CANADIAN AUTOMATIC SPRINKLER ASSOCIATION

Fire Sprinklers Save Lives...

Sean Pearce — National Marketing Manager

Matt Osburn — Technical & Codes Manager

The Changing World of Structure Fires

NRC light weight construction study phase 1

Interesting facts

- The time to untenability (conditions would make it improbable that occupants would survive the fire) in the test scenario was in all cases reached before the floor systems collapsed.

Escape times

- The report did not identify set times for required response and evacuation in a residential fire. We are concerned that this decreased time is such that the elderly, those with mobility impairments, and the very young may not be able to safely evacuate in the required time. This is being reflected in current Ontario fire statistics where 42% of fire fatalities are in seniors and in children.
- The study shows that time to safely evacuate is significantly less than the public may expect – approximately 2 ½ minutes from activation of the smoke alarm.

“Time is of the essence “

What do the Occupants do

- Each occupant is likely to have a different time required for escape because of different characteristics and behaviours of the occupants among other variables. In fire situations, occupants may not necessarily begin evacuation immediately upon recognizing the warning from smoke alarms. They may spend time in various pre-movement activities, such as confirming the existence of a fire, attempting to fight the fire, warning and gathering family members, gathering valuables and donning warm clothes in winter, etc. If occupants get involved in these various pre-movement activities rather than begin evacuation immediately, they may miss the window of opportunity to evacuate safely under certain circumstances.

Who Decides Where the Fire Starts

- The tenability analysis indicates that, regardless what test floor assemblies were used, the untenable conditions (for incapacitation) were reached at a consistent time frame in the experiments with the open basement doorway. The incapacitation conditions due to heat or toxic fire gases were reached soon after smoke obscuration. The presence of a closed door in the doorway to the basement reduced the rate at which combustion products were conveyed to the upper storeys and thereby prolonged the time available for escape before the onset of untenable (incapacitation) conditions.

Temperature Rise in Test Fire

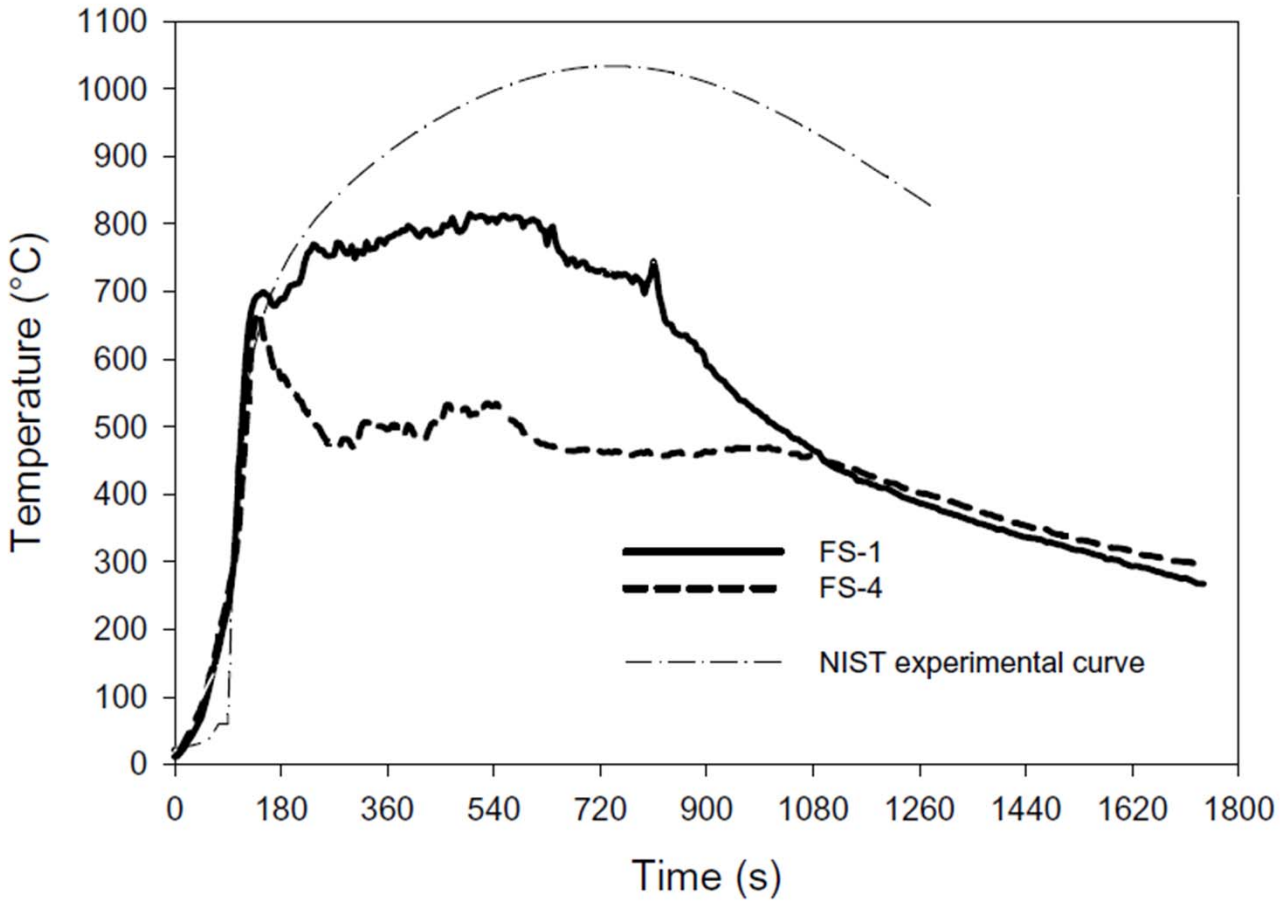


Table 9. Summary of Sequence of Events (in seconds)

Floor Assembly Type	Test	First Alarm	OD = 2 m^{-1}	FED=0.3-1 1st storey	FED=0.3-1 2nd storey	Structural Failure
Tests with open basement doorway						
Solid wood joist	UF-01	40	185	*205-235*	*225-255*	740
Wood I-joist A	UF-03	48	183	**205-213**	*225-247*	490
Steel C-joist	UF-04	30	195	**207-215**	*245-280*	462
Metal-plate wood truss	UF-05	40	190	*206-232*	*235-260*	469
Wood I-joist B	UF-06	45	170	*198*-**211**	*208-241*	382
	UF-06R	38	161	*198*-**199**	*207-241*	380
	UF-06RR	43	184	*203*-**216**	*218-248*	414
Metal web wood truss	UF-07	40	170	**192-207**	*230*-**255**	325
Tests with closed basement doorway						
Solid wood joist	UF-02	42	297	*466-676*	*362-501*	1200
Metal web wood truss	UF-08	50	360	*400*-**486**	*375-510*	474
Wood I-joist A	UF-09	44	319	*329-484*	*364-504*	778

Synopsis

- The failure of unprotected floor assemblies in the test fire scenario does not appear to be the critical issue affecting occupant life safety since the tenability limits were reached before the structural failure of the test floor assemblies.

- the times to reach structural failure for the wood I-joist, steel C-joist, metal plate and metal web wood truss assemblies were 35-60% shorter than that for the solid wood joist assemblies.

Table 8. Time to Failure (t_f) of Unprotected Floor Assemblies

	Open basement doorway		Closed basement doorway	
Assemblies tested	**Test**	**t_f (s)**	**Test**	**t_f (s)**
Solid wood joist (235 mm depth)	UF-01	740	UF-02	1200
Wood I-joist A (302 mm depth)	UF-03	490	UF-09	778
Steel C-joist (203 mm depth)	UF-04	462	-	-
Metal-plate wood truss (305 mm depth)	UF-05	469	-	-
Wood I-joist B (302 mm depth)	UF-06	382	-	-
	UF-06R	380	-	-
	UF-06RR	414	-	-
Metal web wood truss (302 mm depth)	UF-07	325	UF-08	474

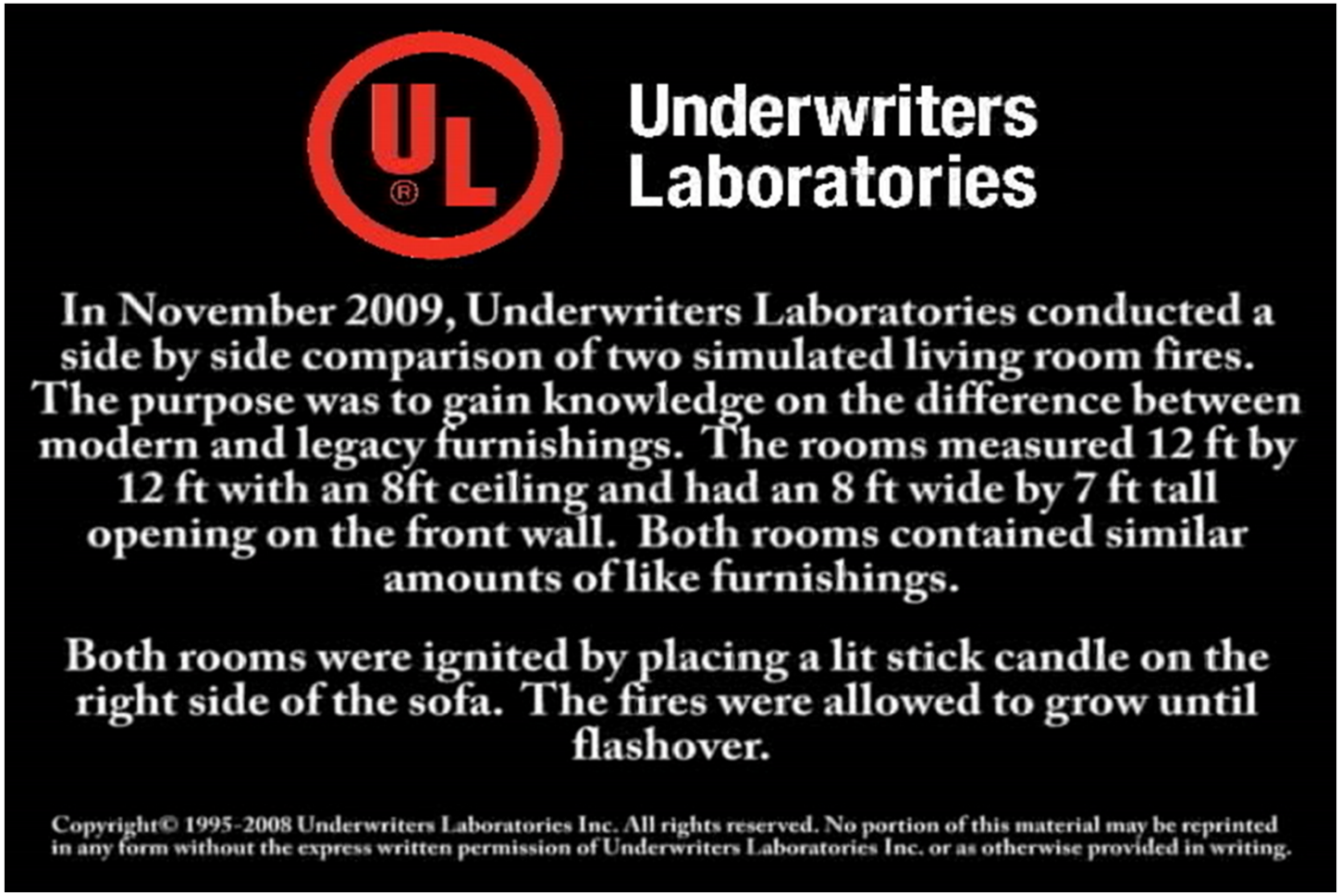
Note:

1. In addition to the solid wood joist assembly, two engineered floor assemblies – one with the longest time and the other with the shortest time to reach failure in the open basement doorway scenario – were selected for testing with the closed basement doorway.

Why are fires getting so hot so fast?

- An experiment was conducted at UL with two side by side living room fires. The purpose was to gain knowledge on the difference between modern and legacy furnishings.
- Both rooms were ignited by placing a lit stick candle on the right side of the sofa. The fires were allowed to grow until flashover. The modern room transitioned to flashover in 3 minutes and 30 seconds and the legacy room at 29 minutes and 30 seconds.

Modern vs. Legacy



- The average time for flame penetration was 446 s. For the assemblies using a single OSB panel, there was flame penetration through a large section of the OSB subfloor. The average time for flame penetration was 670 s.

FIRE PERFORMANCE
OF WOOD PRODUCTS
American Wood Council

Table 1: Flame Spread Indices of Wood Products

Wood Material	Flame Spread Index	
Yellow Poplar Lumber	185	Class C
Doug Fir Plywood	155	
Walnut Lumber	140	
Oriented Strand Board	138	
Yellow Birch Lumber	110	
Southern Pine Plywood	110	
Maple Lumber	104	
Douglas Fir Lumber	100	
Red or White Oak Lumber	100	
Eastern White Pine Lumber	85	
Western White Pine Lumber	75	Class B
Red Cedar Lumber	73	
Redwood Lumber	70	
White Fir Lumber	65	
Fire Retardant Treated Lumber/Plywood	Less than 25	Class A

What Happens when you Protect the Structure?

Table 23. Summary of Sequence of Events in Test PF-05 (in seconds)

Floor Assembly Type	Test	First Alarm	OD = 2 m^{-1}	FED=0.3-1 1st storey	FED=0.3-1 2nd storey	Structural Failure
Suspended ceiling protected wood I-joists	PF-05	47	192-222	**220-255**	**282-342**	638
Unprotected wood I-joists	UF-03	48	183	**205-213**	*225-247*	490

With a Suspended Ceiling

What Happens when you Protect the Structure?

Table 24. Summary of Sequence of Events in Test PF-03 (in seconds)

Floor Assembly Type	Test	First Alarm	OD = 2 m^{-1}	FED=0.3-1 1st storey	FED=0.3-1 2nd storey	Structural Failure
Sprinkler protected wood I-joists	PF-03	45	n.r.	n.r.	n.r.	n.r.
Unprotected wood I-joists	UF-03	48	183	**205-213**	*225-247*	490

With A Fire Sprinkler System

Environmental Impact of Automatic Fire Sprinklers

- In addition to the dramatic reduction of greenhouse gas emissions, the findings showed that sprinklers reduce the amount of water pollution released into the environment, reduce fire damage by up to 97 percent, and reduce water damage by up to 90 percent.

How do we create an Environment of Acceptance

- Working with the Fire Service
- Working with Injury Prevention Specialists
- Working with Codes Agencies
- Working with the Insurance Industry

Next Steps

- Identifying Insurance Industry Interest
- Providing information required to create discounts for sprinklered properties
- Promote these new discounts with the help of the other agencies

Questions?

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