Why do we need the 7th Edition of UL 268©?

Few would argue that working smoke detectors* save lives.

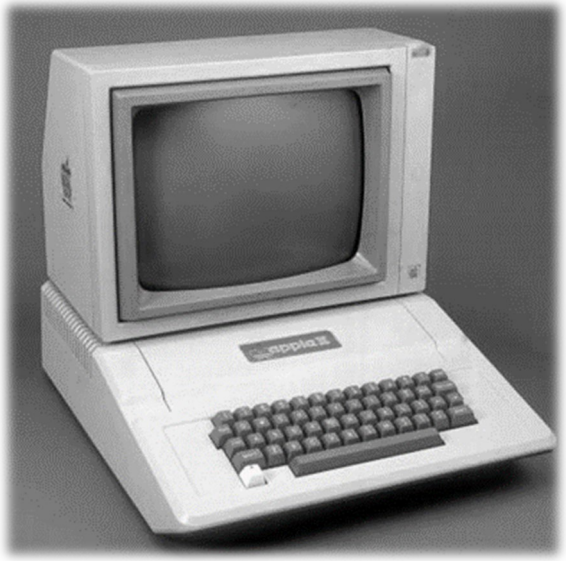
The death rate from reported fires in homes that had at least one smoke alarm (0.59 deaths per 100 fires) was 40% lower than in homes that had no smoke alarms at all (0.98 deaths per 100 fires).[1]

* – In this presentation the terms smoke detector and smoke alarm are used interchangeably. See NFPA 72 chapter 3 for definitions of each.

One of the most well-known and reputable test laboratories for smoke detector testing and approval is UL.

The first UL 268 standard was authored by Underwriters Laboratories in 1976.

Many things have changed since 1976.



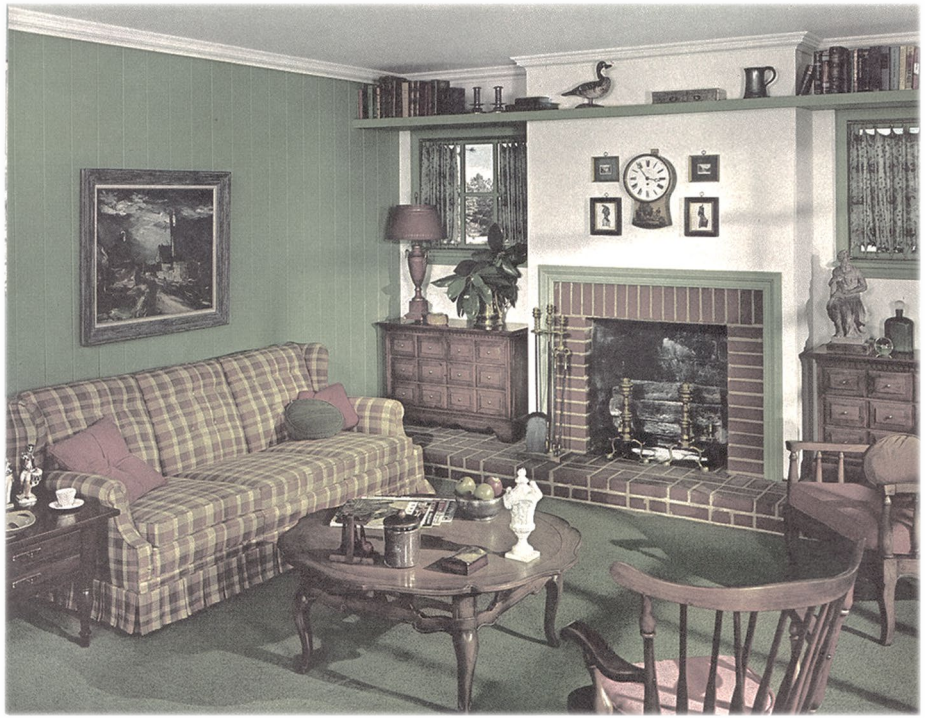
To keep up with changing technology, UL 268 has changed too.

A series of smoke detector performance tests were done in the mid-1970s

This is commonly referred to as the “Dunes Study”

Many of the requirements that were eventually included in UL 268, UL 217, and NFPA 72 were based on the results of this testing.[2]

The Dunes Study was a series of full-scale residential fire detection tests, using equipment and furnishings commonly available at the time.



Furnishings were mostly of wood and natural materials like cotton and linen.

As the years passed, there was increased discussion about two big concerns:

- The performance of ionization smoke detectors during actual fires
- Unwanted alarms from cooking leading to disablement of smoke detectors

In many cases it was feedback and comments from the public that drove this discussion

NFPA technical committees picked up on these issues and started to address them

The 2010 Edition of NFPA 72 included detailed information in Annex A regarding the placement of smoke detectors in and near cooking areas. Ionization smoke detectors were identified as being more susceptible to cooking nuisance alarms than the photoelectric type of detector, but it was also stated that both types of detector technology will produce nuisance alarms due to cooking. A "zone of exclusion" was identified; smoke detectors should not be installed within a 10 ft. radial distance from stationary or fixed cooking appliances.[3]

The 2013 Edition of NFPA 72 took the further step of adding a requirement to the body of the code:[4]

> **29.7.3 Resistance to Nuisance Source.** Effective January 1, 2019, smoke alarms and smoke detectors used in household fire alarm systems shall be listed for resistance to common nuisance sources.

Additional investigation of these matters was clearly needed

Another set of extensive full-scale tests were performed in the early 2000s

These are commonly referred to as the “Dunes II Study”

As with the first Dunes study, equipment and furnishings commonly available at the time were used.

Many things were learned from this additional research. For example:

		1975 Tests	Current Tests
Alarm Times	Flaming	146 ± 93	47 ± 35
	Smoldering	1931 ± 1103	2042 ± 876
Tenability Times	Flaming	1036 ± 374	177 ± 69
	Smoldering	4419 ± 1790	2148 ± 1023

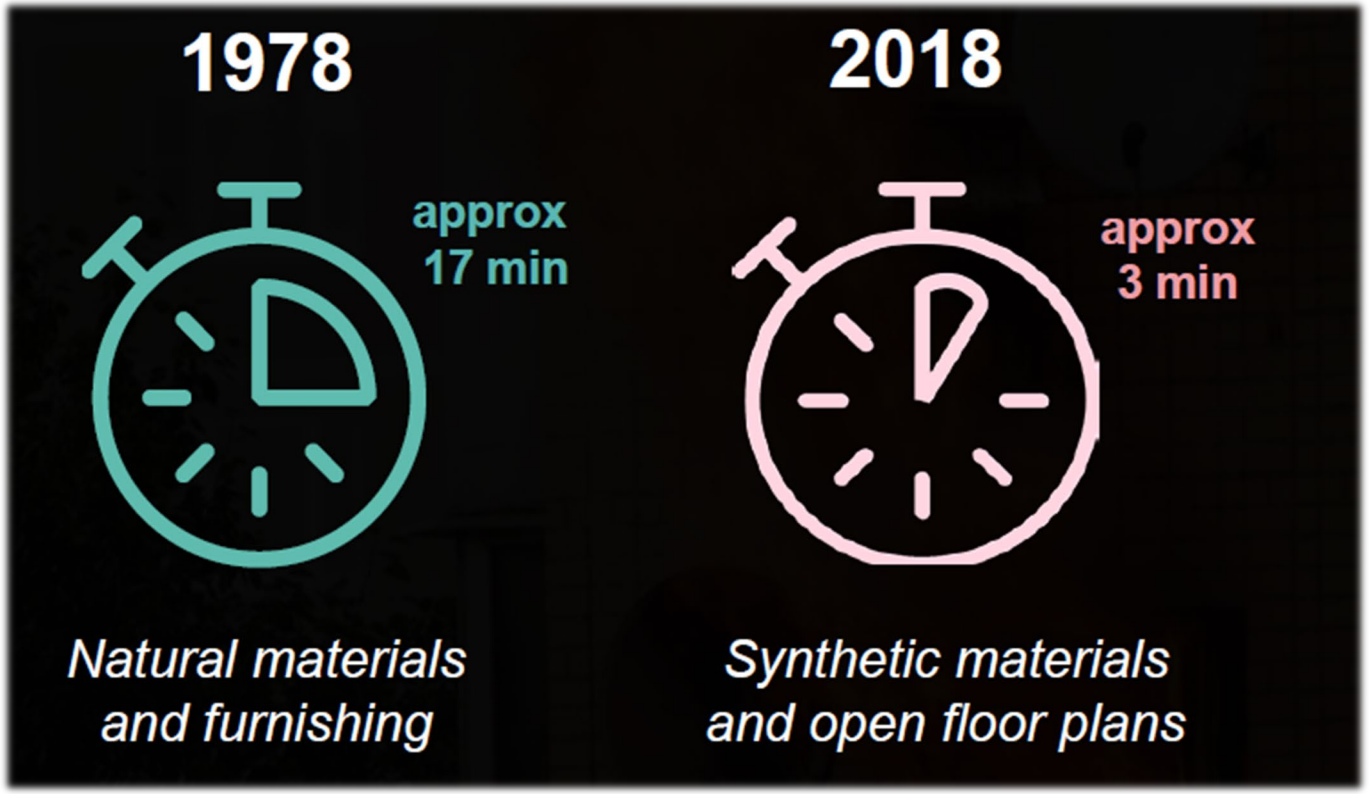
Times shown are in seconds

The time to untenable conditions was dramatically less in the new tests.[5]

What changed?

"Escape times in this study were systematically shorter than those found in a similar study conducted in the 1970's. This is related to some combination of faster fire development times for today's products that provide the main fuel sources for fires, such as upholstered furniture and mattresses, different criteria for time to untenable conditions, and improved understanding of the speed and range of threats to tenability." [6]

https://www.youtube.com/watch?v=aDNPhq5ggoE

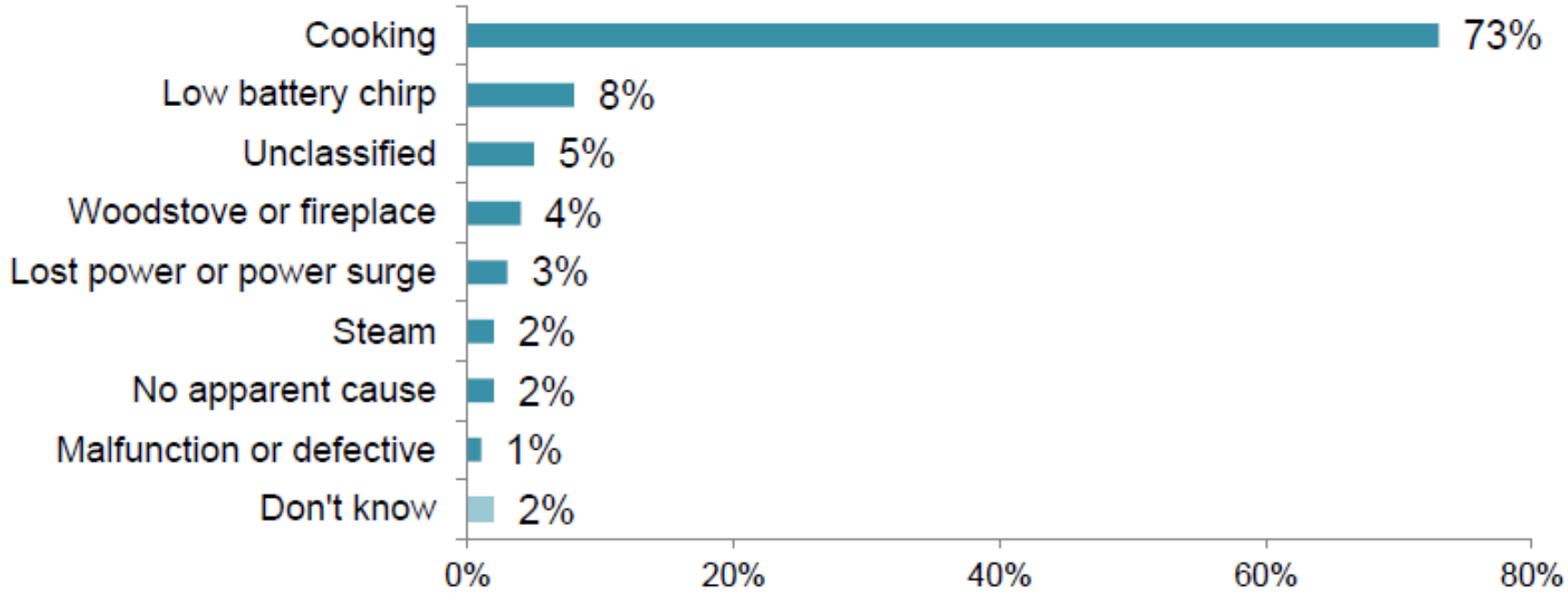


"Escape times in a home have decreased from approximately **17 minutes** to approximately **3 minutes** over the past 40 years, due to changes in materials and floorplans in modern homes." [7]

Also from the study: [8]

> The Smoke Detector Operability Survey…conducted by the U.S. Consumer Products Safety Commission, reported that about one half of the 1,012 respondents indicated they experienced nuisance alarms, with 80 % of those attributed to cooking activities…
>
> The Survey also reported that of the alarms with missing or disconnected batteries or disconnected AC power, more than one-third of the respondents indicated that power was removed due to nuisance alarms.

Figure 14. Reasons Given for Smoke Alarm Activations in Past Year [9]



Source: Harris Poll National Quorum. National Fire Protection Association -- Smoke Alarms. 2010.

Smoke detectors needed to be more effective in detecting fire in modern furnishing materials and better at resisting nuisance alarms from cooking.

UL formed two task groups; one to consider how to approach cooking nuisance alarms, and a second to develop new flaming and smoldering fire tests using polyurethane (PU) foam.

Why PU foam? [10]

Table 1 – Items commonly found in residential settings

Residential Area	Common Items	Common Base Materials
Bedroom and Living Room	Appliance wiring	Flexible PVC (plasticized)
	Bed clothing	Cotton, Polyester, Acrylic, Blends
	Candles	Hydrocarbon wax, Cotton wick
	Carpeting	Polyolefin, Nylon, Polyester
	Drapes and blinds	Cotton, Linen, Wood, PVC
	Mattress	Polyurethane foam, Cotton, Polyester
	Paper products	Paper
	Plastic enclosures for electrical products	Polyolefin, ABS, Nylon
	Upholstered furniture	Polyurethane foam, Polyester, Cotton, Wood
	Wallpaper	Paper, PVC plastisol, Polyacrylates coatings
	Wood furniture	Wood, Polyurethane, Cotton, Polyester, Adhesives
Kitchen	Appliance enclosures	Polyolefins, ABS, Polycarbonate
	Appliance wiring	Flexible PVC (plasticized)
	Cabinets	Wood, MDF, Adhesives
	Counter tops	Laminates, Acrylics, Wood
	Food containers	Polyolefins, PVDC
	Foods	Fats, Oils, Carbohydrates, etc.
	Wallpaper	Paper, PVC plastisol, Polyacrylates

Some results of the investigation -

Flaming Tests	Alarm Trigger Times		Non-Flaming Tests	Alarm Trigger Times	
	Ion	Photo		Ion	Photo
Douglas Fir	142	172	Ponderosa Pine	3378	3304
Newspaper	133	150	PU Foam	5610	3032
Heptane/Toluene	35	70	PU Foam in Cotton	No Alarm	3870
PU Foam	68	No Alarm	PU Foam in Poly	No Alarm	4741
PU Foam in Cotton/Poly	104	171	Nylon Carpet	No Alarm	5727
Nylon Carpet	157	272	Polystyrene	No Alarm	5546
			Bread	323	394

Tests in the small-scale and intermediate-scale showed that PU foam generated smoke that is different in particle size and count than the UL 217 test materials.[12]

Clearly, the standards for smoke detectors should be updated to address the very real danger of fire in PU foam furnishings.

But would an increase in the detector's responsiveness to flaming and/or smoldering PU foam also increase nuisance alarms – especially as a result of cooking?

Not only do detectors need to be able to detect flaming and smoldering fire in furnishings, but they must resist common nuisance alarms that may result when cooking.

A “broiling hamburger” test was developed to cover a range of cooking scenarios.

Detectors must not alarm below 1.5%/ft. obscuration.

The broiling hamburger nuisance test challenged the majority of pre-seventh edition smoke detectors that were subjected to it.

Research indicated that few, if any (at the time) smoke alarms would meet the performance level required by these new tests.[13]

"…an across the board increase to the level of performance specified in ANSI-UL 217-2015 would significantly improve the overall performance of smoke alarms by expanding the range of fire scenarios alarms must respond to while requiring resistance to nuisance alarms."[14]

The next step was clear – develop new standards to include these tests.

This is great news for the public!

Smoke detectors and alarms will have much-improved performance under the new standard. Better performance = greater safety!

Manufacturers of smoke detectors needed to get to work!

A deadline was established - all listed smoke detectors must meet the requirements of the new standard by the deadline date.

How has Hochiki responded to the UL 268 7th Edition challenge?

Hochiki is a well-respected leader in the fire protection industry. Founded in 1918 in Tokyo Japan, Hochiki has designed, manufactured, and provided smoke detectors to many industry-leading OEM alarm manufacturers.

Hochiki's smoke detector engineering team began work in 2017 on new detector designs to meet the enhanced requirements of the updated UL standard.

Conventional and analog/addressable detectors have been designed and have already passed all preliminary tests at UL for the updated requirements.

The new detectors will maintain the high level of quality and reliability that is associated with the name "Hochiki".

Summary:

The updated UL requirements for smoke detectors represent a major advance in the performance and stability of UL-listed smoke detectors.

Everyone will benefit –

- End-users will benefit from better detection of all types of fires in furnishings
- AHJs, installation companies, and end-users will benefit from less unwanted alarms due to cooking

The changes to UL 268 is something that the fire alarm industry can feel good about!

Hochiki is ready to support you with questions about UL updates, system design, and product application.

With over 100 years of experience in the fire alarm and life-safety business, Hochiki is uniquely qualified to support you with any and all fire alarm and life-safety projects, questions, and concerns.

Quality, Reliability, and Integrity – That’s the Hochiki way.

References

1 - Ahrens, M. (2015), *Smoke Alarms in U.S. Home Fires*, Copyright © 2015, National Fire Protection Association, page ii

2 - Geiman J. and Gottuk D., *Alarm Thresholds for Smoke Detector Modeling*, Copyright © International Association for Fire Science

3 - NFPA 72, *National Fire Alarm and Signaling Code, 2010 Edition*, Copyright © 2009, National Fire Protection Association

4 - NFPA 72, *National Fire Alarm and Signaling Code, 2013 Edition*, Copyright © 2012, National Fire Protection Association

5 - NIST Technical Note 1455-1, 2008 Revision "*Performance of Home Smoke Alarms*", page 248

6 - NIST Technical Note 1455-1, 2008 Revision "*Performance of Home Smoke Alarms*", page 254

7 - Mills, D. and DeCrane S., *Smoke Alarms and Detectors, UL Standards for Safety – UL 217 and UL 268*, Copyright © UL LLC

8 - NIST Technical Note 1455-1, 2008 Revision "*Performance of Home Smoke Alarms*", page 149

9 - Ahrens, M. (2015), *Smoke Alarms in U.S. Home Fires*, Copyright © 2015, National Fire Protection Association, page 18

10 - Fabian, T. and Gandhi, P. (2007), *Smoke Characterization Project Final Report,* Copyright © 2007, Underwriters Laboratories Inc., page 20

11 - Fabian, T. and Gandhi, P. (2007), *Smoke Characterization Project Final Report,* Copyright © 2007, Underwriters Laboratories Inc., page 137

12 - Fabian, T. and Gandhi, P. (2007), *Smoke Characterization Project Final Report,* Copyright © 2007, Underwriters Laboratories Inc., page 146

13 - Cleary, T. (2016), *A Study on the Performance of Current Smoke Alarms to the New Fire and Nuisance Tests Prescribed in ANSI/UL 217-2015,* page 83

14 - Cleary, T. (2016), *A Study on the Performance of Current Smoke Alarms to the New Fire and Nuisance Tests Prescribed in ANSI/UL 217-2015,* page ii

Hochiki Corporation
2-10-43 Kamiosaki, Shinagawa-ku,
Tokyo 141-8660
Japan

Hochiki America Corporation
7051 Village Drive, Suite 100
Buena Park, CA 90621
United States of America

Hochiki Europe (U.K.) Limited
Grosvenor Road
Gillingham Business Park
Gillingham, Kent, ME8 0SA,
United Kingdom

Hochiki Middle East FZE
Office No. C-205
HQ Building, Dubai Silicon Oasis
PO Box 341415
Dubai, UAE

Hochiki Asia Pacific PTE LTD.
71 UBI Road 1 #07-40/41
Oxley Bizhub
Singapore 408732

Hochiki de Mexico, S.A. de C.V
Av Junto Al Rio 24FA
Colonia Junto Al Rio Temixco
Morelos, CP 62584
Mexico

Hochiki Australia Pty Ltd
Block Y, Unit 1 Regents Park Estate
391 Park Road, Regents Park
NSW 2143
Australia

Hochiki Italia SRL a s.u.
Via Luigi Galvani, 20
37138 Verona VR
Italy

Kentec Electronics Ltd
Units 25 – 27 Fawkes Avenue
Questor, Dartford, Kent
DA1 1JQ
United Kingdom

Hochiki Thailand Co. Ltd.
BB Bldg., 10th Floor 1011
54 Sukhumvit 21,
Kwaeng Klong Toey Nua, Khet Wattana,
Bangkok 10110 Thailand

Hochiki Asia Pacific - Jakarta Office
Sahid Sudirman Center, 56th Floor
JI Jend Sudirman no 86 Karet Tengsin
Tanah Abang
Jakarta Pusat 10220

Hochiki Europe Limited – India Office
#704 7th Floor, Time Tower
MG Road, Gurgaon-122002
Haryana, India