

# PCERF

Protective Clothing and Equipment Research Facility  
B33 Human Ecology Building  
University of Alberta, Edmonton, Alberta T6G 2N1  
Email: pcerf@ualberta.ca

Phone (780) 492-3832  
Fax (780) 492-4821

## TEST REPORT

**Client:** Ted Parker  
**Sparlings Sporting Goods (1977) Ltd.**  
1128 East Georgia Street  
Vancouver, BC, V6A 2A8  
  
sparlingssports@gmail.com

**Date:** Sept 24, 2015  
**Reference:** P23-009-13

## MATERIAL FOR TESTING

The following two garment systems were evaluated.

1. Blue standard coveralls, GR 2015-TW-1, 70% aramid/20% modacrylic/8% nylon/2% anti-static, tested with 100% cotton t-shirt and briefs
2. Blue coveralls with visibility trim, double layer elbows and knees, GR 2015-TW-1, 70% aramid/20% modacrylic/8% nylon/2% anti-static, tested with 100% cotton t-shirt and briefs.

## TESTING REQUESTED

The garment systems were to be tested in accordance with **ASTM F1930-15** *Standard Test Method for Evaluation of Flame Resistant Clothing for Protection Against Fire Simulations Using an Instrumented Manikin*. Garment system 1 was tested using a 3-second exposure. Garment system 2 was tested using a 5-second exposure.

Three replications of the test were performed for each garment system

## TEST APPARATUS

Thermally Instrumented Mannequin

- The flash fires are produced with propane diffusion flames.
- 110 skin simulant sensors are used to measure the rate of heat transfer to the mannequin surface.
- A computer controlled data acquisition system is used to run the test, record and store the data, calculate the extent and nature of the skin damage and display the results. The sampling rate of the system is 1100Hz.

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## ABOUT THIS REPORT:

Samples submitted for testing are accepted on the understanding that the report issued can not form the basis of, or instrument for, any legal liability against the Protective Clothing and Equipment Research Facility and applies specifically to the sample tested and not necessarily to the bulk. It is assumed that the information supplied by the client was valid and complete. Copyright in this report is owned by the Protective Clothing and Equipment Research Facility. The contents of the report are not to be abstracted (summarized) or reproduced in part. Permission is granted to the client to reproduce the report in whole.

## TEST CONDITIONS

- Date of Tests: September 24, 2015
- Exposure Heat Flux:
  - Start: 82.4 kW/m<sup>2</sup>
  - End: 80.7 kW/m<sup>2</sup>
- Conditions of test room: 15-22°C, 40-50%RH
- Sensor temperature measurements (data collection) taken for 60 seconds during and after flame exposure
- Specimen garments were laundered one time as per AATCC Method 135 (1, V A iii), as prescribed in ASTM F1930-15 Paragraphs 9.1.4, and conditioned at 21° C and 65% RH for a minimum of 24 hours after laundering. Garments were tested within 10 minutes of removal from the conditioned environment

## RESULTS

Test results are summarized in Table 1. Detailed results are provided in Appendix 1 and data print-outs from the mannequin system are provided in Appendix 2.

**Table 1: Summary of Test Results**

Garment System		% of Mannequin Surface Reaching Criteria for 2 <sup>nd</sup> & 3 <sup>rd</sup> Degree Burn <sup>1</sup>	% of Mannequin Surface Under Garment Reaching Criteria for 2 <sup>nd</sup> & 3 <sup>rd</sup> Degree Burn <sup>2</sup>
1.	GR 2015-TW-1 Standard Coveralls 3-sec Exposure	14.5	7.3
2.	GR 2015-TW-1 Coveralls 5-sec Exposure	25.6	21.8

<sup>1</sup> Since the hands and feet do not contain sensors, 88% is the maximum percentage of the mannequin surface which may burn when all sensors are working.

<sup>2</sup> 100% is the maximum percentage of the under-garment surface which may burn.

## CONCLUSION

Tests performed on garment system 1 resulted in 14.5% of the mannequin surface and 7.3% of the surface area covered by the garment system predicted to receive 2nd degree burn or worse, calculated as the mean of the burn predictions over three replications of the test.

Tests performed on garment system 2 resulted in 25.6% of the mannequin surface and 21.8% of the surface area covered by the garment system predicted to receive 2nd degree burn or worse, calculated as the mean of the burn predictions over three replications of the test.

Tests conducted and report written by

Stephen Paskaluk, P.Eng.  
Research Engineer

ShuQin Wen, PhD  
Textile Technologist

Report approved by

Jane Batcheller, PhD  
Principal Investigator, PCERF

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## APPENDIX 1

## DETAILED TEST RESULTS

Table 2: GR 2015-TW-1 Standard Coveralls - 3-sec Exposure

Burn #	% of Total Mannequin Surface Reaching Criteria for 2 <sup>nd</sup> & 3 <sup>rd</sup> Degree Burn			% of Mannequin Surface Under Garment Reaching Criteria for 2 <sup>nd</sup> & 3 <sup>rd</sup> Degree Burn			After-flame (s)	Observations
	2 <sup>nd</sup> °	3 <sup>rd</sup> °	Total	2 <sup>nd</sup> °	3 <sup>rd</sup> °	Total		
4309 <sup>3</sup>	8.50	8.30	<b>16.80</b>	9.9	0.0	<b>9.9</b>	3.3	Full-body afterflame; moderate-heavy smoke; some discolouration, shrinking, and stiffening of fabric; some charring of fabric on sleeves and legs.
4312 <sup>3</sup>	4.95	8.30	<b>13.25</b>	6.3	0.0	<b>6.3</b>	2.6	Afterflame on legs and torso; moderate-heavy smoke; some discolouration, shrinking, and stiffening of fabric; some charring of fabric on sleeves and legs.
4314 <sup>3</sup>	5.05	9.30	<b>13.35</b>	5.6	0.0	<b>5.6</b>	2.6	Afterflame on legs and torso; moderate-heavy smoke; some discolouration, shrinking, and stiffening of fabric; some charring of fabric on sleeves and legs.

<sup>3</sup> For this test 88% is the maximum possible burn injury prediction on the mannequin surface and 79.05% of the mannequin surface is covered by the garment system.

**Table 3: GR 2015-TW-1 Coveralls - 5-sec Exposure**

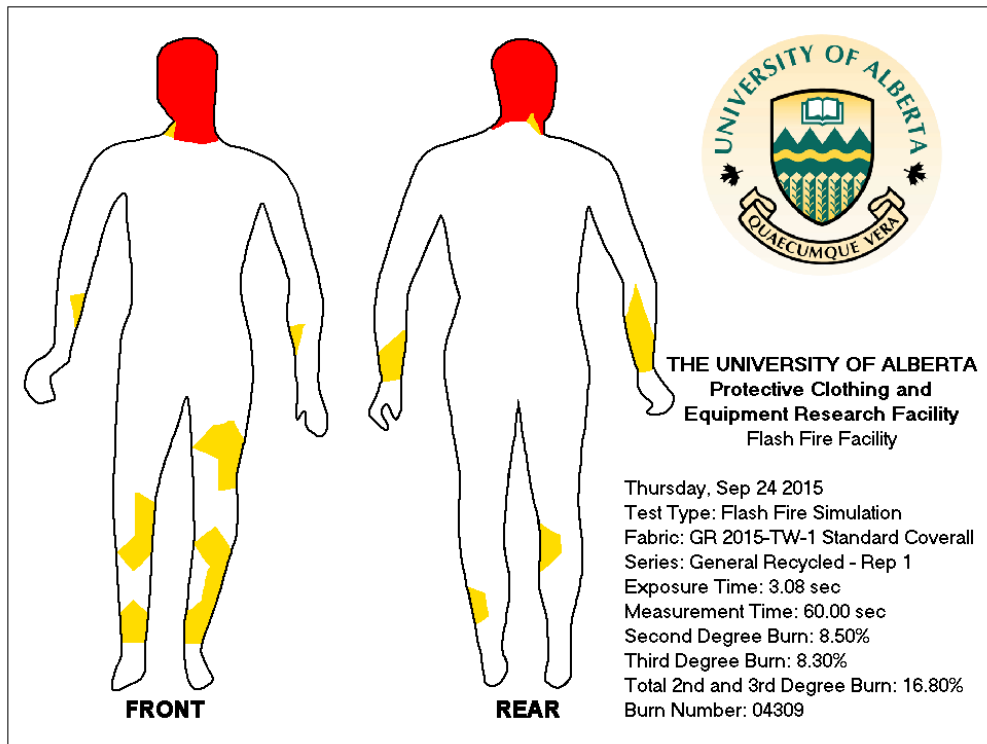
Burn #	% of Total Mannequin Surface Reaching Criteria for 2 <sup>nd</sup> & 3 <sup>rd</sup> Degree Burn			% of Mannequin Surface Under Garment Reaching Criteria for 2 <sup>nd</sup> & 3 <sup>rd</sup> Degree Burn			After-flame (s)	Observations
	2 <sup>nd</sup> °	3 <sup>rd</sup> °	Total	2 <sup>nd</sup> °	3 <sup>rd</sup> °	Total		
4311 <sup>4</sup>	18.60	7.65	<b>26.25</b>	22.7	0.0	<b>22.7</b>	<1.0	Brief afterflame on right sleeve; heavy smoke; widespread discolouration, shrinking, and stiffening of fabric; charring of fabric on sleeves, legs, and back.
4313 <sup>4</sup>	18.60	7.00	<b>25.60</b>	21.9	0.0	<b>21.9</b>	-	No afterflame; heavy smoke; widespread discolouration, shrinking, and stiffening of fabric; charring of fabric on sleeves, legs, and back.
4315 <sup>4</sup>	17.20	7.65	<b>24.85</b>	20.9	0.0	<b>20.9</b>	-	No afterflame; heavy smoke; widespread discolouration, shrinking, and stiffening of fabric; charring of fabric on sleeves, legs, and back.

<sup>4</sup> For this test 88% is the maximum possible burn injury prediction on the mannequin surface and 79.05% of the mannequin surface is covered by the garment system.

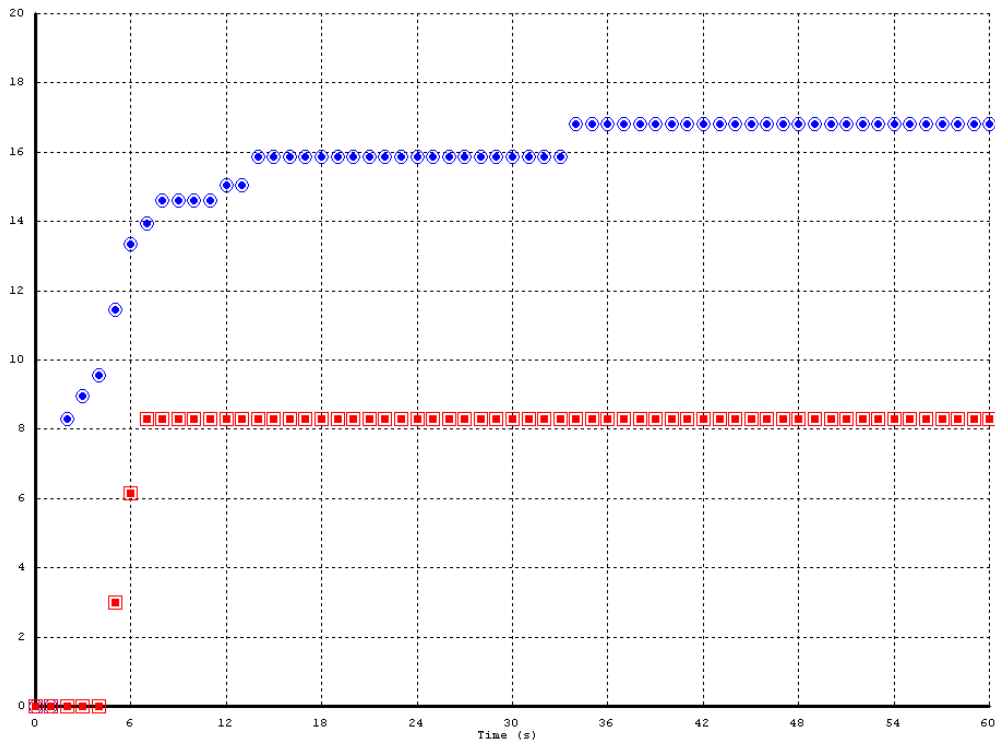
**APPENDIX 2**  
**PRINT-OUTS FROM MANNEQUIN TESTS**

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Figure 1: GR 2015-TW-1 Standard Coveralls - 3-sec Exposure - Replication 1



Percent Burn vs. Time (s)



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Test Type:                Flash Fire Simulation
Mannequin:                Harry III - F1930-15
Fabric:                   GR 2015-TW-1 Standard Coverall
Series:                   General Recycled - Rep 1
Burn Time:                3.078
Measurement Time:        60.00
Test Date:                Thursday, Sep 24 2015
Burn Number:              04309
Ambient Temperature:     16.70
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SUMMARY OF SENSOR RESPONSE

SENSOR NUMBER	SENSOR LOCATION	TIME	TIME	TOTAL	TOTAL	DEPTH	DEG BURN
		2nd DEG BURN sec	3rd DEG BURN sec	HEAT AT BURN kJ/m^2	HEAT AT 60 sec kJ/m^2	OF DAMAGE cm	
1	Left lower arm	4.5	-----	71.5	188.6	0.0427	2
2	Left lower arm	-----	-----	-----	93.3	0.0000	0
3	Left lower arm	-----	-----	-----	127.2	0.0000	0
4	Left upper arm	-----	-----	-----	47.8	0.0000	0
5	Left upper arm	-----	-----	-----	63.2	0.0000	0
6	Left upper arm	-----	-----	-----	41.7	0.0000	0
7	Left upper arm	-----	-----	-----	39.6	0.0000	0
8	Abdomen, lower right	-----	-----	-----	76.0	0.0000	0
9	Abdomen, lower center	-----	-----	-----	43.7	0.0000	0
10	Abdomen, lower left	-----	-----	-----	51.1	0.0000	0
11	Abdomen, upper right	-----	-----	-----	74.6	0.0000	0
12	Abdomen, upper center	-----	-----	-----	33.4	0.0000	0
13	Abdomen, upper left	-----	-----	-----	32.6	0.0000	0
14	Chest, lower right	-----	-----	-----	127.7	<0.0075	1
15	Chest, center	-----	-----	-----	16.7	0.0000	0
16	Chest, lower left	-----	-----	-----	117.0	0.0000	0
17	Right lower arm	11.2	-----	99.6	147.9	0.0075	2
18	Right lower arm	-----	-----	-----	108.7	0.0000	0
19	Right lower arm	-----	-----	-----	107.9	0.0000	0
20	Right upper arm	-----	-----	-----	82.6	0.0000	0
21	Right upper arm	-----	-----	-----	69.1	0.0000	0
22	Right upper arm	-----	-----	-----	90.9	0.0000	0
23	Right upper arm	-----	-----	-----	85.5	0.0000	0
24	Chest, upper right	-----	-----	-----	85.1	0.0000	0
25	Chest, upper left	-----	-----	-----	48.6	0.0000	0
26	Right shoulder	-----	-----	-----	38.0	0.0000	0
27	Left shoulder	-----	-----	-----	36.1	0.0000	0
28	Side of trunk, lower left	-----	-----	-----	16.5	0.0000	0
29	Side of trunk, upper left	-----	-----	-----	16.1	0.0000	0
30	Lower back, lower left	-----	-----	-----	5.2	0.0000	0
31	Lower back, upper left	-----	-----	-----	44.3	0.0000	0
32	Upper back, lower left	-----	-----	-----	79.9	0.0000	0
33	Upper back, upper left	-----	-----	-----	81.6	0.0000	0
34	Pelvis, rear center	-----	-----	-----	0.4	0.0000	0
35	Back, mid center	-----	-----	-----	30.4	0.0000	0
36	Back, upper center	-----	-----	-----	67.6	0.0000	0
37	Lower back, lower right	-----	-----	-----	34.2	0.0000	0
38	Lower back, upper right	-----	-----	-----	49.9	0.0000	0
39	Upper back, lower right	-----	-----	-----	86.0	0.0000	0
40	Upper back, upper right	-----	-----	-----	81.4	0.0000	0
41	Side of trunk, lower right	-----	-----	-----	31.5	0.0000	0
42	Side of trunk, upper right	-----	-----	-----	19.9	0.0000	0
43	Left lower leg, inner	-----	-----	-----	120.8	0.0000	0
44	Left lower leg, outer	5.1	-----	84.3	140.4	0.0176	2
45	Left shin	4.7	-----	83.7	156.8	0.0236	2
46	Left calf	-----	-----	-----	103.7	0.0000	0
47	Left mid leg, inner	-----	-----	-----	96.2	0.0000	0
48	Left mid leg, outer	-----	-----	-----	110.9	0.0000	0
49	Left lower thigh, front inner	-----	-----	-----	91.4	0.0000	0
50	Left lower thigh, front outer	5.7	-----	87.2	166.6	0.0149	2
51	Left lower thigh, rear	-----	-----	-----	133.7	<0.0075	1
52	Left mid thigh, front	33.2	-----	127.9	138.3	0.0075	2



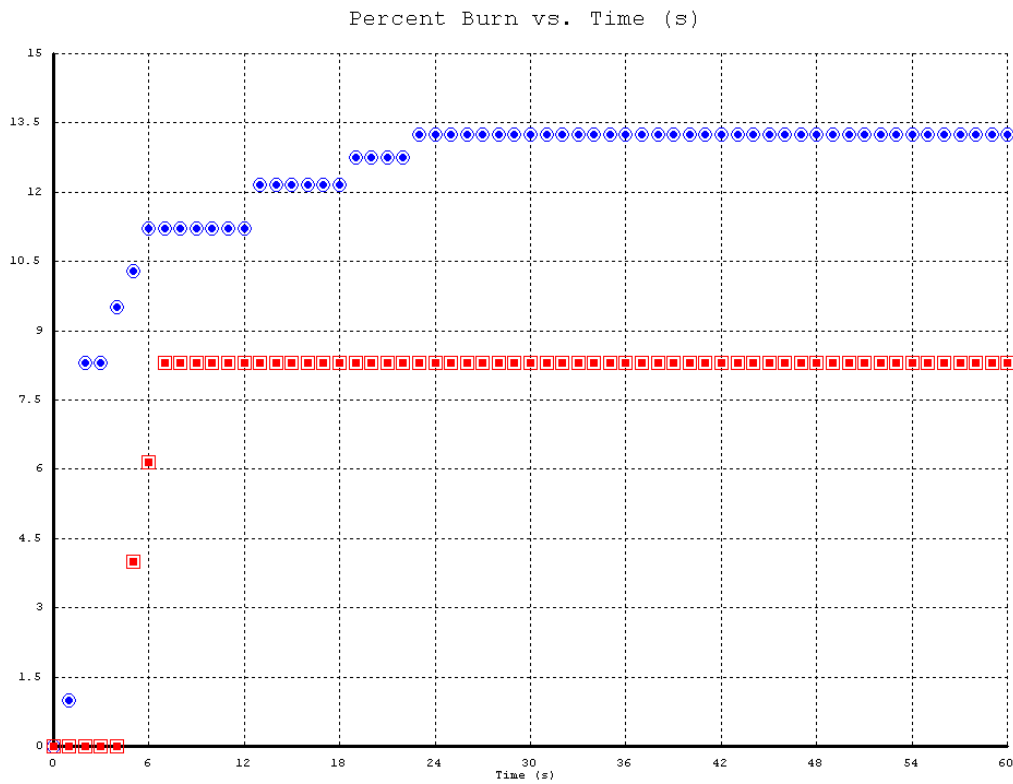
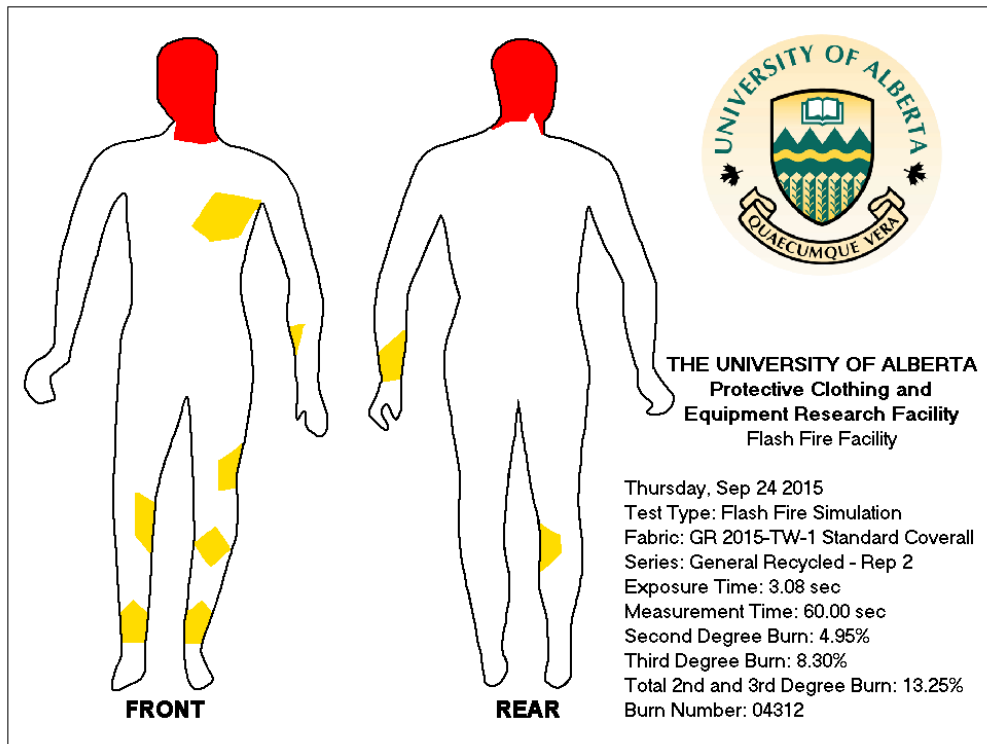
53	Left mid thigh, outer	-----	-----	-----	106.4	0.0000	0
54	Left mid thigh, rear inner	-----	-----	-----	103.3	0.0000	0
55	Left upper thigh, front inner	-----	-----	-----	99.7	0.0000	0
56	Left upper thigh, front outer	-----	-----	-----	67.8	0.0000	0
57	Left upper thigh, rear	-----	-----	-----	92.0	0.0000	0
58	Left buttock	-----	-----	-----	77.7	0.0000	0
59	Left buttock, side	-----	-----	-----	28.4	0.0000	0
60	Left hip	-----	-----	-----	34.7	0.0000	0
61	Left pelvis, front	-----	-----	-----	40.8	0.0000	0
62	Right lower leg, inner	-----	-----	-----	94.0	0.0000	0
63	Right lower leg, outer	-----	-----	-----	122.8	0.0000	0
64	Right shin	13.0	-----	103.5	147.8	0.0075	2
65	Right calf	-----	-----	-----	101.5	0.0000	0
66	Right mid leg, inner	6.9	-----	92.3	157.7	0.0075	2
67	Right mid leg, outer	-----	-----	-----	107.0	0.0000	0
68	Right lower thigh, inner	-----	-----	-----	69.2	0.0000	0
69	Rt. lower thigh, front outer	-----	-----	-----	85.1	0.0000	0
70	Right lower thigh, rear	-----	-----	-----	118.8	0.0000	0
71	Right mid thigh, front	-----	-----	-----	88.9	0.0000	0
72	Right mid thigh, rear outer	-----	-----	-----	135.1	<0.0075	1
73	Right mid thigh, rear inner	-----	-----	-----	109.9	0.0000	0
74	Rt. upper thigh, front inner	-----	-----	-----	83.0	0.0000	0
75	Rt. upper thigh, front outer	-----	-----	-----	54.4	0.0000	0
76	Right upper thigh, rear	-----	-----	-----	134.9	0.0000	0
77	Right buttock	-----	-----	-----	95.9	0.0000	0
78	Right buttock, side	-----	-----	-----	46.6	0.0000	0
79	Right hip	-----	-----	-----	65.7	0.0000	0
80	Right pelvis, front	-----	-----	-----	37.9	0.0000	0
81	Right upper arm	-----	-----	-----	90.4	0.0000	0
82	Right lower arm	-----	-----	-----	130.3	0.0000	0
83	Right upper arm	-----	-----	-----	39.8	0.0000	0
84	Right upper arm	-----	-----	-----	111.5	0.0000	0
85	Right lower arm	7.8	-----	93.9	163.6	0.0075	2
86	Left upper arm	-----	-----	-----	85.0	0.0000	0
87	Left lower arm	-----	-----	-----	90.5	0.0000	0
88	Left upper arm	-----	-----	-----	45.0	0.0000	0
89	Left upper arm	-----	-----	-----	69.6	0.0000	0
90	Left lower arm	-----	-----	-----	124.5	0.0000	0
91	Lower jaw	1.1	4.6	41.5	315.4	>0.1200	3
92	Right cheek	1.3	5.0	45.0	296.9	>0.1200	3
93	Left cheek	1.0	4.4	33.7	334.6	>0.1200	3
94	Forehead	1.2	5.3	35.9	265.7	>0.1200	3
95	Head, upper back	1.7	6.5	45.3	252.9	>0.1200	3
96	Head, lower back	1.2	4.6	39.6	310.6	>0.1200	3
97	Back, right under rear neck	-----	-----	-----	45.6	0.0000	0
98	Neck, right side	2.8	-----	61.9	117.3	0.0280	2
99	Neck, left side	1.6	6.0	49.2	283.1	>0.1200	3
100	Neck, front	1.4	5.2	44.7	289.9	>0.1200	3
101	Rt. upper thigh, front center	-----	-----	-----	46.8	0.0000	0
102	Lt. upper thigh, front center	-----	-----	-----	65.3	0.0000	0
103	Right lower leg, front	4.0	-----	70.3	137.8	0.0139	2
104	Left lower leg, front	3.0	-----	69.6	189.2	0.0585	2
105	Left lower leg, back	-----	-----	-----	132.2	0.0000	0
106	Right lower leg, back	-----	-----	-----	94.4	0.0000	0
107	Left mid leg, back	-----	-----	-----	110.1	0.0000	0
108	Right mid leg, back	-----	-----	-----	104.8	0.0000	0
109	Lower back, lower center	-----	-----	-----	17.3	0.0000	0
110	Upper back, lower center	-----	-----	-----	53.3	0.0000	0

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 Summary of burn injury prediction

1st Degree Burn	2.80%
2nd Degree Burn	8.50%
3rd Degree Burn	8.30%
Total 2nd and 3rd Degree Burn	16.80%
Total Heat Absorbed at 2nd Degree Burn	65.3 kJ/m^2
Total Heat Absorbed Throughout Test	102.1 kJ/m^2

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Figure 2: GR 2015-TW-1 Standard Coveralls - 3-sec Exposure - Replication 2



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Test Type:                Flash Fire Simulation
Mannequin:                Harry III - F1930-15
Fabric:                   GR 2015-TW-1 Standard Coverall
Series:                   General Recycled - Rep 2
Burn Time:                3.079
Measurement Time:        60.00
Test Date:                Thursday, Sep 24 2015
Burn Number:              04312
Ambient Temperature:     19.10
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SUMMARY OF SENSOR RESPONSE

SENSOR NUMBER	SENSOR LOCATION	TIME	TIME	TOTAL	TOTAL	DEPTH	DEG BURN
		2nd DEG BURN sec	3rd DEG BURN sec	HEAT AT BURN kJ/m^2	HEAT AT 60 sec kJ/m^2	OF DAMAGE cm	
1	Left lower arm	22.2	-----	122.7	148.8	0.0075	2
2	Left lower arm	-----	-----	-----	80.1	0.0000	0
3	Left lower arm	-----	-----	-----	104.5	0.0000	0
4	Left upper arm	-----	-----	-----	49.3	0.0000	0
5	Left upper arm	-----	-----	-----	63.8	0.0000	0
6	Left upper arm	-----	-----	-----	83.4	0.0000	0
7	Left upper arm	-----	-----	-----	66.7	0.0000	0
8	Abdomen, lower right	-----	-----	-----	47.3	0.0000	0
9	Abdomen, lower center	-----	-----	-----	41.6	0.0000	0
10	Abdomen, lower left	-----	-----	-----	61.5	0.0000	0
11	Abdomen, upper right	-----	-----	-----	47.1	0.0000	0
12	Abdomen, upper center	-----	-----	-----	11.2	0.0000	0
13	Abdomen, upper left	-----	-----	-----	37.9	0.0000	0
14	Chest, lower right	-----	-----	-----	118.0	0.0000	0
15	Chest, center	-----	-----	-----	29.0	0.0000	0
16	Chest, lower left	12.2	-----	108.1	134.0	0.0075	2
17	Right lower arm	-----	-----	-----	124.9	0.0000	0
18	Right lower arm	-----	-----	-----	88.9	0.0000	0
19	Right lower arm	-----	-----	-----	103.8	0.0000	0
20	Right upper arm	-----	-----	-----	68.5	0.0000	0
21	Right upper arm	-----	-----	-----	32.6	0.0000	0
22	Right upper arm	-----	-----	-----	81.7	0.0000	0
23	Right upper arm	-----	-----	-----	60.0	0.0000	0
24	Chest, upper right	-----	-----	-----	61.5	0.0000	0
25	Chest, upper left	-----	-----	-----	47.7	0.0000	0
26	Right shoulder	-----	-----	-----	15.8	0.0000	0
27	Left shoulder	-----	-----	-----	30.6	0.0000	0
28	Side of trunk, lower left	-----	-----	-----	29.5	0.0000	0
29	Side of trunk, upper left	-----	-----	-----	35.6	0.0000	0
30	Lower back, lower left	-----	-----	-----	12.0	0.0000	0
31	Lower back, upper left	-----	-----	-----	-3.2	0.0000	0
32	Upper back, lower left	-----	-----	-----	72.5	0.0000	0
33	Upper back, upper left	-----	-----	-----	63.5	0.0000	0
34	Pelvis, rear center	-----	-----	-----	9.2	0.0000	0
35	Back, mid center	-----	-----	-----	28.4	0.0000	0
36	Back, upper center	-----	-----	-----	46.1	0.0000	0
37	Lower back, lower right	-----	-----	-----	15.4	0.0000	0
38	Lower back, upper right	-----	-----	-----	42.4	0.0000	0
39	Upper back, lower right	-----	-----	-----	92.1	0.0000	0
40	Upper back, upper right	-----	-----	-----	86.8	0.0000	0
41	Side of trunk, lower right	-----	-----	-----	32.4	0.0000	0
42	Side of trunk, upper right	-----	-----	-----	37.8	0.0000	0
43	Left lower leg, inner	-----	-----	-----	123.6	0.0000	0
44	Left lower leg, outer	-----	-----	-----	127.5	<0.0075	1
45	Left shin	4.4	-----	78.7	144.2	0.0126	2
46	Left calf	-----	-----	-----	89.6	0.0000	0
47	Left mid leg, inner	-----	-----	-----	79.9	0.0000	0
48	Left mid leg, outer	-----	-----	-----	103.4	0.0000	0
49	Left lower thigh, front inner	-----	-----	-----	69.1	0.0000	0
50	Left lower thigh, front outer	5.2	-----	81.6	160.8	0.0115	2
51	Left lower thigh, rear	-----	-----	-----	121.2	0.0000	0
52	Left mid thigh, front	-----	-----	-----	126.8	0.0000	0

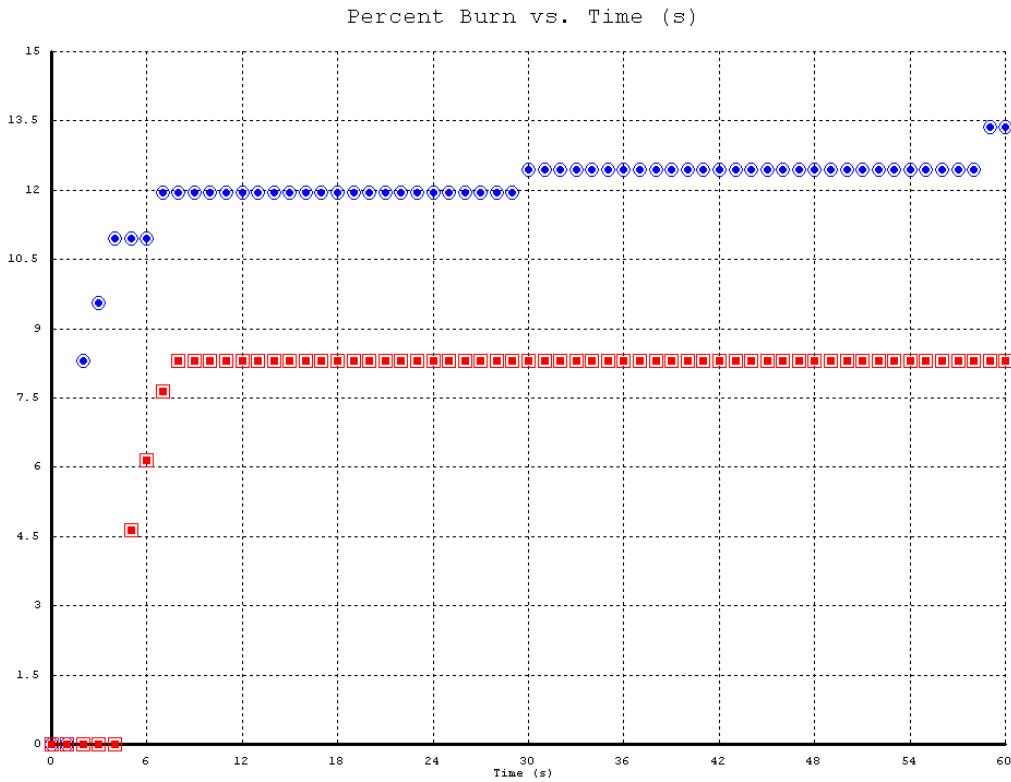
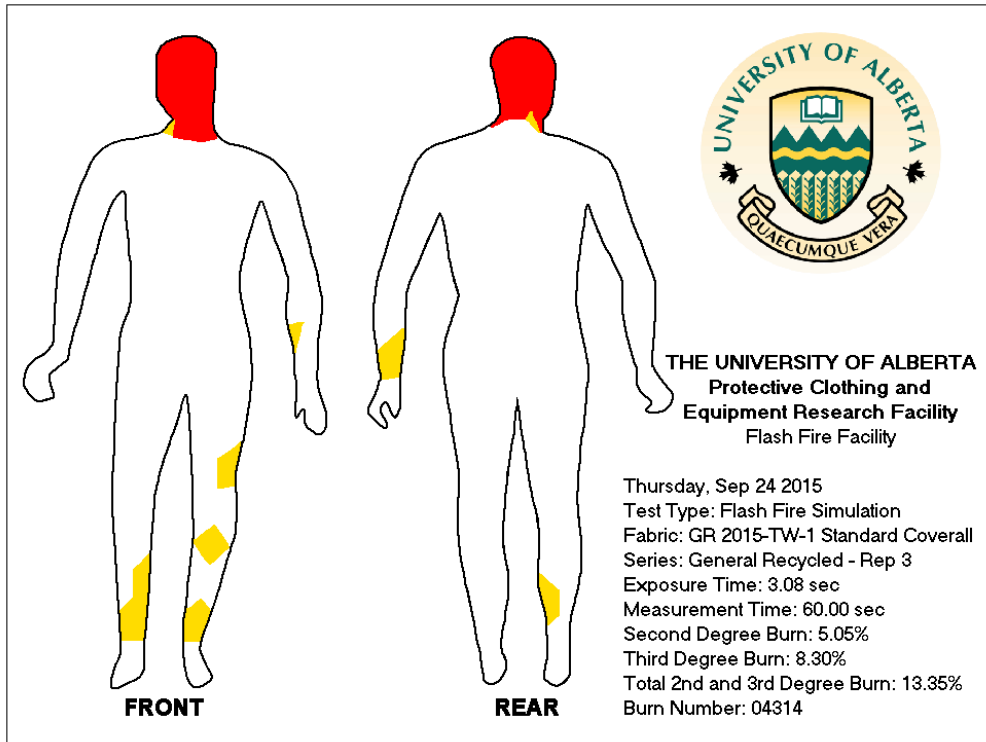
53	Left mid thigh, outer	-----	-----	-----	86.1	0.0000	0
54	Left mid thigh, rear inner	-----	-----	-----	106.5	0.0000	0
55	Left upper thigh, front inner	-----	-----	-----	81.1	0.0000	0
56	Left upper thigh, front outer	-----	-----	-----	22.3	0.0000	0
57	Left upper thigh, rear	-----	-----	-----	120.6	0.0000	0
58	Left buttock	-----	-----	-----	27.4	0.0000	0
59	Left buttock, side	-----	-----	-----	45.5	0.0000	0
60	Left hip	-----	-----	-----	36.3	0.0000	0
61	Left pelvis, front	-----	-----	-----	32.6	0.0000	0
62	Right lower leg, inner	-----	-----	-----	116.0	0.0000	0
63	Right lower leg, outer	-----	-----	-----	105.4	0.0000	0
64	Right shin	-----	-----	-----	127.1	0.0000	0
65	Right calf	-----	-----	-----	95.8	0.0000	0
66	Right mid leg, inner	18.9	-----	119.1	145.4	0.0075	2
67	Right mid leg, outer	-----	-----	-----	90.9	0.0000	0
68	Right lower thigh, inner	-----	-----	-----	72.5	0.0000	0
69	Rt. lower thigh, front outer	-----	-----	-----	101.3	0.0000	0
70	Right lower thigh, rear	-----	-----	-----	99.5	0.0000	0
71	Right mid thigh, front	-----	-----	-----	90.3	0.0000	0
72	Right mid thigh, rear outer	-----	-----	-----	110.0	0.0000	0
73	Right mid thigh, rear inner	-----	-----	-----	95.3	0.0000	0
74	Rt. upper thigh, front inner	-----	-----	-----	84.7	0.0000	0
75	Rt. upper thigh, front outer	-----	-----	-----	44.0	0.0000	0
76	Right upper thigh, rear	-----	-----	-----	113.0	0.0000	0
77	Right buttock	-----	-----	-----	77.6	0.0000	0
78	Right buttock, side	-----	-----	-----	44.8	0.0000	0
79	Right hip	-----	-----	-----	56.2	0.0000	0
80	Right pelvis, front	-----	-----	-----	55.3	0.0000	0
81	Right upper arm	-----	-----	-----	56.9	0.0000	0
82	Right lower arm	-----	-----	-----	135.2	0.0000	0
83	Right upper arm	-----	-----	-----	47.0	0.0000	0
84	Right upper arm	-----	-----	-----	84.1	0.0000	0
85	Right lower arm	-----	-----	-----	125.6	0.0000	0
86	Left upper arm	-----	-----	-----	93.2	0.0000	0
87	Left lower arm	-----	-----	-----	102.9	0.0000	0
88	Left upper arm	-----	-----	-----	67.2	0.0000	0
89	Left upper arm	-----	-----	-----	59.9	0.0000	0
90	Left lower arm	-----	-----	-----	107.4	0.0000	0
91	Lower jaw	1.0	4.4	37.8	322.0	>0.1200	3
92	Right cheek	1.1	4.8	39.6	299.6	>0.1200	3
93	Left cheek	0.9	4.2	32.5	344.3	>0.1200	3
94	Forehead	1.1	5.1	36.5	273.0	>0.1200	3
95	Head, upper back	1.7	6.5	46.9	251.9	>0.1200	3
96	Head, lower back	1.3	4.7	42.3	300.9	>0.1200	3
97	Back, right under rear neck	-----	-----	-----	33.5	0.0000	0
98	Neck, right side	-----	-----	-----	96.5	<0.0075	1
99	Neck, left side	1.5	6.1	48.2	275.7	>0.1200	3
100	Neck, front	1.2	5.5	42.3	273.7	>0.1200	3
101	Rt. upper thigh, front center	-----	-----	-----	49.3	0.0000	0
102	Lt. upper thigh, front center	-----	-----	-----	57.6	0.0000	0
103	Right lower leg, front	3.8	-----	73.0	145.2	0.0200	2
104	Left lower leg, front	3.1	-----	68.7	162.5	0.0355	2
105	Left lower leg, back	-----	-----	-----	122.0	0.0000	0
106	Right lower leg, back	-----	-----	-----	77.8	0.0000	0
107	Left mid leg, back	-----	-----	-----	103.8	0.0000	0
108	Right mid leg, back	-----	-----	-----	100.6	0.0000	0
109	Lower back, lower center	-----	-----	-----	12.7	0.0000	0
110	Upper back, lower center	-----	-----	-----	53.4	0.0000	0

\*\*\*\*\*  
 Summary of burn injury prediction

1st Degree Burn	1.65%
2nd Degree Burn	4.95%
3rd Degree Burn	8.30%
Total 2nd and 3rd Degree Burn	13.25%
Total Heat Absorbed at 2nd Degree Burn	60.0 kJ/m^2
Total Heat Absorbed Throughout Test	94.6 kJ/m^2

\*\*\*\*\*

Figure 3: GR 2015-TW-1 Standard Coveralls - 3-sec Exposure - Replication 3



```

*****
Test Type:                Flash Fire Simulation
Mannequin:               Harry III - F1930-15
Fabric:                  GR 2015-TW-1 Standard Coverall
Series:                  General Recycled - Rep 3
Burn Time:               3.078
Measurement Time:       60.00
Test Date:               Thursday, Sep 24 2015
Burn Number:             04314
Ambient Temperature:    20.40
*****

```

SUMMARY OF SENSOR RESPONSE

SENSOR NUMBER	SENSOR LOCATION	TIME	TIME	TOTAL	TOTAL	DEPTH	DEG BURN
		2nd DEG BURN sec	3rd DEG BURN sec	HEAT AT BURN kJ/m^2	HEAT AT 60 sec kJ/m^2	OF DAMAGE cm	
1	Left lower arm	29.7	-----	133.8	156.4	0.0075	2
2	Left lower arm	-----	-----	-----	95.2	0.0000	0
3	Left lower arm	-----	-----	-----	118.9	0.0000	0
4	Left upper arm	-----	-----	-----	56.4	0.0000	0
5	Left upper arm	-----	-----	-----	80.6	0.0000	0
6	Left upper arm	-----	-----	-----	53.6	0.0000	0
7	Left upper arm	-----	-----	-----	58.3	0.0000	0
8	Abdomen, lower right	-----	-----	-----	61.4	0.0000	0
9	Abdomen, lower center	-----	-----	-----	23.1	0.0000	0
10	Abdomen, lower left	-----	-----	-----	61.8	0.0000	0
11	Abdomen, upper right	-----	-----	-----	84.8	0.0000	0
12	Abdomen, upper center	-----	-----	-----	28.0	0.0000	0
13	Abdomen, upper left	-----	-----	-----	38.5	0.0000	0
14	Chest, lower right	-----	-----	-----	130.9	<0.0075	1
15	Chest, center	-----	-----	-----	28.7	0.0000	0
16	Chest, lower left	-----	-----	-----	109.6	0.0000	0
17	Right lower arm	-----	-----	-----	142.4	0.0000	0
18	Right lower arm	-----	-----	-----	104.4	0.0000	0
19	Right lower arm	-----	-----	-----	114.8	0.0000	0
20	Right upper arm	-----	-----	-----	82.7	0.0000	0
21	Right upper arm	-----	-----	-----	77.0	0.0000	0
22	Right upper arm	-----	-----	-----	107.2	0.0000	0
23	Right upper arm	-----	-----	-----	94.6	0.0000	0
24	Chest, upper right	-----	-----	-----	79.5	0.0000	0
25	Chest, upper left	-----	-----	-----	42.2	0.0000	0
26	Right shoulder	-----	-----	-----	35.4	0.0000	0
27	Left shoulder	-----	-----	-----	37.2	0.0000	0
28	Side of trunk, lower left	-----	-----	-----	35.1	0.0000	0
29	Side of trunk, upper left	-----	-----	-----	28.6	0.0000	0
30	Lower back, lower left	-----	-----	-----	19.9	0.0000	0
31	Lower back, upper left	-----	-----	-----	50.3	0.0000	0
32	Upper back, lower left	-----	-----	-----	71.2	0.0000	0
33	Upper back, upper left	-----	-----	-----	62.9	0.0000	0
34	Pelvis, rear center	-----	-----	-----	17.6	0.0000	0
35	Back, mid center	-----	-----	-----	38.8	0.0000	0
36	Back, upper center	-----	-----	-----	53.6	0.0000	0
37	Lower back, lower right	-----	-----	-----	34.3	0.0000	0
38	Lower back, upper right	-----	-----	-----	44.2	0.0000	0
39	Upper back, lower right	-----	-----	-----	78.9	0.0000	0
40	Upper back, upper right	-----	-----	-----	85.5	0.0000	0
41	Side of trunk, lower right	-----	-----	-----	44.6	0.0000	0
42	Side of trunk, upper right	-----	-----	-----	33.2	0.0000	0
43	Left lower leg, inner	-----	-----	-----	104.4	0.0000	0
44	Left lower leg, outer	-----	-----	-----	126.6	<0.0075	1
45	Left shin	3.8	-----	76.0	142.5	0.0130	2
46	Left calf	-----	-----	-----	96.3	0.0000	0
47	Left mid leg, inner	-----	-----	-----	92.5	0.0000	0
48	Left mid leg, outer	-----	-----	-----	96.5	0.0000	0
49	Left lower thigh, front inner	-----	-----	-----	84.6	0.0000	0
50	Left lower thigh, front outer	58.5	-----	143.2	143.9	0.0075	2
51	Left lower thigh, rear	-----	-----	-----	115.9	0.0000	0
52	Left mid thigh, front	-----	-----	-----	125.2	0.0000	0

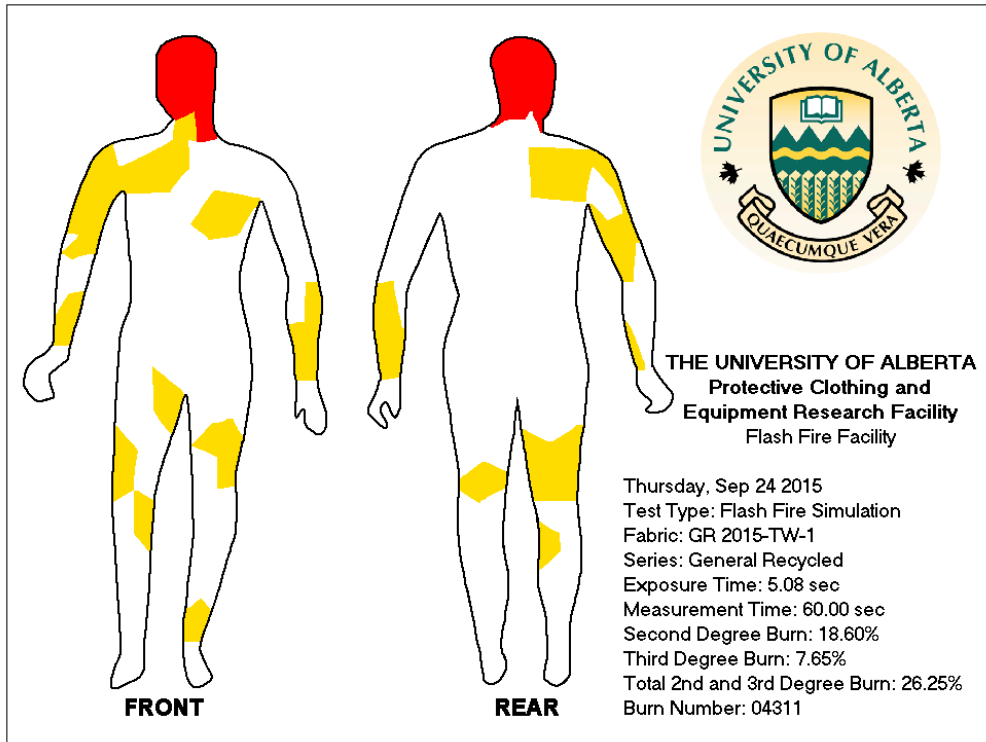
53	Left mid thigh, outer	-----	-----	-----	102.3	0.0000	0
54	Left mid thigh, rear inner	-----	-----	-----	94.0	0.0000	0
55	Left upper thigh, front inner	-----	-----	-----	98.1	0.0000	0
56	Left upper thigh, front outer	-----	-----	-----	56.2	0.0000	0
57	Left upper thigh, rear	-----	-----	-----	112.2	0.0000	0
58	Left buttock	-----	-----	-----	77.2	0.0000	0
59	Left buttock, side	-----	-----	-----	29.0	0.0000	0
60	Left hip	-----	-----	-----	27.6	0.0000	0
61	Left pelvis, front	-----	-----	-----	13.6	0.0000	0
62	Right lower leg, inner	6.3	-----	83.3	131.1	0.0075	2
63	Right lower leg, outer	-----	-----	-----	95.1	0.0000	0
64	Right shin	-----	-----	-----	127.1	0.0000	0
65	Right calf	-----	-----	-----	98.1	0.0000	0
66	Right mid leg, inner	-----	-----	-----	140.7	<0.0075	1
67	Right mid leg, outer	-----	-----	-----	84.7	0.0000	0
68	Right lower thigh, inner	-----	-----	-----	72.5	0.0000	0
69	Rt. lower thigh, front outer	-----	-----	-----	117.3	0.0000	0
70	Right lower thigh, rear	-----	-----	-----	115.2	0.0000	0
71	Right mid thigh, front	-----	-----	-----	81.1	0.0000	0
72	Right mid thigh, rear outer	-----	-----	-----	123.6	0.0000	0
73	Right mid thigh, rear inner	-----	-----	-----	102.1	0.0000	0
74	Rt. upper thigh, front inner	-----	-----	-----	80.4	0.0000	0
75	Rt. upper thigh, front outer	-----	-----	-----	32.2	0.0000	0
76	Right upper thigh, rear	-----	-----	-----	125.2	0.0000	0
77	Right buttock	-----	-----	-----	83.5	0.0000	0
78	Right buttock, side	-----	-----	-----	39.0	0.0000	0
79	Right hip	-----	-----	-----	41.3	0.0000	0
80	Right pelvis, front	-----	-----	-----	49.2	0.0000	0
81	Right upper arm	-----	-----	-----	90.5	0.0000	0
82	Right lower arm	-----	-----	-----	145.1	<0.0075	1
83	Right upper arm	-----	-----	-----	53.3	0.0000	0
84	Right upper arm	-----	-----	-----	102.9	0.0000	0
85	Right lower arm	-----	-----	-----	115.7	0.0000	0
86	Left upper arm	-----	-----	-----	100.4	0.0000	0
87	Left lower arm	-----	-----	-----	92.1	0.0000	0
88	Left upper arm	-----	-----	-----	29.8	0.0000	0
89	Left upper arm	-----	-----	-----	66.7	0.0000	0
90	Left lower arm	-----	-----	-----	119.9	0.0000	0
91	Lower jaw	1.1	4.5	38.8	327.1	>0.1200	3
92	Right cheek	1.1	4.9	40.7	289.9	>0.1200	3
93	Left cheek	1.0	4.2	36.9	340.9	>0.1200	3
94	Forehead	1.1	5.2	32.8	271.5	>0.1200	3
95	Head, upper back	1.6	6.1	46.3	261.5	>0.1200	3
96	Head, lower back	1.1	4.5	36.7	321.8	>0.1200	3
97	Back, right under rear neck	-----	-----	-----	46.1	0.0000	0
98	Neck, right side	2.3	-----	54.6	142.3	0.0507	2
99	Neck, left side	1.4	7.0	44.6	250.7	>0.1200	3
100	Neck, front	1.2	4.9	40.8	315.3	>0.1200	3
101	Rt. upper thigh, front center	-----	-----	-----	45.0	0.0000	0
102	Lt. upper thigh, front center	-----	-----	-----	67.2	0.0000	0
103	Right lower leg, front	3.6	-----	72.9	141.4	0.0172	2
104	Left lower leg, front	2.7	-----	66.1	162.0	0.0313	2
105	Left lower leg, back	-----	-----	-----	107.5	0.0000	0
106	Right lower leg, back	-----	-----	-----	84.9	0.0000	0
107	Left mid leg, back	-----	-----	-----	103.9	0.0000	0
108	Right mid leg, back	-----	-----	-----	92.8	0.0000	0
109	Lower back, lower center	-----	-----	-----	15.7	0.0000	0
110	Upper back, lower center	-----	-----	-----	38.9	0.0000	0

\*\*\*\*\*  
 Summary of burn injury prediction

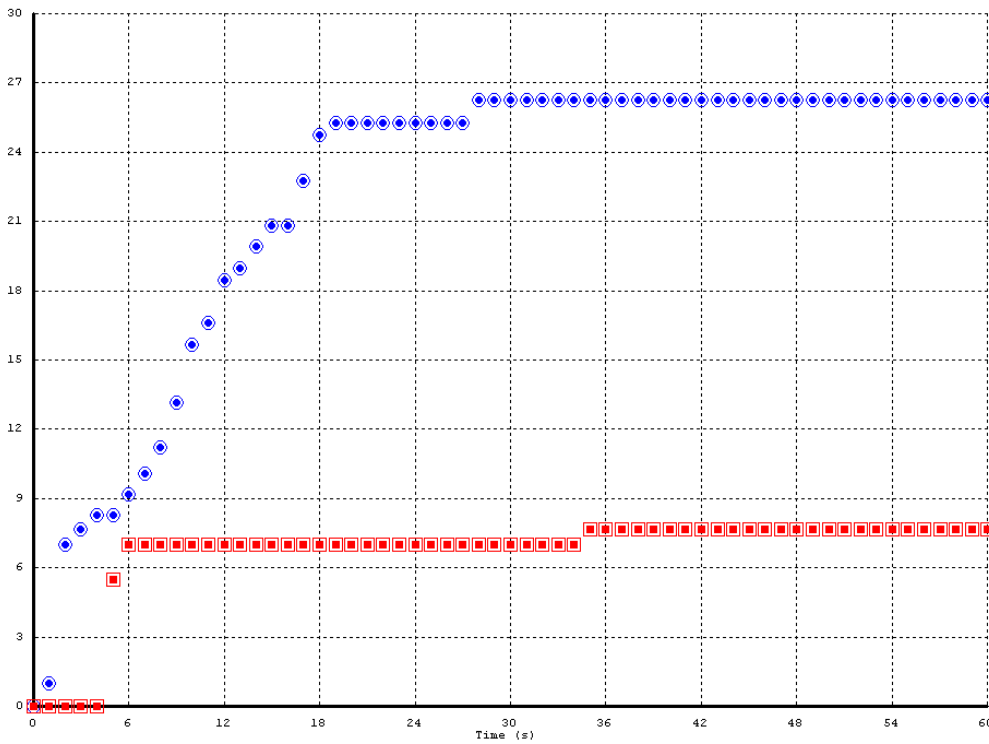
1st Degree Burn	3.05%
2nd Degree Burn	5.05%
3rd Degree Burn	8.30%
Total 2nd and 3rd Degree Burn	13.35%
Total Heat Absorbed at 2nd Degree Burn	58.8 kJ/m^2
Total Heat Absorbed Throughout Test	99.9 kJ/m^2

\*\*\*\*\*

Figure 4: GR 2015-TW-1 Coveralls - 5-sec Exposure - Replication 1



Percent Burn vs. Time (s)





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*****
Test Type:                Flash Fire Simulation
Mannequin:               Harry III - F1930-15
Fabric:                  GR 2015-TW-1
Series:                  General Recycled
Burn Time:               5.078
Measurement Time:       60.00
Test Date:               Thursday, Sep 24 2015
Burn Number:             04311
Ambient Temperature:    18.20
*****
    
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SUMMARY OF SENSOR RESPONSE

SENSOR NUMBER	SENSOR LOCATION	TIME	TIME	TOTAL	TOTAL	DEPTH	DEG BURN
		2nd DEG BURN sec	3rd DEG BURN sec	HEAT AT BURN kJ/m^2	HEAT AT 60 sec kJ/m^2	OF DAMAGE cm	
1	Left lower arm	9.8	-----	100.4	204.9	0.0452	2
2	Left lower arm	18.1	-----	122.2	166.8	0.0075	2
3	Left lower arm	-----	-----	-----	127.4	0.0000	0
4	Left upper arm	-----	-----	-----	50.0	0.0000	0
5	Left upper arm	-----	-----	-----	128.7	0.0000	0
6	Left upper arm	-----	-----	-----	77.5	0.0000	0
7	Left upper arm	-----	-----	-----	75.0	0.0000	0
8	Abdomen, lower right	-----	-----	-----	83.8	0.0000	0
9	Abdomen, lower center	-----	-----	-----	62.8	0.0000	0
10	Abdomen, lower left	-----	-----	-----	89.2	0.0000	0
11	Abdomen, upper right	-----	-----	-----	46.3	0.0000	0
12	Abdomen, upper center	-----	-----	-----	92.8	0.0000	0
13	Abdomen, upper left	-----	-----	-----	59.3	0.0000	0
14	Chest, lower right	-----	-----	-----	69.1	0.0000	0
15	Chest, center	-----	-----	-----	86.8	0.0000	0
16	Chest, lower left	16.3	-----	116.5	169.5	0.0075	2
17	Right lower arm	17.7	-----	117.2	161.8	0.0075	2
18	Right lower arm	-----	-----	-----	140.5	0.0000	0
19	Right lower arm	-----	-----	-----	103.0	0.0000	0
20	Right upper arm	-----	-----	-----	119.5	0.0000	0
21	Right upper arm	16.9	-----	113.2	165.0	0.0075	2
22	Right upper arm	9.8	-----	94.7	204.4	0.0579	2
23	Right upper arm	12.8	-----	109.5	171.7	0.0075	2
24	Chest, upper right	10.6	-----	101.8	176.7	0.0188	2
25	Chest, upper left	-----	-----	-----	97.9	0.0000	0
26	Right shoulder	-----	-----	-----	72.2	0.0000	0
27	Left shoulder	-----	-----	-----	46.9	0.0000	0
28	Side of trunk, lower left	-----	-----	-----	58.1	0.0000	0
29	Side of trunk, upper left	-----	-----	-----	33.9	0.0000	0
30	Lower back, lower left	-----	-----	-----	19.6	0.0000	0
31	Lower back, upper left	-----	-----	-----	82.0	0.0000	0
32	Upper back, lower left	-----	-----	-----	131.2	0.0000	0
33	Upper back, upper left	-----	-----	-----	139.4	<0.0075	1
34	Pelvis, rear center	-----	-----	-----	16.7	0.0000	0
35	Back, mid center	-----	-----	-----	63.4	0.0000	0
36	Back, upper center	-----	-----	-----	87.6	0.0000	0
37	Lower back, lower right	-----	-----	-----	26.0	0.0000	0
38	Lower back, upper right	-----	-----	-----	97.7	0.0000	0
39	Upper back, lower right	-----	-----	-----	104.6	0.0000	0
40	Upper back, upper right	8.4	-----	94.7	172.8	0.0277	2
41	Side of trunk, lower right	-----	-----	-----	43.8	0.0000	0
42	Side of trunk, upper right	-----	-----	-----	65.2	0.0000	0
43	Left lower leg, inner	-----	-----	-----	103.8	0.0000	0
44	Left lower leg, outer	-----	-----	-----	116.2	0.0000	0
45	Left shin	-----	-----	-----	116.2	0.0000	0
46	Left calf	-----	-----	-----	103.1	0.0000	0
47	Left mid leg, inner	-----	-----	-----	86.3	0.0000	0
48	Left mid leg, outer	-----	-----	-----	101.1	0.0000	0
49	Left lower thigh, front inner	-----	-----	-----	138.5	0.0000	0
50	Left lower thigh, front outer	14.4	-----	110.2	139.9	0.0075	2
51	Left lower thigh, rear	6.2	-----	86.7	196.7	0.0698	2
52	Left mid thigh, front	11.4	-----	104.1	148.8	0.0075	2

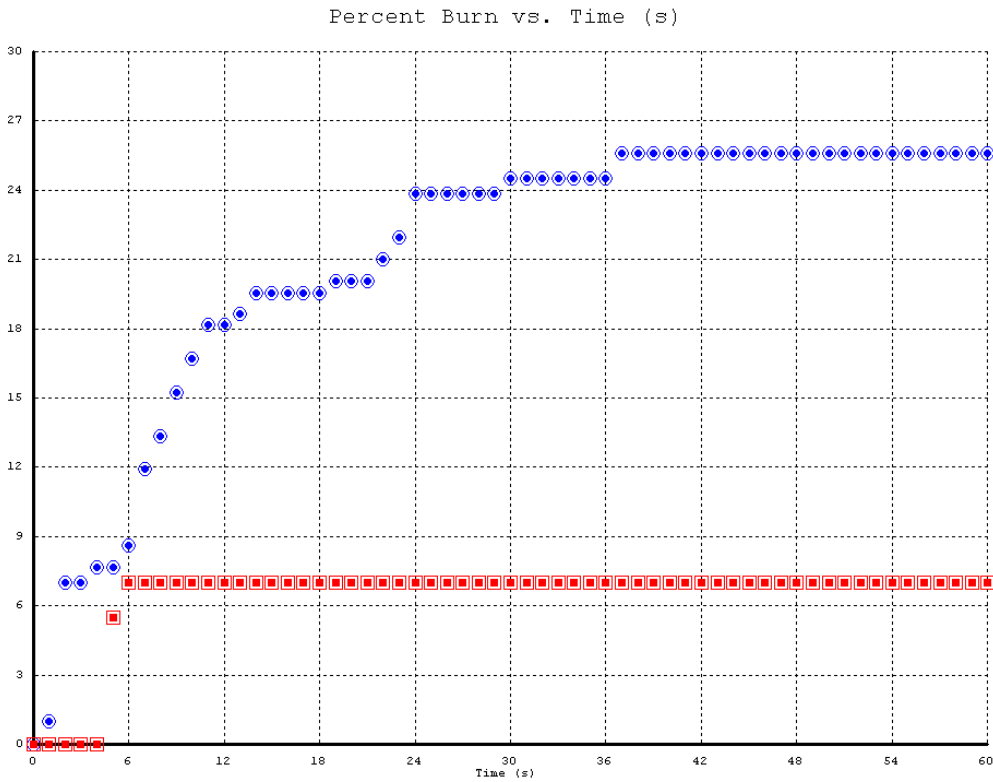
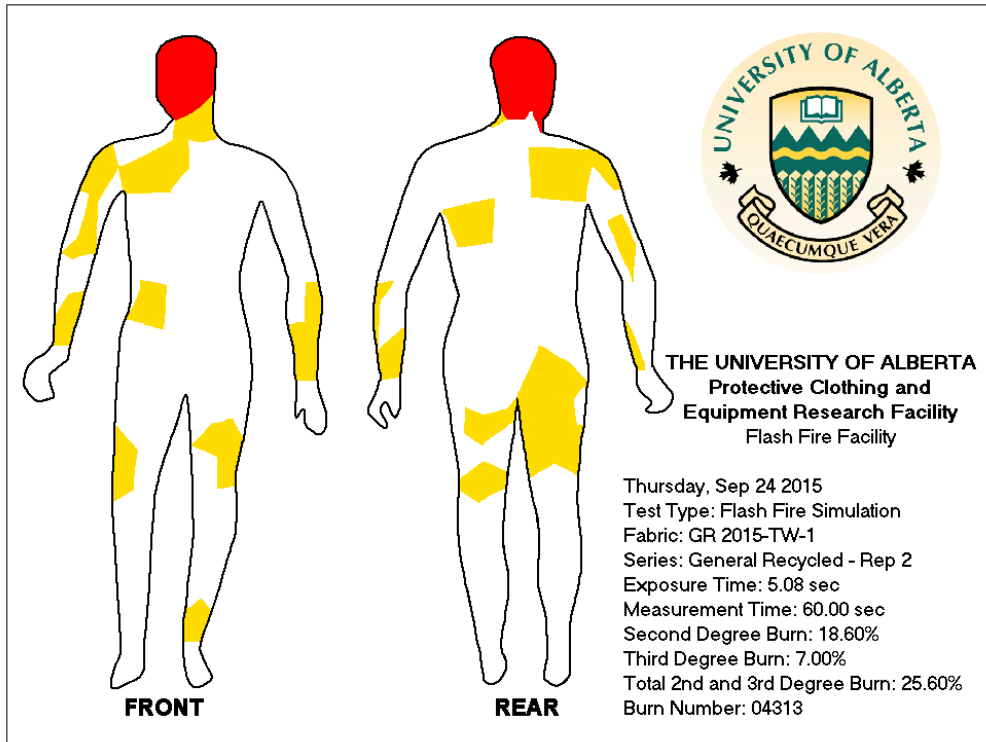
53	Left mid thigh, outer	-----	-----	-----	116.0	<0.0075	1
54	Left mid thigh, rear inner	-----	-----	-----	144.7	<0.0075	1
55	Left upper thigh, front inner	-----	-----	-----	111.5	0.0000	0
56	Left upper thigh, front outer	-----	-----	-----	50.5	0.0000	0
57	Left upper thigh, rear	-----	-----	-----	114.4	0.0000	0
58	Left buttock	-----	-----	-----	122.5	0.0000	0
59	Left buttock, side	-----	-----	-----	57.1	0.0000	0
60	Left hip	-----	-----	-----	29.9	0.0000	0
61	Left pelvis, front	-----	-----	-----	22.7	0.0000	0
62	Right lower leg, inner	-----	-----	-----	95.2	0.0000	0
63	Right lower leg, outer	-----	-----	-----	78.2	0.0000	0
64	Right shin	-----	-----	-----	119.7	0.0000	0
65	Right calf	-----	-----	-----	70.6	0.0000	0
66	Right mid leg, inner	17.4	-----	117.9	171.8	0.0075	2
67	Right mid leg, outer	-----	-----	-----	94.0	0.0000	0
68	Right lower thigh, inner	-----	-----	-----	139.9	0.0000	0
69	Rt. lower thigh, front outer	5.8	-----	81.6	194.2	0.0630	2
70	Right lower thigh, rear	11.9	-----	104.3	169.7	0.0075	2
71	Right mid thigh, front	-----	-----	-----	62.8	0.0000	0
72	Right mid thigh, rear outer	17.2	-----	114.9	156.1	0.0075	2
73	Right mid thigh, rear inner	13.1	-----	107.9	166.0	0.0075	2
74	Rt. upper thigh, front inner	27.2	-----	128.9	145.3	0.0075	2
75	Rt. upper thigh, front outer	-----	-----	-----	86.3	0.0000	0
76	Right upper thigh, rear	-----	-----	-----	106.2	0.0000	0
77	Right buttock	-----	-----	-----	136.0	0.0000	0
78	Right buttock, side	-----	-----	-----	71.8	0.0000	0
79	Right hip	-----	-----	-----	60.9	0.0000	0
80	Right pelvis, front	-----	-----	-----	62.4	0.0000	0
81	Right upper arm	9.7	-----	95.3	203.5	0.0599	2
82	Right lower arm	9.7	-----	97.0	190.1	0.0249	2
83	Right upper arm	-----	-----	-----	51.6	0.0000	0
84	Right upper arm	8.7	-----	92.3	202.9	0.0680	2
85	Right lower arm	-----	-----	-----	146.6	0.0000	0
86	Left upper arm	-----	-----	-----	137.4	0.0000	0
87	Left lower arm	7.0	-----	85.4	217.1	0.1035	2
88	Left upper arm	-----	-----	-----	85.3	0.0000	0
89	Left upper arm	-----	-----	-----	127.3	0.0000	0
90	Left lower arm	8.0	-----	99.5	204.6	0.0368	2
91	Lower jaw	1.0	4.3	40.6	520.0	>0.1200	3
92	Right cheek	1.0	4.5	37.4	517.4	>0.1200	3
93	Left cheek	0.8	4.0	29.1	582.3	>0.1200	3
94	Forehead	1.0	4.7	33.1	470.9	>0.1200	3
95	Head, upper back	1.4	5.3	41.8	454.0	>0.1200	3
96	Head, lower back	1.2	4.7	36.9	476.3	>0.1200	3
97	Back, right under rear neck	-----	-----	-----	107.6	0.0000	0
98	Neck, right side	-----	-----	-----	124.1	0.0000	0
99	Neck, left side	2.1	34.9	57.2	250.0	>0.1200	3
100	Neck, front	3.8	-----	72.4	180.2	0.0412	2
101	Rt. upper thigh, front center	-----	-----	-----	63.7	0.0000	0
102	Lt. upper thigh, front center	-----	-----	-----	64.2	0.0000	0
103	Right lower leg, front	-----	-----	-----	125.8	0.0000	0
104	Left lower leg, front	7.0	-----	88.4	134.6	0.0075	2
105	Left lower leg, back	-----	-----	-----	95.4	0.0000	0
106	Right lower leg, back	-----	-----	-----	122.6	0.0000	0
107	Left mid leg, back	-----	-----	-----	115.9	0.0000	0
108	Right mid leg, back	-----	-----	-----	106.4	0.0000	0
109	Lower back, lower center	-----	-----	-----	23.7	0.0000	0
110	Upper back, lower center	-----	-----	-----	80.2	0.0000	0

\*\*\*\*\*  
 Summary of burn injury prediction

1st Degree Burn	2.85%
2nd Degree Burn	18.60%
3rd Degree Burn	7.65%
Total 2nd and 3rd Degree Burn	26.25%
Total Heat Absorbed at 2nd Degree Burn	84.0 kJ/m^2
Total Heat Absorbed Throughout Test	140.3 kJ/m^2

\*\*\*\*\*

Figure 5: GR 2015-TW-1 Coveralls - 5-sec Exposure - Replication 2



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*****
Test Type:                Flash Fire Simulation
Mannequin:               Harry III - F1930-15
Fabric:                  GR 2015-TW-1
Series:                  General Recycled - Rep 2
Burn Time:               5.078
Measurement Time:       60.00
Test Date:               Thursday, Sep 24 2015
Burn Number:             04313
Ambient Temperature:    19.70
*****
  
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SUMMARY OF SENSOR RESPONSE

SENSOR NUMBER	SENSOR LOCATION	TIME	TIME	TOTAL	TOTAL	DEPTH	DEG BURN
		2nd DEG BURN sec	3rd DEG BURN sec	HEAT AT BURN kJ/m^2	HEAT AT 60 sec kJ/m^2	OF DAMAGE cm	
1	Left lower arm	8.9	-----	96.6	207.7	0.0586	2
2	Left lower arm	12.1	-----	108.8	172.6	0.0075	2
3	Left lower arm	-----	-----	-----	127.7	0.0000	0
4	Left upper arm	-----	-----	-----	52.4	0.0000	0
5	Left upper arm	-----	-----	-----	85.1	0.0000	0
6	Left upper arm	-----	-----	-----	61.0	0.0000	0
7	Left upper arm	-----	-----	-----	95.5	0.0000	0
8	Abdomen, lower right	23.1	-----	124.0	156.8	0.0075	2
9	Abdomen, lower center	-----	-----	-----	75.5	0.0000	0
10	Abdomen, lower left	-----	-----	-----	85.1	0.0000	0
11	Abdomen, upper right	-----	-----	-----	115.0	0.0000	0
12	Abdomen, upper center	-----	-----	-----	70.4	0.0000	0
13	Abdomen, upper left	-----	-----	-----	54.8	0.0000	0
14	Chest, lower right	-----	-----	-----	131.1	0.0000	0
15	Chest, center	-----	-----	-----	41.8	0.0000	0
16	Chest, lower left	-----	-----	-----	129.0	0.0000	0
17	Right lower arm	10.1	-----	98.6	179.1	0.0200	2
18	Right lower arm	-----	-----	-----	130.0	0.0000	0
19	Right lower arm	-----	-----	-----	128.5	0.0000	0
20	Right upper arm	-----	-----	-----	102.4	0.0000	0
21	Right upper arm	-----	-----	-----	119.0	0.0000	0
22	Right upper arm	-----	-----	-----	101.4	0.0000	0
23	Right upper arm	18.8	-----	119.2	160.0	0.0075	2
24	Chest, upper right	9.8	-----	98.5	181.0	0.0202	2
25	Chest, upper left	-----	-----	-----	111.6	0.0000	0
26	Right shoulder	-----	-----	-----	70.4	0.0000	0
27	Left shoulder	-----	-----	-----	41.8	0.0000	0
28	Side of trunk, lower left	-----	-----	-----	71.0	0.0000	0
29	Side of trunk, upper left	-----	-----	-----	27.9	0.0000	0
30	Lower back, lower left	-----	-----	-----	36.1	0.0000	0
31	Lower back, upper left	-----	-----	-----	93.6	0.0000	0
32	Upper back, lower left	23.7	-----	127.4	152.8	0.0075	2
33	Upper back, upper left	-----	-----	-----	121.8	0.0000	0
34	Pelvis, rear center	-----	-----	-----	46.6	0.0000	0
35	Back, mid center	-----	-----	-----	81.1	0.0000	0
36	Back, upper center	-----	-----	-----	109.1	0.0000	0
37	Lower back, lower right	-----	-----	-----	54.6	0.0000	0
38	Lower back, upper right	-----	-----	-----	109.5	0.0000	0
39	Upper back, lower right	-----	-----	-----	126.5	0.0000	0
40	Upper back, upper right	6.5	-----	85.2	189.2	0.0673	2
41	Side of trunk, lower right	-----	-----	-----	80.7	0.0000	0
42	Side of trunk, upper right	-----	-----	-----	57.1	0.0000	0
43	Left lower leg, inner	-----	-----	-----	120.2	0.0000	0
44	Left lower leg, outer	-----	-----	-----	123.2	0.0000	0
45	Left shin	-----	-----	-----	115.2	0.0000	0
46	Left calf	-----	-----	-----	104.1	0.0000	0
47	Left mid leg, inner	-----	-----	-----	91.9	0.0000	0
48	Left mid leg, outer	-----	-----	-----	106.0	0.0000	0
49	Left lower thigh, front inner	-----	-----	-----	137.3	0.0000	0
50	Left lower thigh, front outer	7.2	-----	93.4	172.1	0.0262	2
51	Left lower thigh, rear	6.8	-----	87.8	185.5	0.0372	2
52	Left mid thigh, front	5.8	-----	81.2	206.0	0.0832	2

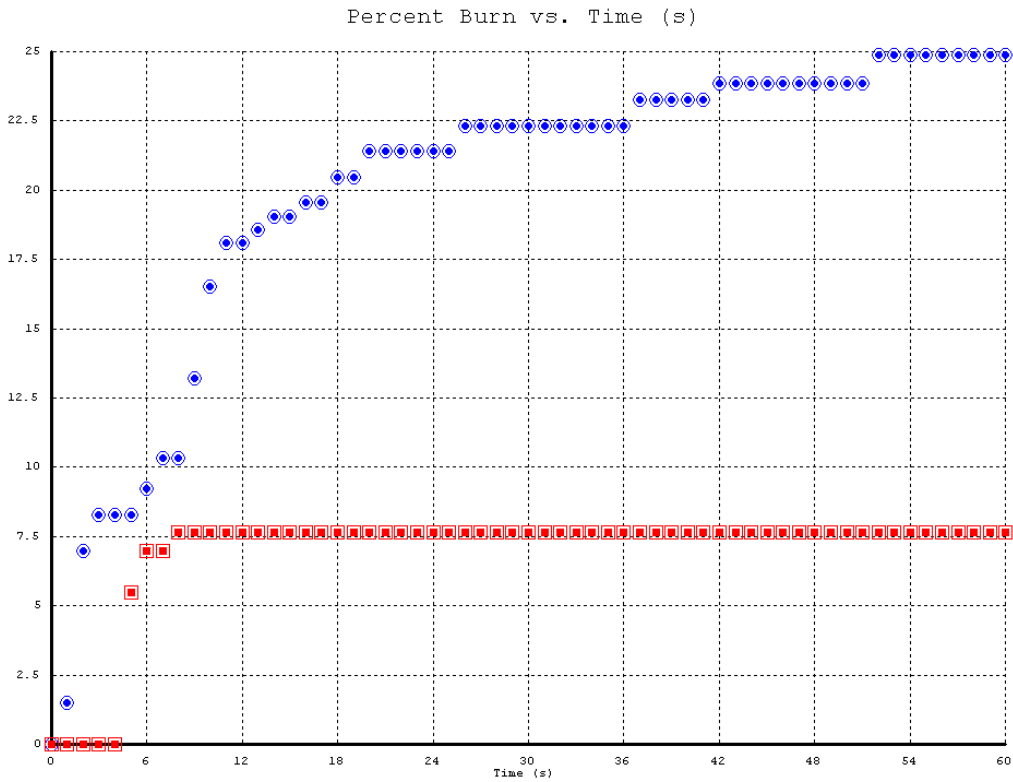
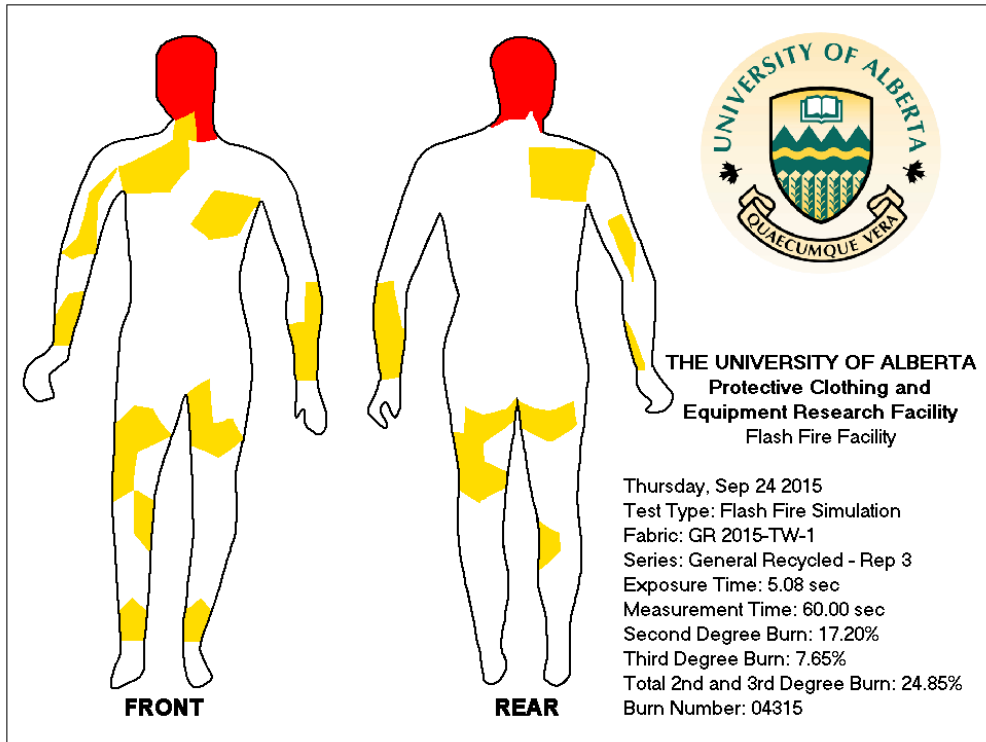
53	Left mid thigh, outer	-----	-----	-----	122.4	0.0000	0
54	Left mid thigh, rear inner	-----	-----	-----	135.3	0.0000	0
55	Left upper thigh, front inner	-----	-----	-----	108.9	0.0000	0
56	Left upper thigh, front outer	-----	-----	-----	37.5	0.0000	0
57	Left upper thigh, rear	13.7	-----	111.6	168.5	0.0075	2
58	Left buttock	-----	-----	-----	112.8	0.0000	0
59	Left buttock, side	-----	-----	-----	46.2	0.0000	0
60	Left hip	-----	-----	-----	41.3	0.0000	0
61	Left pelvis, front	-----	-----	-----	50.9	0.0000	0
62	Right lower leg, inner	-----	-----	-----	123.4	0.0000	0
63	Right lower leg, outer	-----	-----	-----	62.1	0.0000	0
64	Right shin	-----	-----	-----	107.5	0.0000	0
65	Right calf	-----	-----	-----	81.8	0.0000	0
66	Right mid leg, inner	-----	-----	-----	142.1	0.0000	0
67	Right mid leg, outer	-----	-----	-----	66.1	0.0000	0
68	Right lower thigh, inner	-----	-----	-----	130.3	0.0000	0
69	Rt. lower thigh, front outer	6.5	-----	81.5	188.8	0.0503	2
70	Right lower thigh, rear	-----	-----	-----	150.7	<0.0075	1
71	Right mid thigh, front	-----	-----	-----	74.2	0.0000	0
72	Right mid thigh, rear outer	22.6	-----	121.5	153.0	0.0075	2
73	Right mid thigh, rear inner	21.8	-----	121.4	153.8	0.0075	2
74	Rt. upper thigh, front inner	-----	-----	-----	131.8	0.0000	0
75	Rt. upper thigh, front outer	-----	-----	-----	46.8	0.0000	0
76	Right upper thigh, rear	8.4	-----	92.3	189.5	0.0328	2
77	Right buttock	36.2	-----	140.9	154.5	0.0075	2
78	Right buttock, side	-----	-----	-----	68.8	0.0000	0
79	Right hip	-----	-----	-----	38.2	0.0000	0
80	Right pelvis, front	-----	-----	-----	80.2	0.0000	0
81	Right upper arm	10.5	-----	105.7	204.8	0.0589	2
82	Right lower arm	8.1	-----	93.2	199.9	0.0536	2
83	Right upper arm	-----	-----	-----	88.9	0.0000	0
84	Right upper arm	9.3	-----	95.8	184.9	0.0283	2
85	Right lower arm	-----	-----	-----	133.3	0.0000	0
86	Left upper arm	-----	-----	-----	140.5	0.0000	0
87	Left lower arm	7.3	-----	86.1	204.5	0.0650	2
88	Left upper arm	-----	-----	-----	65.2	0.0000	0
89	Left upper arm	-----	-----	-----	125.1	0.0000	0
90	Left lower arm	-----	-----	-----	156.6	<0.0075	1
91	Lower jaw	1.2	4.6	43.7	482.9	>0.1200	3
92	Right cheek	1.0	4.6	36.1	516.2	>0.1200	3
93	Left cheek	0.9	4.2	31.9	557.5	>0.1200	3
94	Forehead	1.0	4.8	33.2	459.7	>0.1200	3
95	Head, upper back	1.7	5.4	47.4	443.5	>0.1200	3
96	Head, lower back	1.5	4.8	46.4	447.2	>0.1200	3
97	Back, right under rear neck	-----	-----	-----	74.7	0.0000	0
98	Neck, right side	-----	-----	-----	131.9	0.0000	0
99	Neck, left side	29.7	-----	137.3	171.0	0.0075	2
100	Neck, front	3.9	-----	70.9	178.0	0.0415	2
101	Rt. upper thigh, front center	-----	-----	-----	50.0	0.0000	0
102	Lt. upper thigh, front center	-----	-----	-----	105.3	0.0000	0
103	Right lower leg, front	-----	-----	-----	122.3	0.0000	0
104	Left lower leg, front	6.7	-----	92.5	152.7	0.0084	2
105	Left lower leg, back	-----	-----	-----	122.0	0.0000	0
106	Right lower leg, back	-----	-----	-----	99.9	0.0000	0
107	Left mid leg, back	-----	-----	-----	100.2	0.0000	0
108	Right mid leg, back	-----	-----	-----	95.3	0.0000	0
109	Lower back, lower center	-----	-----	-----	29.2	0.0000	0
110	Upper back, lower center	-----	-----	-----	94.6	0.0000	0

\*\*\*\*\*  
 Summary of burn injury prediction

1st Degree Burn	1.40%
2nd Degree Burn	18.60%
3rd Degree Burn	7.00%
Total 2nd and 3rd Degree Burn	25.60%
Total Heat Absorbed at 2nd Degree Burn	86.6 kJ/m^2
Total Heat Absorbed Throughout Test	141.3 kJ/m^2

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Figure 6: GR 2015-TW-1 Coveralls - 5-sec Exposure - Replication 3



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*****
Test Type:                Flash Fire Simulation
Mannequin:                Harry III - F1930-15
Fabric:                   GR 2015-TW-1
Series:                   General Recycled - Rep 3
Burn Time:                5.078
Measurement Time:        60.00
Test Date:                Thursday, Sep 24 2015
Burn Number:              04315
Ambient Temperature:     21.30
*****
  
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SUMMARY OF SENSOR RESPONSE

SENSOR NUMBER	SENSOR LOCATION	TIME	TIME	TOTAL	TOTAL	DEPTH	DEG BURN
		2nd DEG BURN sec	3rd DEG BURN sec	HEAT AT BURN kJ/m^2	HEAT AT 60 sec kJ/m^2	OF DAMAGE cm	
1	Left lower arm	8.0	-----	93.3	216.1	0.0761	2
2	Left lower arm	13.2	-----	109.0	160.1	0.0075	2
3	Left lower arm	-----	-----	-----	129.5	0.0000	0
4	Left upper arm	-----	-----	-----	49.0	0.0000	0
5	Left upper arm	-----	-----	-----	76.9	0.0000	0
6	Left upper arm	-----	-----	-----	77.5	0.0000	0
7	Left upper arm	-----	-----	-----	103.1	0.0000	0
8	Abdomen, lower right	-----	-----	-----	103.7	0.0000	0
9	Abdomen, lower center	-----	-----	-----	33.9	0.0000	0
10	Abdomen, lower left	-----	-----	-----	84.1	0.0000	0
11	Abdomen, upper right	-----	-----	-----	62.9	0.0000	0
12	Abdomen, upper center	-----	-----	-----	47.6	0.0000	0
13	Abdomen, upper left	-----	-----	-----	60.0	0.0000	0
14	Chest, lower right	-----	-----	-----	83.2	0.0000	0
15	Chest, center	-----	-----	-----	48.3	0.0000	0
16	Chest, lower left	36.5	-----	142.3	160.4	0.0075	2
17	Right lower arm	12.3	-----	105.7	178.9	0.0179	2
18	Right lower arm	-----	-----	-----	105.6	0.0000	0
19	Right lower arm	-----	-----	-----	114.6	0.0000	0
20	Right upper arm	-----	-----	-----	93.7	0.0000	0
21	Right upper arm	-----	-----	-----	115.2	0.0000	0
22	Right upper arm	-----	-----	-----	107.3	0.0000	0
23	Right upper arm	-----	-----	-----	109.7	0.0000	0
24	Chest, upper right	9.9	-----	98.3	185.5	0.0289	2
25	Chest, upper left	-----	-----	-----	107.8	0.0000	0
26	Right shoulder	-----	-----	-----	70.1	0.0000	0
27	Left shoulder	-----	-----	-----	70.0	0.0000	0
28	Side of trunk, lower left	-----	-----	-----	66.6	0.0000	0
29	Side of trunk, upper left	-----	-----	-----	29.1	0.0000	0
30	Lower back, lower left	-----	-----	-----	21.1	0.0000	0
31	Lower back, upper left	-----	-----	-----	76.9	0.0000	0
32	Upper back, lower left	-----	-----	-----	106.1	0.0000	0
33	Upper back, upper left	-----	-----	-----	95.3	0.0000	0
34	Pelvis, rear center	-----	-----	-----	67.0	0.0000	0
35	Back, mid center	-----	-----	-----	85.3	0.0000	0
36	Back, upper center	-----	-----	-----	109.0	0.0000	0
37	Lower back, lower right	-----	-----	-----	24.2	0.0000	0
38	Lower back, upper right	-----	-----	-----	92.9	0.0000	0
39	Upper back, lower right	-----	-----	-----	99.6	0.0000	0
40	Upper back, upper right	9.2	-----	97.1	164.3	0.0175	2
41	Side of trunk, lower right	-----	-----	-----	33.8	0.0000	0
42	Side of trunk, upper right	-----	-----	-----	32.6	0.0000	0
43	Left lower leg, inner	-----	-----	-----	88.4	0.0000	0
44	Left lower leg, outer	-----	-----	-----	108.8	0.0000	0
45	Left shin	-----	-----	-----	143.2	<0.0075	1
46	Left calf	-----	-----	-----	93.0	0.0000	0
47	Left mid leg, inner	-----	-----	-----	73.2	0.0000	0
48	Left mid leg, outer	-----	-----	-----	104.1	0.0000	0
49	Left lower thigh, front inner	-----	-----	-----	138.4	0.0000	0
50	Left lower thigh, front outer	-----	-----	-----	141.4	<0.0075	1
51	Left lower thigh, rear	9.3	-----	97.1	179.4	0.0174	2
52	Left mid thigh, front	8.3	-----	92.9	173.2	0.0221	2

53	Left mid thigh, outer	19.8	-----	118.5	142.7	0.0075	2
54	Left mid thigh, rear inner	-----	-----	-----	138.3	0.0000	0
55	Left upper thigh, front inner	51.8	-----	145.4	148.9	0.0075	2
56	Left upper thigh, front outer	-----	-----	-----	40.1	0.0000	0
57	Left upper thigh, rear	17.0	-----	116.2	162.3	0.0075	2
58	Left buttock	-----	-----	-----	111.6	0.0000	0
59	Left buttock, side	-----	-----	-----	49.4	0.0000	0
60	Left hip	-----	-----	-----	46.3	0.0000	0
61	Left pelvis, front	-----	-----	-----	65.6	0.0000	0
62	Right lower leg, inner	-----	-----	-----	123.8	0.0000	0
63	Right lower leg, outer	-----	-----	-----	115.7	0.0000	0
64	Right shin	-----	-----	-----	113.7	0.0000	0
65	Right calf	-----	-----	-----	76.8	0.0000	0
66	Right mid leg, inner	41.6	-----	146.8	158.6	0.0075	2
67	Right mid leg, outer	-----	-----	-----	105.8	0.0000	0
68	Right lower thigh, inner	-----	-----	-----	115.0	0.0000	0
69	Rt. lower thigh, front outer	8.0	-----	92.9	182.9	0.0334	2
70	Right lower thigh, rear	-----	-----	-----	130.5	0.0000	0
71	Right mid thigh, front	5.9	-----	82.2	191.5	0.0840	2
72	Right mid thigh, rear outer	-----	-----	-----	139.5	0.0000	0
73	Right mid thigh, rear inner	-----	-----	-----	126.5	0.0000	0
74	Rt. upper thigh, front inner	-----	-----	-----	135.5	0.0000	0
75	Rt. upper thigh, front outer	-----	-----	-----	47.1	0.0000	0
76	Right upper thigh, rear	25.8	-----	127.2	155.2	0.0075	2
77	Right buttock	-----	-----	-----	118.4	0.0000	0
78	Right buttock, side	-----	-----	-----	65.4	0.0000	0
79	Right hip	-----	-----	-----	87.1	0.0000	0
80	Right pelvis, front	-----	-----	-----	84.1	0.0000	0
81	Right upper arm	10.8	-----	104.6	195.5	0.0358	2
82	Right lower arm	9.0	-----	98.3	199.9	0.0514	2
83	Right upper arm	-----	-----	-----	91.3	0.0000	0
84	Right upper arm	15.4	-----	113.1	161.3	0.0075	2
85	Right lower arm	-----	-----	-----	113.3	0.0000	0
86	Left upper arm	-----	-----	-----	129.2	0.0000	0
87	Left lower arm	8.7	-----	95.8	187.2	0.0230	2
88	Left upper arm	-----	-----	-----	84.3	0.0000	0
89	Left upper arm	-----	-----	-----	107.7	0.0000	0
90	Left lower arm	6.2	-----	88.8	223.6	0.0908	2
91	Lower jaw	0.9	4.3	34.0	531.0	>0.1200	3
92	Right cheek	1.0	4.6	36.9	506.4	>0.1200	3
93	Left cheek	0.9	4.1	31.6	567.6	>0.1200	3
94	Forehead	1.0	4.8	31.6	460.4	>0.1200	3
95	Head, upper back	1.7	5.4	47.4	447.2	>0.1200	3
96	Head, lower back	1.2	4.7	39.7	470.2	>0.1200	3
97	Back, right under rear neck	-----	-----	-----	89.4	0.0000	0
98	Neck, right side	-----	-----	-----	130.4	0.0000	0
99	Neck, left side	2.5	7.2	59.9	330.6	>0.1200	3
100	Neck, front	2.5	-----	59.9	188.2	0.0647	2
101	Rt. upper thigh, front center	-----	-----	-----	79.8	0.0000	0
102	Lt. upper thigh, front center	-----	-----	-----	57.3	0.0000	0
103	Right lower leg, front	6.1	-----	88.7	181.2	0.0148	2
104	Left lower leg, front	10.7	-----	99.8	151.9	0.0075	2
105	Left lower leg, back	-----	-----	-----	92.3	0.0000	0
106	Right lower leg, back	-----	-----	-----	109.8	0.0000	0
107	Left mid leg, back	-----	-----	-----	93.2	0.0000	0
108	Right mid leg, back	-----	-----	-----	85.4	0.0000	0
109	Lower back, lower center	-----	-----	-----	21.4	0.0000	0
110	Upper back, lower center	-----	-----	-----	109.4	0.0000	0

\*\*\*\*\*  
 Summary of burn injury prediction

1st Degree Burn	1.70%
2nd Degree Burn	17.20%
3rd Degree Burn	7.65%
Total 2nd and 3rd Degree Burn	24.85%
Total Heat Absorbed at 2nd Degree Burn	85.7 kJ/m^2
Total Heat Absorbed Throughout Test	138.8 kJ/m^2

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APPENDIX 3

NUDE BURN HEAT FLUX

Table 4: Exposure heat flux - start of day, September 24 2015

**Flux Breakdown**

1.0 sec - 4.0 sec

	Mean	Std. Dev.
Chest and Abdomen	84.66	19.87
Back	83.12	13.37
Left Arm	82.66	14.80
Right Arm	83.67	16.00
Left Leg Upper	74.11	15.61
Left Leg Lower	85.42	14.63
Right Leg Upper	77.46	8.97
Right Leg Lower	83.28	12.25
Head	95.94	15.66

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**Overall** **83.25** **16.53**

Figure 7: Exposure heat flux - start of day, September 24 2015

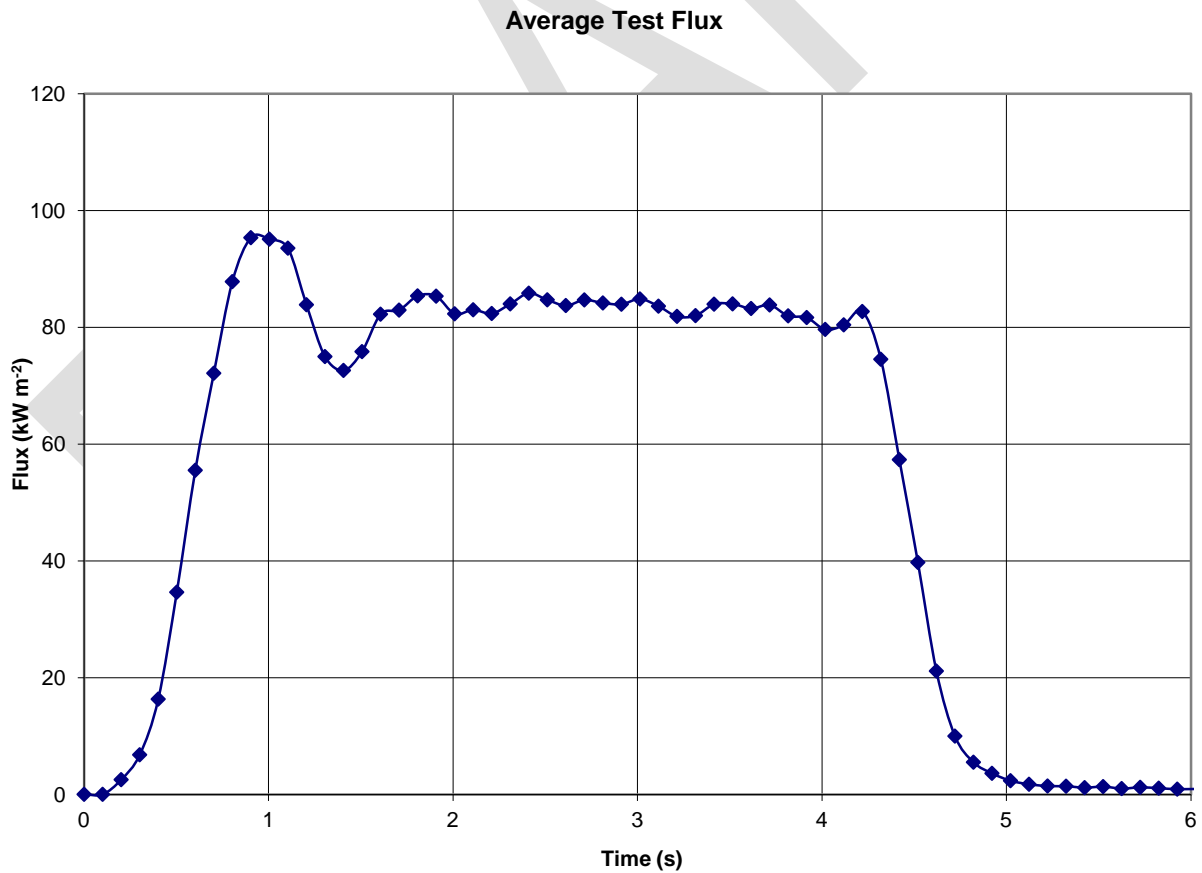


Table 5: Exposure heat flux - end of day, September 24 2015

### Flux Breakdown

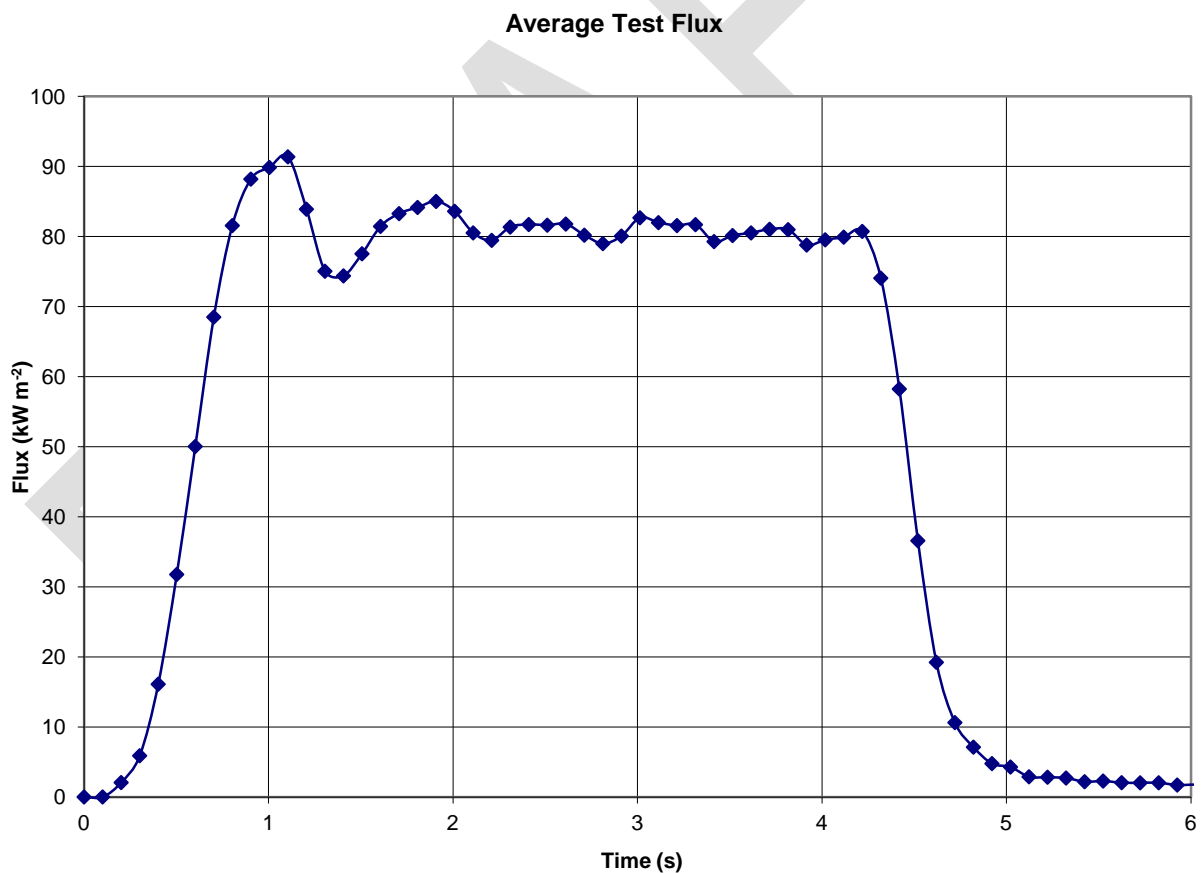
1.0 sec - 4.0 sec

	Mean	Std. Dev.
Chest and Abdomen	82.00	14.18
Back	81.87	13.26
Left Arm	81.20	14.94
Right Arm	81.81	14.74
Left Leg Upper	72.71	10.15
Left Leg Lower	82.02	14.07
Right Leg Upper	74.34	7.61
Right Leg Lower	79.45	9.18
Head	97.50	16.50

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<b>Overall</b>	<b>81.38</b>	<b>15.09</b>
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Figure 8: Exposure heat flux - end of day, September 24 2015



END OF REPORT