

U.S. DEPARTMENT OF COMMERCE
NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY
Gaithersburg, MD 20899

REPORT OF TEST
FR 4009

November 2, 1999
Revised April 10, 2000

**Full-Scale House Fire Experiment for InterFIRE VR
May 6, 1998**

A.D. Putorti Jr and J. McElroy
Building and Fire Research Laboratory
National Institute of Standards and Technology
U.S. Department of Commerce
Gaithersburg, MD 20899

Acknowledgements

Many thanks to Mr. Jason Clement of the University of Canterbury, Christchurch, New Zealand, for assistance in conducting the burn experiment. Appreciation is also extended to Mr. Daniel Madrzykowski of NIST and Mr. Steve Austin of the International Association of Arson Investigators (IAAI) for support of this project.

Introduction

A public/private partnership involving multiple federal agencies and private industry was assembled to develop a comprehensive fire investigation training tool. The partnership consisted of the following federal agencies: the Bureau of Alcohol, Tobacco and Firearms (ATF), the U.S. Fire Administration, and the National Institute of Standards and Technology (NIST); and private industry partners: American Re-Insurance and the National Fire Protection Association. NIST provided technical assistance to the partnership during development of an educational interactive CD-ROM for fire investigators, titled "InterFIRE VR." The CD-ROM contains video of fire ignition and development in a single family dwelling, as well as visual documentation of the pre and post-fire scene. Prior to the fire, NIST provided input into the choice of furnishings, fire scenarios, and ventilation conditions necessary for the desired fire effects. Recommendations were developed using the results of computer-based zone fire models, empirical correlations, and engineering judgment.

During the fire experiment, NIST conducted measurements of temperature and radiant heat flux, and recorded video inside the structure. Data were recorded every 3 s with a computerized acquisition system. The experiment discussed in this report occurred on May 6, 1998, at the Massachusetts State Police Academy, 340 Brookfield Rd., New Braintree, Massachusetts. The address of the dwelling was 5 Circle Drive, New Braintree, Massachusetts. The measurements conducted in the structure during the test included: ceiling to floor temperatures within various rooms, and radiant heat flux at floor level.

The fuels for the fire consisted of household furnishings and a liquid accelerant: two-cycle engine fuel.

Structure

The building used for the fire experiment was an unoccupied, two story, single family dwelling. The building was of wood frame construction, with gypsum board interior walls and ceilings. Exterior walls consisted of wood clapboard. The floors throughout the building, except the kitchen and bathroom, were constructed of hardwood. The floors in the kitchen and bathroom were covered with vinyl flooring. Two of the walls in the living room were covered with laminated wood (pine) paneling.

The building had a full basement, but it did not extend under the attached garage. The pitched roof of the building was covered with asphalt shingles.

The layout of the building is shown in Figs. 1 through 3, and includes four bedrooms, two bathrooms, living room, dining room, kitchen, and garage. The living room served as the fire room for the experiment. All doors in the building were closed fully during the experiments except the first floor door leading to the basement, the door from the kitchen to the dining room, and the upstairs bathroom door. Exterior doors were all fully closed with the exception of the

door from the kitchen to the outside. All windows of the dwelling were fully closed except for the basement windows and the upstairs bathroom window which were opened fully. The kitchen windows over the sink were also open, but not fully.

The distance from the floor to the ceiling in the first floor of the structure was 2.29 m (7.50 ft), while the distance from the floor to the ceiling in the hall and bathroom on the second floor of the building was 2.32 m (7.60 ft). The dimensions of the rooms, door openings, and window openings are given in Figs. 1 through 3. The estimated expanded uncertainties in the ceiling height and door opening dimensions are ± 0.02 m (± 0.8 in).

It should be noted that all of the uncertainties stated in this report are expanded uncertainties¹ derived from Type B evaluations with a coverage factor, k , equal to 2. A coverage factor of 2 corresponds to a confidence interval of approximately 95 percent, assuming a normal distribution applies.

Fuel Load

The experiments were conducted with the contents of the building as the fuel. In addition, an accelerant, consisting of approximately 1.0 L (0.26 gal) of two-cycle engine fuel was poured in the room. The engine fuel consisted of an approximate 40:1 mixture of regular unleaded gasoline and two-cycle engine oil. A diagram of approximate furniture locations is shown in Fig. 4.

An electric match located at the northwest corner of the couch ignited the fire. The electric match consisted of a segment of nickel-chromium wire placed in an open book of paper matches. The wire is heated by applying an electrical potential, resulting in ignition of the matches.

Temperature Measurement

The temperatures were measured with 0.51 mm (0.02 in) nominal diameter bare bead, type K thermocouples. The floor to ceiling thermocouple arrays were in the living room and dining room as shown in Fig. 5. The elevations of the thermocouples above the floor are given in Table 1.

The estimated expanded uncertainties in the temperatures of the thermocouples are ± 7 °C (± 13 °F) as derived from the thermocouple wire manufacturer^{2,3} and voltage measurement estimates. The estimated expanded uncertainties in the thermocouple locations are ± 0.05 m (2.0 in).

¹ Taylor, B.N. and Kuyatt, C.E. "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results." NIST Technical Note 1297, 1994 Edition. National Institute of Standards and Technology, Gaithersburg, MD.

² The Temperature Handbook. Omega Engineering, Inc., Stamford, CT. Vol. 27.

³ The mention of a particular manufacturer's products does not constitute endorsement by NIST, nor does it indicate that the products are necessarily those best suited for the intended purpose.

Radiant Heat Flux Measurement

The radiant heat flux at the floor of the living room was measured with a water cooled, Schmidt-Boelter type heat flux transducer. The transducer was equipped with a sapphire window to exclude convected heat flux. The view angle of the transducer, with the sapphire window installed, was approximately 150°. The radiant heat flux transducer was installed through the floor of the living room in order to protect the cooling and data lines from fire and physical damage. The face of the transducer was parallel and flush with the upper surface of the floor. The estimated expanded uncertainty of the radiant heat flux measurement is $\pm 5\%$ from manufacturer data^{3,4} and voltage measurement estimates. The estimated expanded uncertainty in the radiometer location is ± 0.01 m (0.4 in).

Weather Conditions

The approximate weather conditions during the experiment were as follows: temperature, 12 °C (53 °F); relative humidity, 100 %; barometric pressure, 98.3 kPa (29.1 in Hg); wind speed, 1 m/s (3 mph); wind direction, from 74°.

Results

The sequence of events for the experiment is given in Table 2, with an estimated expanded uncertainty of ± 3 s in the event times. Ignition occurred at approximately 0756 h.

The temperatures of the thermocouples measured within the fire room are shown in Fig. 6. The data are presented for various distances from the floor, illustrating the temperature profile as a function of height. Data from all of the temperature measurements are presented in Appendix A of this report.

Temperatures of the thermocouples measured within the dining room are shown in Fig. 7.

The radiant heat flux measured by the transducer in the living room is shown in Fig. 8.

⁴ Bulletin 118. Medtherm Corporation, Huntsville, Al. 1993.

Table 1. Living room and dining room thermocouple elevations.

Thermocouple Number	Distance From Floor (m)	Distance From Floor (ft)
0	2.26	7.42
1	1.98	6.50
2	1.68	5.50
3	1.37	4.50
4	1.07	3.50
5	0.76	2.50
6	0.46	1.50
7	0.15	0.50

Table 2. Sequence of events.

Event	Elapsed Time (s)
Fuel pour	-46
Ignition	0
Call for suppression	299
Suppression begins	350

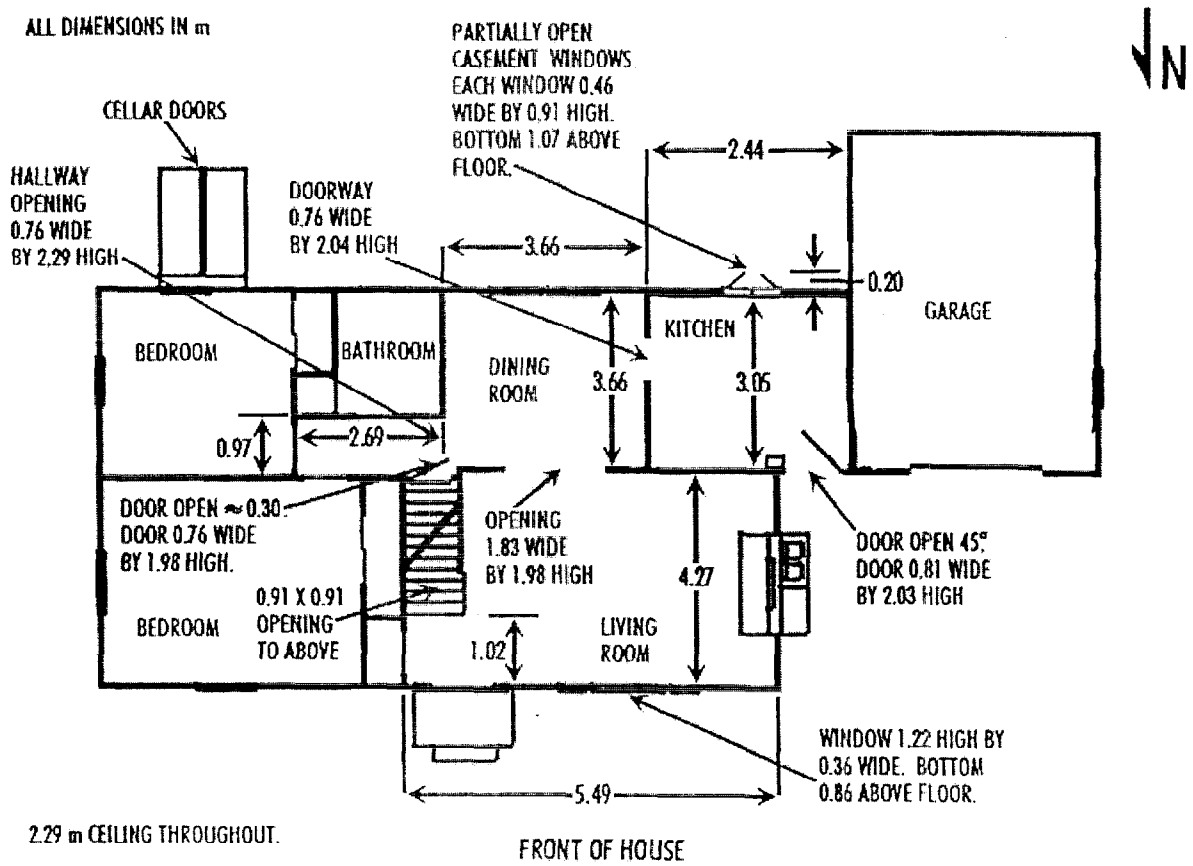
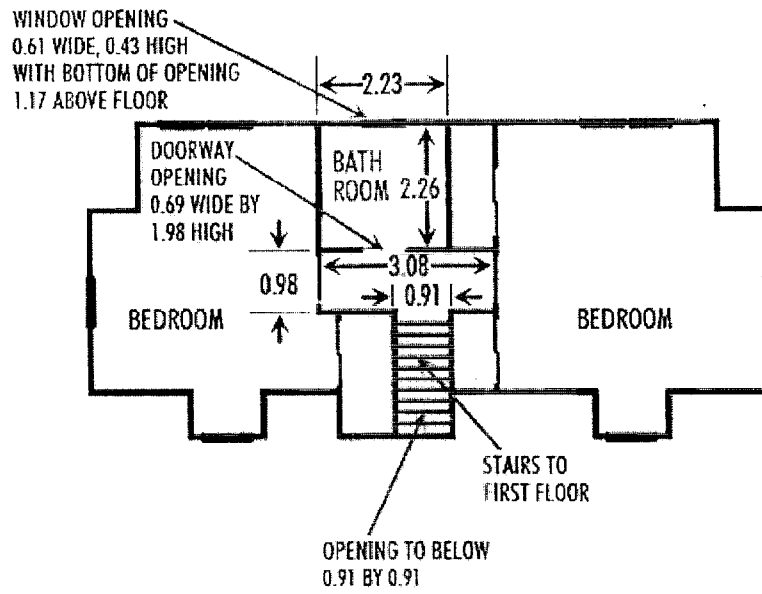


Figure 1. Plan view of first floor.

ALL DIMENSIONS IN m



CEILING HEIGHT OF 2.32

Figure 2. Plan view of second floor.

ALL DIMENSIONS IN m

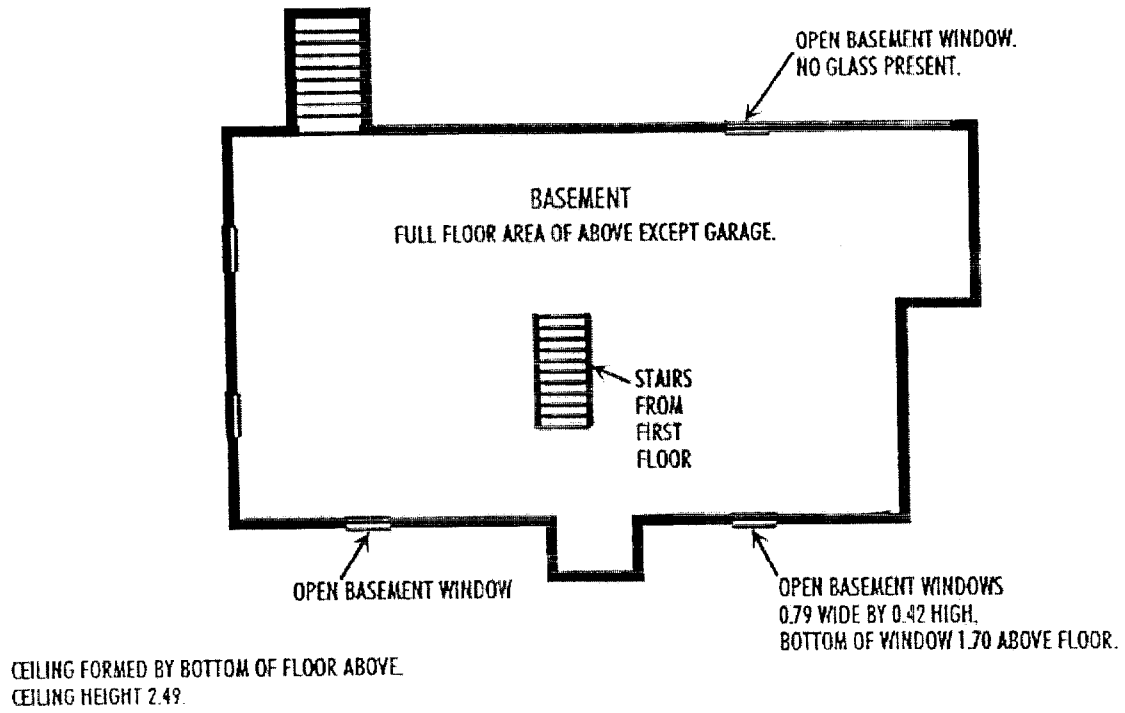


Figure 3. Plan view of basement.

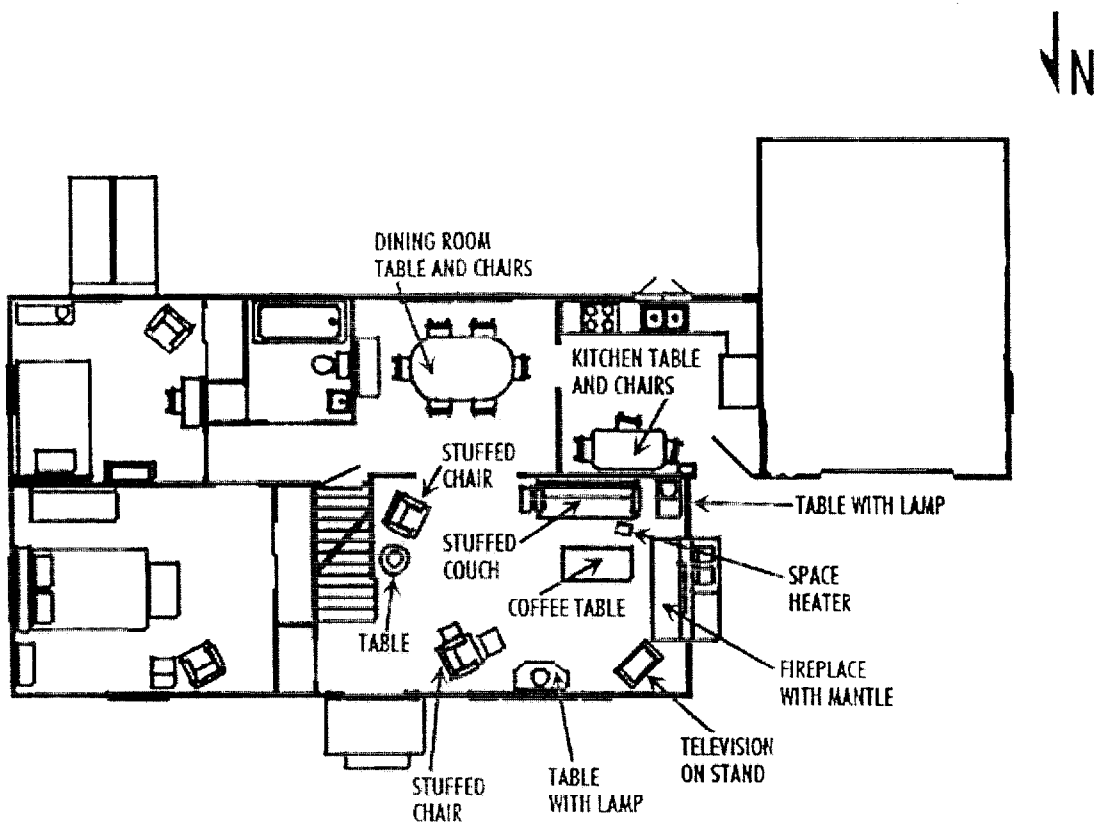


Figure 4. First floor furniture locations.

ALL DIMENSIONS IN m

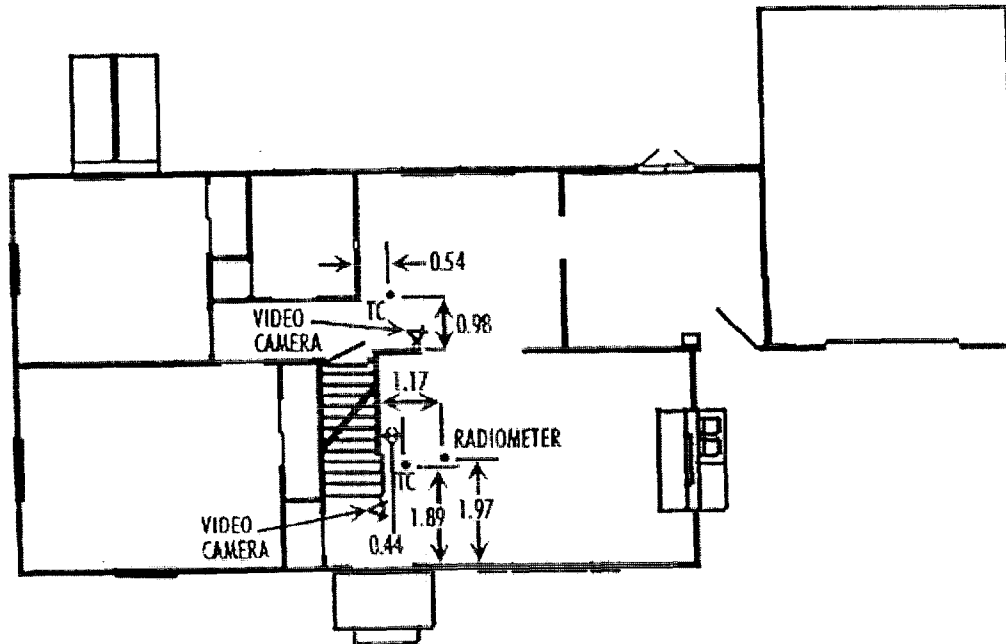


Figure 5. First floor equipment locations.

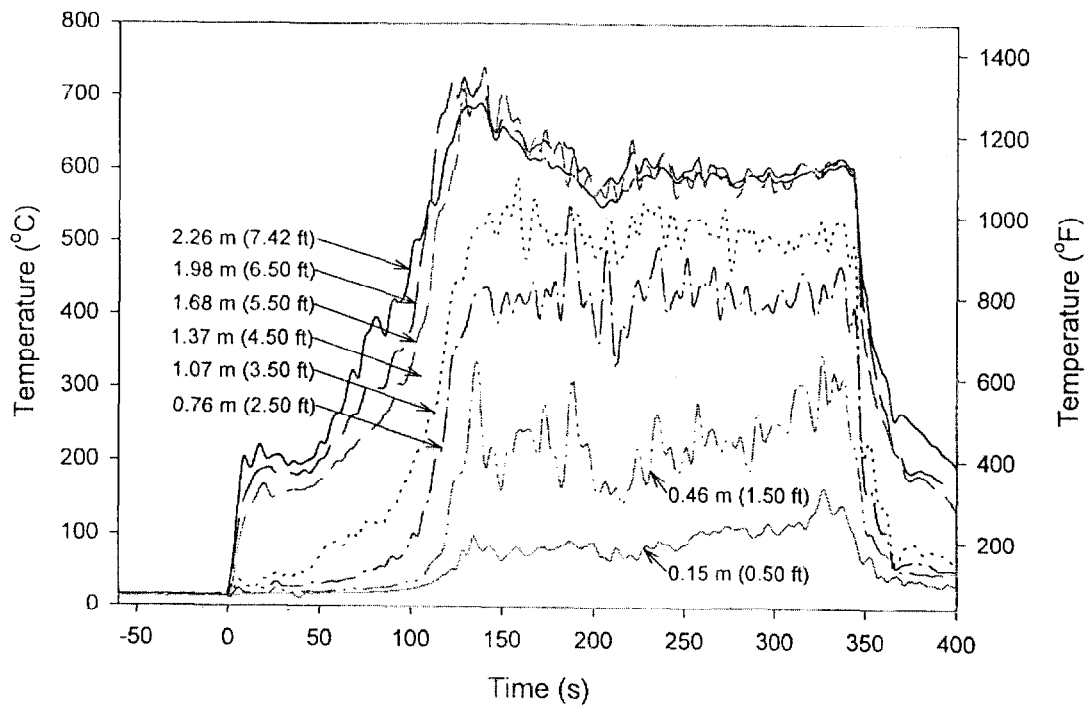


Figure 6. Living room thermocouple temperatures.

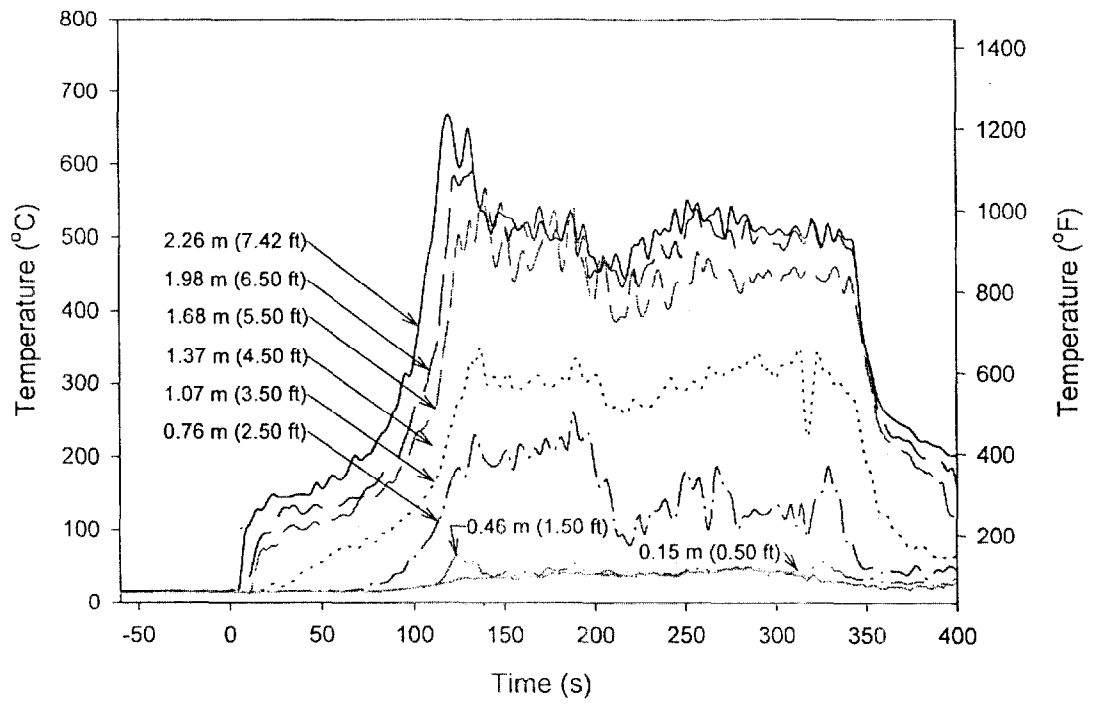


Figure 7. Dining room thermocouple temperatures.

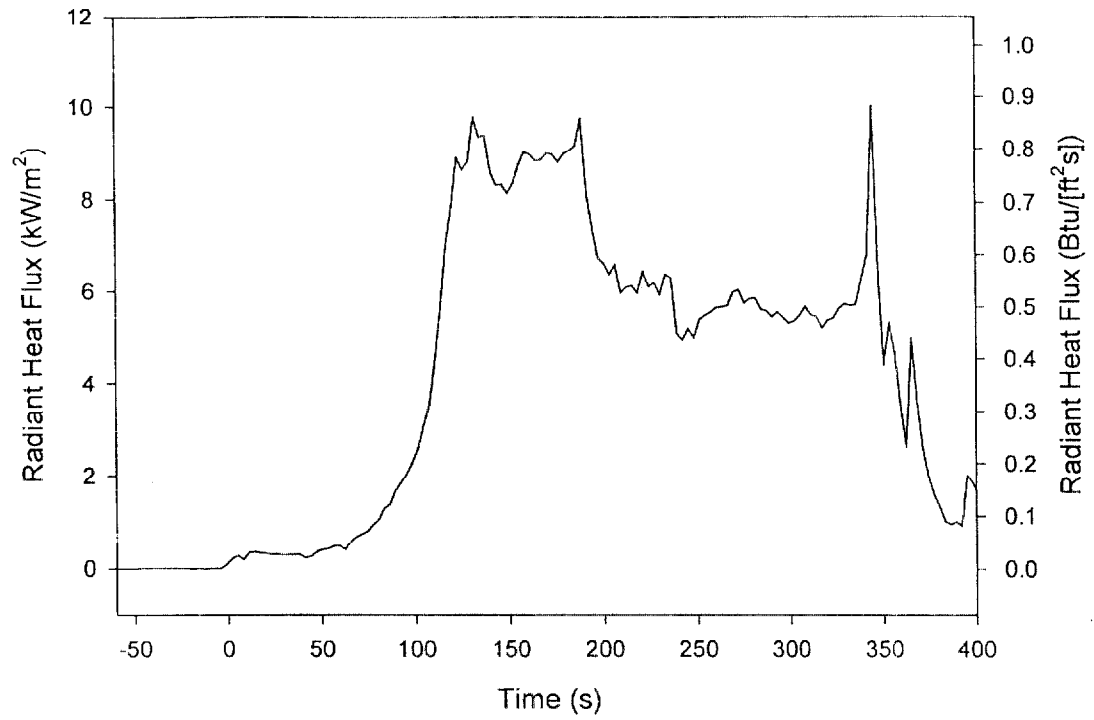


Figure 8. Radiant heat flux at floor level in the living room.

Appendix A

Temperature Measurements

time (s)	living room thermocouple temperatures (°C)							dining room thermocouple temperatures (°C)							radiant heat flux (kW/m ²)		
	tc 0	tc 1	tc 2	tc 3	tc 4	tc 5	tc 6	tc 7	tc 0	tc 1	tc 2	tc 3	tc 4	tc 5		tc 6	tc 7
-121	16	15	15	14	14	14	14	13	15	15	15	13	14	14	14	13	0.05
-118	16	15	15	14	14	14	14	13	16	15	15	13	14	14	14	14	0.04
-115	15	15	15	14	14	14	13	13	16	15	15	13	14	14	14	13	0.02
-112	16	15	15	14	14	14	13	13	16	15	15	14	14	14	14	14	0.01
-109	15	15	15	14	14	14	13	13	16	15	15	14	14	14	14	14	0.02
-106	15	15	15	14	14	14	13	13	16	15	15	14	14	14	14	13	0.01
-103	15	15	15	15	14	14	14	13	16	15	14	15	14	14	14	13	0.01
-100	15	15	15	15	14	14	13	13	16	15	15	14	14	14	14	13	-0.04
-97	16	15	15	14	14	14	14	12	16	15	15	15	14	14	14	13	-0.02
-94	16	15	14	14	14	14	14	13	16	16	15	14	14	14	14	13	0.00
-91	16	15	14	14	14	14	14	13	15	16	15	14	14	14	14	13	0.00
-88	16	15	14	14	14	14	14	13	15	16	15	13	14	13	14	13	0.00
-85	16	15	15	14	14	14	14	14	15	15	15	13	14	14	14	13	0.00
-82	15	15	15	14	14	14	14	14	15	15	14	13	14	14	14	13	-0.20
-79	16	15	15	14	14	14	14	14	16	15	14	13	14	14	14	13	-0.04
-76	16	15	15	14	14	14	14	14	16	14	14	13	14	14	14	13	0.00
-73	16	15	15	14	14	14	14	14	16	14	14	14	14	14	14	13	0.00
-70	16	15	15	14	14	14	14	14	16	14	14	14	14	14	14	13	0.00
-67	15	15	15	14	14	14	14	13	16	15	14	14	13	14	13	13	-0.01
-64	15	15	15	15	14	14	13	13	16	15	14	14	13	14	13	13	-0.05
-61	16	15	15	15	14	14	14	13	16	15	14	15	14	14	14	13	0.00
-58	16	15	15	14	14	14	14	13	16	15	14	14	14	14	14	13	0.00
-55	16	15	15	14	14	14	14	13	16	15	14	14	14	14	14	13	0.00
-52	16	15	15	14	14	14	14	13	15	15	14	13	14	13	14	13	0.00
-49	15	15	15	14	14	14	14	13	16	15	15	13	14	13	14	13	0.00
-46	15	15	15	14	14	14	14	13	16	15	15	13	14	14	13	13	0.01
-43	16	15	15	14	14	14	14	13	16	15	15	14	14	14	13	14	0.01
-40	15	15	15	14	14	14	13	13	16	15	15	14	14	14	13	13	0.01
-37	16	15	15	14	14	14	13	12	16	15	15	14	14	14	13	13	0.01
-34	16	15	15	14	14	13	12	12	16	15	15	15	14	14	13	13	0.01
-31	16	15	15	15	14	14	13	12	16	15	15	15	14	14	14	13	0.01
-28	16	15	15	15	14	14	13	12	16	15	15	15	14	14	13	13	0.01
-25	16	15	15	14	14	14	13	13	16	15	15	14	14	14	14	13	0.01
-22	16	15	15	14	14	14	13	12	16	15	15	14	14	13	14	13	0.01
-19	16	15	15	14	14	13	13	12	15	15	15	14	14	13	14	13	0.00
-16	16	15	15	14	14	13	13	13	15	15	15	14	14	13	14	13	0.01
-13	16	15	15	14	14	13	13	13	16	15	15	13	14	13	13	14	0.00
-10	16	15	15	14	14	13	13	13	16	15	15	13	14	13	13	14	0.01
-7	16	15	15	14	14	13	13	13	16	15	15	14	14	14	13	14	0.01
-4	16	15	15	14	14	14	13	13	16	15	15	14	14	14	13	13	0.01
-1	16	15	15	15	14	14	14	13	16	15	15	15	14	15	13	13	0.11
2	59	41	27	15	15	15	14	14	16	15	15	15	14	14	14	13	0.23
5	137	100	77	60	36	24	15	14	23	15	15	15	14	14	14	13	0.29
8	203	145	112	98	28	19	15	15	91	24	15	15	14	14	14	13	0.20
11	191	162	135	60	26	18	16	15	108	39	15	15	14	14	14	13	0.36
14	202	179	146	58	23	16	16	15	127	70	46	20	15	14	14	14	0.37
17	220	186	162	77	35	25	17	15	127	91	71	33	16	14	14	14	0.35
20	203	189	166	87	37	22	17	16	137	96	71	38	19	15	14	14	0.33
23	204	189	149	81	40	28	18	16	148	99	77	43	25	16	14	14	0.32
26	206	182	154	99	45	33	29	17	145	117	78	47	24	15	14	15	0.32
29	204	190	157	76	39	27	21	16	145	130	96	57	22	15	14	15	0.31
32	193	184	158	90	46	27	19	17	145	129	103	65	28	16	14	14	0.31
35	198	182	159	110	41	27	19	16	147	133	106	66	30	16	15	15	0.31
38	195	181	159	116	49	27	18	11	148	123	101	70	38	16	14	14	0.31
41	196	186	160	121	46	27	19	16	147	122	100	73	43	16	14	14	0.24
44	201	182	163	135	49	29	20	16	149	129	106	79	47	16	14	14	0.27
47	206	190	165	138	59	34	19	17	163	134	110	86	51	16	15	14	0.37
50	224	201	174	140	71	31	19	17	156	130	105	87	55	16	15	15	0.42
53	223	205	176	128	82	32	20	18	164	131	112	92	59	16	14	14	0.44
56	249	222	188	139	86	34	21	17	174	132	114	93	69	16	15	15	0.49
59	263	232	198	149	89	33	21	17	169	132	118	96	72	16	15	15	0.50
62	269	233	199	142	83	35	23	18	172	137	121	97	77	16	14	15	0.42
65	302	251	211	154	93	37	22	18	186	143	119	102	76	17	15	15	0.58
68	322	261	216	153	104	38	24	18	201	143	131	104	74	18	15	15	0.69
71	313	265	226	162	95	42	24	18	196	145	142	107	76	18	15	15	0.75
74	362	291	234	166	116	47	23	18	201	155	146	112	89	18	15	15	0.81
77	377	307	236	181	113	49	24	18	206	159	141	113	83	26	16	15	0.95
80	395	301	245	185	116	51	25	19	220	166	147	115	85	25	14	16	1.06

time (s)	living room thermocouple temperatures (°C)								dining room thermocouple temperatures (°C)							radiant heat flux (kW/m ²)	
	tc 0	tc 1	tc 2	tc 3	tc 4	tc 5	tc 6	tc 7	tc 0	tc 1	tc 2	tc 3	tc 4	tc 5	tc 6		tc 7
83	385	297	250	189	113	55	25	20	231	177	154	117	95	27	16	16	1.31
86	372	304	264	197	119	56	27	20	239	184	165	124	95	30	17	16	1.39
89	415	334	274	214	136	69	28	22	259	190	165	132	104	38	17	17	1.69
92	416	349	303	217	143	66	31	22	275	201	181	140	108	40	18	17	1.86
95	421	352	302	228	165	71	34	24	312	221	190	154	121	46	19	18	2.03
98	449	373	315	249	176	81	34	24	310	241	206	163	122	63	19	20	2.28
101	498	390	338	273	197	102	34	25	349	268	228	167	129	62	20	21	2.59
104	502	457	372	306	214	100	38	27	396	279	235	176	138	73	21	22	3.09
107	523	504	390	338	225	133	43	30	453	297	242	191	149	83	22	22	3.55
110	557	553	434	360	258	153	57	32	494	331	258	212	160	94	24	23	4.50
113	550	633	516	410	267	200	66	35	556	357	274	231	174	110	27	25	5.65
116	586	674	544	446	316	211	74	41	633	428	338	260	197	129	34	26	7.03
119	626	685	559	451	367	254	95	46	667	499	383	321	227	157	47	27	7.83
122	639	720	594	513	426	336	158	53	651	582	439	346	252	176	61	30	8.90
125	666	697	624	538	446	357	179	54	599	571	504	376	277	184	62	33	8.63
128	681	725	710	532	449	372	187	78	615	583	475	371	288	172	57	34	8.81
131	686	704	672	563	491	392	225	73	649	586	523	400	331	201	50	33	9.77
134	682	702	707	611	512	424	316	98	581	586	494	391	326	230	60	33	9.34
137	689	714	715	615	521	434	318	84	540	537	545	454	350	207	42	34	9.38
140	683	703	738	681	523	438	199	79	533	569	543	407	302	194	41	34	8.59
143	658	668	664	621	540	429	213	85	506	525	501	369	307	187	35	35	8.32
146	641	651	658	601	507	391	208	76	531	521	460	371	306	189	37	34	8.33
149	657	668	706	630	535	403	160	65	533	547	493	398	297	200	40	34	8.14
152	653	666	694	636	550	431	208	70	528	498	508	386	316	208	43	36	8.34
155	643	654	665	614	541	403	209	79	525	513	446	373	294	183	37	32	8.75
158	638	653	671	633	590	428	240	84	511	509	456	360	294	213	40	33	9.02
161	626	643	638	600	497	418	240	75	517	517	483	367	292	210	42	36	8.97
164	614	625	620	548	492	422	243	72	518	497	458	361	302	199	42	36	8.84
167	616	633	644	596	561	444	230	78	496	511	464	384	310	212	39	35	8.85
170	613	636	626	591	525	395	211	83	520	543	485	371	309	203	37	34	9.00
173	615	641	655	620	522	434	280	83	511	511	502	426	297	224	45	37	8.97
176	602	631	623	568	493	426	219	80	496	492	520	383	294	207	45	40	8.81
179	605	641	633	578	511	444	206	82	500	510	532	440	300	215	42	38	8.98
182	600	642	629	560	498	395	165	85	497	495	457	386	307	225	45	41	9.06
185	594	630	577	535	524	520	224	91	524	522	494	403	302	211	47	40	9.15
188	593	629	618	597	542	539	314	91	531	529	548	430	327	260	53	39	9.75
191	584	599	583	561	538	458	247	86	496	475	495	430	332	227	52	41	8.13
194	576	605	581	552	499	412	222	84	518	502	466	362	303	227	44	38	7.34
197	567	594	592	545	511	431	220	89	481	449	432	380	307	229	39	39	6.74
200	561	594	566	503	482	392	168	89	474	457	414	377	312	182	40	39	6.63
203	551	580	574	514	492	370	157	74	454	455	471	387	302	157	41	38	6.38
206	552	583	563	528	506	486	174	71	469	482	469	365	273	169	44	38	6.59
209	560	590	592	548	530	425	157	67	458	458	404	325	264	137	43	39	5.97
212	557	582	561	504	476	328	165	85	478	455	386	324	269	94	39	36	6.09
215	572	594	582	565	481	387	142	72	455	433	393	325	262	94	37	38	6.13
218	573	608	614	560	499	371	161	72	450	451	401	319	259	79	36	37	5.96
221	588	625	639	617	540	419	177	74	487	471	456	346	277	89	36	37	6.45
224	587	596	575	523	507	449	219	69	490	434	409	332	275	121	38	40	6.10
227	593	615	601	583	554	421	183	84	499	451	395	324	267	94	37	39	6.20
230	593	609	601	578	542	447	179	86	472	465	414	333	266	123	37	40	5.93
233	590	604	589	575	542	475	248	85	509	469	440	349	274	126	39	41	6.38
236	603	618	616	599	548	490	258	93	504	491	456	364	283	132	38	37	6.31
239	600	625	620	575	496	414	212	89	513	481	414	352	295	141	40	37	5.09
242	591	607	595	570	541	412	222	88	511	474	407	351	308	116	39	36	4.95
245	584	589	562	527	520	435	187	82	540	496	437	356	295	126	38	36	5.20
248	589	597	591	540	494	429	197	87	506	474	438	369	291	168	42	39	5.00
251	592	600	586	555	527	482	221	91	551	517	444	362	293	178	45	42	5.39
254	587	605	582	541	534	418	203	101	536	526	440	353	303	156	45	41	5.49
257	599	615	620	590	533	436	282	105	548	539	481	366	296	171	46	43	5.66
260	586	589	579	552	534	448	229	109	523	508	455	358	298	135	45	41	5.65
263	596	608	604	557	514	441	240	104	530	524	473	372	323	103	45	42	5.68
266	596	605	605	572	516	468	243	109	534	508	452	377	319	181	46	42	5.70
269	593	605	589	552	514	397	216	108	539	502	448	378	309	174	45	45	6.00
272	592	601	594	559	547	442	228	115	499	501	453	374	318	154	47	45	6.05
275	582	584	571	515	466	436	234	114	544	510	458	388	318	145	47	46	5.76
278	578	586	565	519	504	412	222	111	521	484	437	377	328	102	49	46	5.85
281	582	588	576	547	524	421	235	112	528	495	426	388	320	118	46	47	5.87
284	592	600	603	592	511	442	196	111	531	525	452	376	331	119	48	50	5.63

time (s)	living room thermocouple temperatures (°C)								dining room thermocouple temperatures (°C)								radiant heat flux (kW/m ²)
	tc 0	tc 1	tc 2	tc 3	tc 4	tc 5	tc 6	tc 7	tc 0	tc 1	tc 2	tc 3	tc 4	tc 5	tc 6	tc 7	
287	594	601	595	561	523	403	206	100	511	494	439	391	332	129	47	46	5.59
290	590	594	588	558	491	412	271	103	511	502	452	390	345	123	47	44	5.46
293	586	597	580	555	508	411	235	107	515	496	446	376	318	122	40	43	5.57
296	595	605	598	560	511	417	239	119	506	499	458	376	324	126	38	42	5.45
299	586	596	572	542	503	408	255	109	507	492	442	376	307	136	43	42	5.33
302	588	594	587	558	499	439	254	106	512	491	440	389	323	129	44	42	5.37
305	586	597	578	529	489	428	246	113	505	484	450	405	326	116	40	42	5.50
308	589	597	582	549	506	415	251	119	507	501	453	395	330	135	40	42	5.69
311	593	603	599	547	491	429	303	116	516	509	461	392	338	105	37	44	5.51
314	597	613	612	566	513	459	308	121	506	498	446	406	339	137	36	43	5.47
317	599	610	609	563	518	455	304	113	501	496	456	362	233	90	32	31	5.22
320	602	612	608	565	508	429	267	130	521	526	456	409	269	126	47	38	5.39
323	594	601	591	554	507	401	255	139	511	501	447	393	344	148	51	31	5.44
326	596	605	603	567	532	446	350	166	490	488	442	392	320	156	57	29	5.64
329	604	609	614	590	491	424	279	151	519	511	443	387	319	188	54	30	5.75
332	604	613	609	566	522	443	323	134	495	495	458	375	301	156	45	28	5.71
335	608	617	616	571	530	468	302	140	512	504	455	378	306	149	44	30	5.72
338	608	615	615	591	526	450	316	141	501	492	425	377	292	90	37	28	6.28
341	597	605	603	564	472	381	245	118	499	487	448	398	287	87	36	27	6.81
344	575	583	559	530	481	409	220	102	480	471	415	362	276	67	33	25	10.01
347	470	452	414	325	239	251	169	71	394	395	372	318	233	50	33	27	6.47
350	430	399	355	290	219	161	112	69	347	338	325	276	193	47	32	23	4.41
353	374	355	310	238	222	164	107	75	315	312	295	253	173	49	35	25	5.34
356	349	312	281	222	160	130	91	49	286	270	253	229	130	43	32	23	4.68
359	326	283	263	226	142	109	80	49	268	252	233	218	124	43	30	20	3.57
362	310	263	244	217	135	104	75	41	258	235	222	205	117	45	29	23	2.63
365	262	222	221	175	72	65	58	47	252	227	219	194	102	43	28	22	5.01
368	267	219	210	176	69	61	55	46	247	228	213	184	95	43	30	22	3.61
371	267	199	189	166	85	65	53	37	243	223	207	168	84	39	27	21	2.62
374	260	188	179	160	90	66	54	42	239	222	204	170	74	41	27	19	1.99
377	252	191	184	166	91	69	52	40	230	211	189	160	76	51	29	23	1.59
380	246	193	184	165	82	66	51	41	222	201	185	152	80	44	30	24	1.34
383	238	189	180	154	76	68	52	36	222	199	179	134	74	34	28	23	1.02
386	229	187	173	139	81	62	49	36	218	199	177	129	66	38	25	20	0.96
389	225	181	167	139	77	57	51	34	215	196	162	94	62	46	26	24	1.01
392	215	177	165	137	77	55	50	33	212	194	165	93	62	44	27	22	0.93
395	210	170	154	124	74	56	50	38	204	182	127	89	62	50	28	26	2.02
398	203	166	145	105	66	55	51	35	203	183	119	91	62	48	33	25	1.84
401	195	158	132	113	68	55	49	39	200	146	103	92	69	41	34	35	1.57
404	192	150	122	100	64	54	47	38	195	152	92	81	68	43	38	36	1.31
407	185	153	121	89	65	56	51	36	190	134	92	78	64	38	36	35	1.14
410	184	147	120	77	58	57	49	35	182	127	77	70	62	37	29	32	1.02
413	177	134	114	75	56	56	54	39	164	112	72	70	53	32	26	30	0.94
416	176	128	108	72	55	55	53	41	173	128	67	62	53	35	32	32	0.88
419	173	124	104	68	56	54	52	38	172	112	66	60	49	35	31	31	3.78
422	168	117	103	71	56	53	52	39	172	113	73	57	50	37	32	30	3.00
425	160	112	102	72	55	54	50	38	146	89	71	65	47	32	32	31	3.51