times the burns, as judged by surface appearance, produced beneath the treated fabrics, both green and khaki, are less severe than those beneath the untreated fabric. However, at 2-3 sec. exposure times there is very little difference, if any, between the protection afforded by treated and untreated fabrics.

When the burns are evaluated microscopically, those produced at 0.7 sec. beneath the treated fabric are less severe than those beneath the untreated fabric. A marked difference was noted at the 0.7 sec. exposure time with khaki fabric, where the depth of damage was reduced as much as 0.5 mm. by fire retardant treatment.

At the 2-3 sec. exposure time the depth of damage of burns produced beneath the treated fabric was the same as that beneath the untreated fabric one time, less severe two times, and more severe one time. Fire-retardant treatment appeared to be of value in protection only at the short exposure time.

The effect of air space

The introduction of an air space of one cm. produces variable results in the severity of burns judged by surface appearance. Under some circumstances it provides increasing protection; under other circumstances it gives the same amount of protection as that provided by cloth in contact. The most marked effect of the air space is noted with the treated khaki fabric at an exposure time of 0.7 sec. where the severity of burns is reduced from 3+ moderate to 2+ severe by the 10 mm. air space.

When the fabric was separated from the skin by 10 mm., the depth of damage was reduced four times, was not changed twice, and was increased twice.

From the results of the two methods of evaluation it appears that the introduction of a 1 cm. air space reduced burn severity.

The effect of exposure time

At the shorter exposure time of 0.7 sec. the severity of burn tends to be less than that at the longer exposure time. This holds for both methods of evaluation.

DISCUSSION

These studies demonstrate that poplin fabrics, either untreated or impregnated with fire-retardant material L-S 123P, reduce the severity of large area radiant burns. This corresponds with the results of earlier studies both in the laboratory on small area burns and in the field on larger exposed areas.

At 16 cal/cm² it was observed that increasing the air space reduces severity. There was one exception. Increasing the separation of the green fabric from the skin from 5 to 10 mm. resulted in less protection. This observation confirms that of a previous experiment (3). At both 5 and 10 mm. separation the cloths were consumed by flaming. The supposition that at 5 mm.

separation the fabric remained as a barrier longer than at 10 mm. would explain these findings. Conditions here, however, do not simulate those in the field.

At 16 cal/cm^2 there was no difference in the severity of burns produced beneath the treated and untreated green fabrics spaced 0 or 5 mm. from the skin. At 10 mm. separation the treated fabric reduced the severity of the burns more than the untreated did, probably because the former remained as a barrier while the latter disintegrated during the exposure.

Somewhat different results were found with the khaki fabrics. With increasing separation the burn severity was less without exception. Also, the untreated fabric gave more protection than the treated fabric. The percentage of times the untreated khaki cloth flamed was high, yet the fabric tended to remain as a barrier during the exposure. The treated fabric always flared and remained as a barrier. It seems reasonable to explain the greater amount of protection that the untreated cloth gives by loss of energy due to flaming away from the animal's skin.

Another factor which is important in the mechanism of protection is reflectance. At 16 cal/cm^2 with the 0.7 sec. exposure time, increasing reflectance causes a reduction in burn severity.

The mechanisms acting at an incident exposure of 16 cal/cm^2 at 0.7 sec. are better understood by considering the amount of energy absorbed in the fabric system. Less energy is absorbed by the khaki fabric than by the green fabric. The khaki fabric then remains intact and gives added protection with increasing separation. Since the untreated fabric flames as the space is increased, energy is dissipated by convection and less reaches the skin. This loss of energy does not occur with the treated fabric and more energy reaches the skin.

The behavior of the green fabric reflects the mechanisms acting at a higher absorbed energy level than that obtaining with the khaki fabric. The loss of energy by flaming is less evident than that observed at the lower absorbed energy level. As the absorbed energy increases as a result of increasing the air space by moving the fabric closer to the source, the untreated fabric disintegrates during the exposure. The treated fabric remains as a barrier and provides more protection than its untreated counterpart.

In Experiment 2, at an energy level of 20 cal/cm^2 and with the 0.7 sec. exposure time, reflectance is an almost negligible factor, but the length of time the fabric persists is quite important. Apparently the treated fabric which remains intact during the exposure provides more protection than the untreated fabric which disintegrates in the same time period. The loss of energy by flaming is apparently negligible. With disintegration of the fabric during the exposure, separation loses its effectiveness.

In Experiment 2 at an energy level of 20 cal/cm^2 and with a 2-3 sec. exposure, two factors, both of which cause an increase in protection, seem to be operating simultaneously: (1) flaming, and (2) persistence of fabric. Undoubtedly the length of time the cloth persists is important in this regard and is worthy of further investigation.

Increasing the exposure time results in decreasing protection, an effect also observed in a study of small area sub-fabric burns (2).

The evaluation of burns by the laborious and expensive process of microscopic examination has emphasized one point. Although assessment of severity by surface appearance indicated little difference in the protection afforded by treated and untreated materials (with the 0.7 sec. exposure time), histologic examination revealed the superiority of the fire-retardant treated materials.

CONCLUSIONS

1. Both ~~khaki~~ and green (shade 116) poplin, untreated and treated with fire-retardant material L-S 123P, reduce the severity of burns produced in swine by a 150 gm. charge of magnesium flash powder. Exposures of 16 cal/cm² with an exposure time of 0.7 sec., and 20 cal/cm² at 0.7 and 2-3 sec. exposure times were studied.
2. As the fabrics are separated from the skin, protection increases if the fabric remains intact during the exposure.
3. The burns produced behind the khaki fabric are less severe than those beneath the green fabric at 16 cal/cm² at an exposure time of 0.7 sec. and at 20 cal/cm² at an exposure time of 2-3 sec., but are not significantly different at 20 cal/cm² at an exposure time of 0.7 sec.
4. Impregnation of poplin fabric with fire-retardant material L-S 123P provides both more and less protection than its untreated counterpart, under the conditions of this experiment, depending on the amount of separation, the color of the fabric, radiant exposure, and exposure time.
 - a. When the fabric remains intact but flares or flames during the exposure, the fire-retardant treated material gives less protection than the untreated cloth.
 - b. The fire-retardant treated material was observed to persist during the exposure while the untreated cloth disintegrates. In this circumstance the treated material gave more protection than the untreated.

Fig. 1

THE EFFECT OF SEPARATION OF FOUR POPLIN FABRICS
ON SEVERITY OF CUTANEOUS PORCINE BURNS
PRODUCED BY EXPLODING MAGNESIUM POWDER
AT A DISTANCE OF 25 CM.

(16 cal/cm²)

Fig. 2

(20 cal/cm²)

Fig. 3

THE EFFECT OF SEPARATION OF GREEN POPLIN FABRIC AND EXPOSURE TIME
ON SEVERITY OF CUTANEOUS PORCINE BURNS (SURFACE APPEARANCE)
PRODUCED BY EXPLODING MAGNESIUM POWDER
AT A DISTANCE OF 20 CM.

(20 cal/cm²)

Fig. 4

THE EFFECT OF SEPARATION OF GREEN POPLIN FABRIC AND EXPOSURE TIME
ON SEVERITY OF CUTANEOUS PORCINE BURNS (DEPTH OF DAMAGE)
PRODUCED BY EXPLODING MAGNESIUM POWDER
AT A DISTANCE OF 20 CM.

(20 cal/cm²)

Fig. 5

THE EFFECT OF SEPARATION OF KHAKI POPLIN AND EXPOSURE TIME
ON SEVERITY OF CUTANEOUS PORCINE BURNS (DEPTH OF DAMAGE)
PRODUCED BY EXPLODING MAGNESIUM POWDER
AT A DISTANCE OF 20 CM.
(20 cal/cm²)

Fig. 6

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APPENDIX 1

Fabric	Space mm.	Grade (Surface Appearance)					Score
		0	1+	2+	3+	4+	
Gr.	0		50		50		10
	0			25	75		11
	0				100		12
	0				100		12
Gr.	5		50	50			6
	5	25	25	50			6
	5	75		25			5
	5		75	25			5
Gr.	10		75		25		9
	10		25				1
	10	75	50	25	25		9
	10			100			8
Gr. FR	0				100		12
	0			50	50		10
	0				100		12
	0				100		12
Gr. FR	5	50		50			6
	5		50	25	25		9
	5		75	25			5
	5	25	75				3
Gr. FR	10	50	25	25			5
	10	25	75				3
	10	100					0
	10			100			8

APPENDIX 1 (continued)

Fabric	Space mm.	Grade (Surface Appearance)					Score
		0	1+	2+	3+	4+	
Kh.	0		25		75		11
	0	25	25	25	25		9
	0		75	25			5
	0	50	25	25			5
Kh.	5	75	25				1
	5	100					0
	5	100					0
	5	25	50	25			5
Kh.	10	100					0
	10	100					0
	10	100					0
	10	100					0
Kh. FR	0		75		25		9
	0	25	25	50			6
	0	25			75		11
	0	25	25	25	25		9
Kh. FR	5	100					0
	5		25	25	50		10
	5	100					0
	5			100			8
Kh. FR	10	50		50			6
	10	100					0
	10	100					0
	10	100					0

This shows the evaluation by surface appearance of subfabric burns produced by exploding 150 mgm. of magnesium powder at a distance of 25 cm. (16 cal/cm² at 0.7 sec. exposure)
(Experiment 1)

APPENDIX 2

Fabric	Space (mm)	Exposure Time (sec)	Burn Grade							4+	Score
			2+			3+					
			Mild	Mod	Sev	Mild	Mod	Sev			
Green	0	2-3						75 75 75 90 100	25 25 25 10	7 7 7 7 6 5	
Green	10	2-3					75 100 100 100 100	75	25 25	7 7 5 5 5 5	
Green	0	0.7					100 100 100 100 100	100		5 6 5 5 5 5	
Green	10	0.7			25	25	100 100 100 75 75 100			5 5 5 5 5 5	

This shows the evaluation by surface appearance of subfabric burns produced by exploding magnesium powder at a distance of 20 cm., which provides 20 cal/cm² (Experiment 2)

APPENDIX 3

Fabric	Space (mm)	Exposure Time (sec)	Burn Grade							
			2+			3+			4+	Score
			Mild	Mod	Sev	Mild	Mod	Sev		
Green FR	0	2-3					75 100	90 75 100 100	10 25 25	7 7 7 5 6 6
Green FR	10	2-3					90 100 100 75	90 100	10 10 25	7 7 5 5 6 7
Green FR	0	0.7			25	25 75 100 50	75 100 100 50			5 4 5 4 5 5
Green FR	10	0.7		100 25 25	100 100	75 75	100			3 2 3 4 4 5

This shows the evaluation by surface appearance of subfabric burns produced by exploding magnesium powder at a distance of 20 cm., which provides 20 cal/cm² (Experiment 2)

APPENDIX 4

Fabric	Space (mm)	Exposure Time	Burn Grade							
			2+			3+			4+	Score
			Mild	Mod	Sev	Mild	Mod	Sev		
Khaki	0	2-3					75 100 100 100	90 100	10 25	7 7 6 5 5 5
Khaki	10	2-3			25	100	75 100 100 100 100			5 5 5 4 5 5
Khaki	0	0.7					100 100 100 100	100 100		6 5 5 5 5 5 6
Khaki	10	0.7					100 100 75 100 100 100		25	5 5 7 5 5 5 5

This shows the evaluation by surface appearance of subfabric burns produced by exploding magnesium powder at a distance of 20 cm., which provides 20 cal/cm² (Experiment 2)

APPENDIX 5

Fabric	Space (mm)	Exposure Time (sec)	Burn Grade							4+	Score
			2+			3+					
			Mild	Mod	Sev	Mild	Mod	Sev			
Khaki FR	0	2-3			25	75	100 90 100 75	10 25	6 4 7 5 5 7		
Khaki FR	10	2-3					100 100 100 100 100	100	6 5 5 5 5 5		
Khaki FR	0	0.7			50	50 100	100 100 100 100		5 4 5 5 4 5		
Khaki FR	10	0.7		100	100 100 100		100 100		3 2 3 3 5 5		

This shows the evaluation by surface appearance of subfabric burns produced by exploding magnesium powder at a distance of 20 cm., which provides 20 cal/cm² (Experiment 2)

APPENDIX 6

	Exposure Time (sec)	Burn Grade						
		3+		4+			5+	Score
		Mod	Sev	Mild	Mod	Sev		
Bare Skin	0.7			100				7
				100				7
				100				7
					50		50	10
				100				7
				100				7
Bare Skin	2-3				100			8
				100				7
					50		50	10
		75			25			8
				100				7
				100				7

This shows the evaluation of the surface appearance of burns produced on bare skin by 150 mgm. of magnesium powder exploded at a distance of 20 cm., providing 20 cal/cm² (Experiment 2)