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# **UL 217, 268 and NFPA 72**

**California Office of the State Fire Marshal  
Smoke Alarm Task Force  
February 16 & 17, 2011**

**Underwriters Laboratories Inc.**

# Smoke Alarms and Detectors: Test Standards, Codes, & Certification

## Alarm and Detector Placement

- Specified in NFPA 72 “National Fire Alarm Code”

## Alarm and Detector Performance

- Specified in UL 217 and 268
- ANSI Consensus maintained test standards (UL is the administrator)
- Originally developed by a joint collaboration between NIST (NBS), UL, and the Life Safety industry

## Alarm and Detector Certification Testing

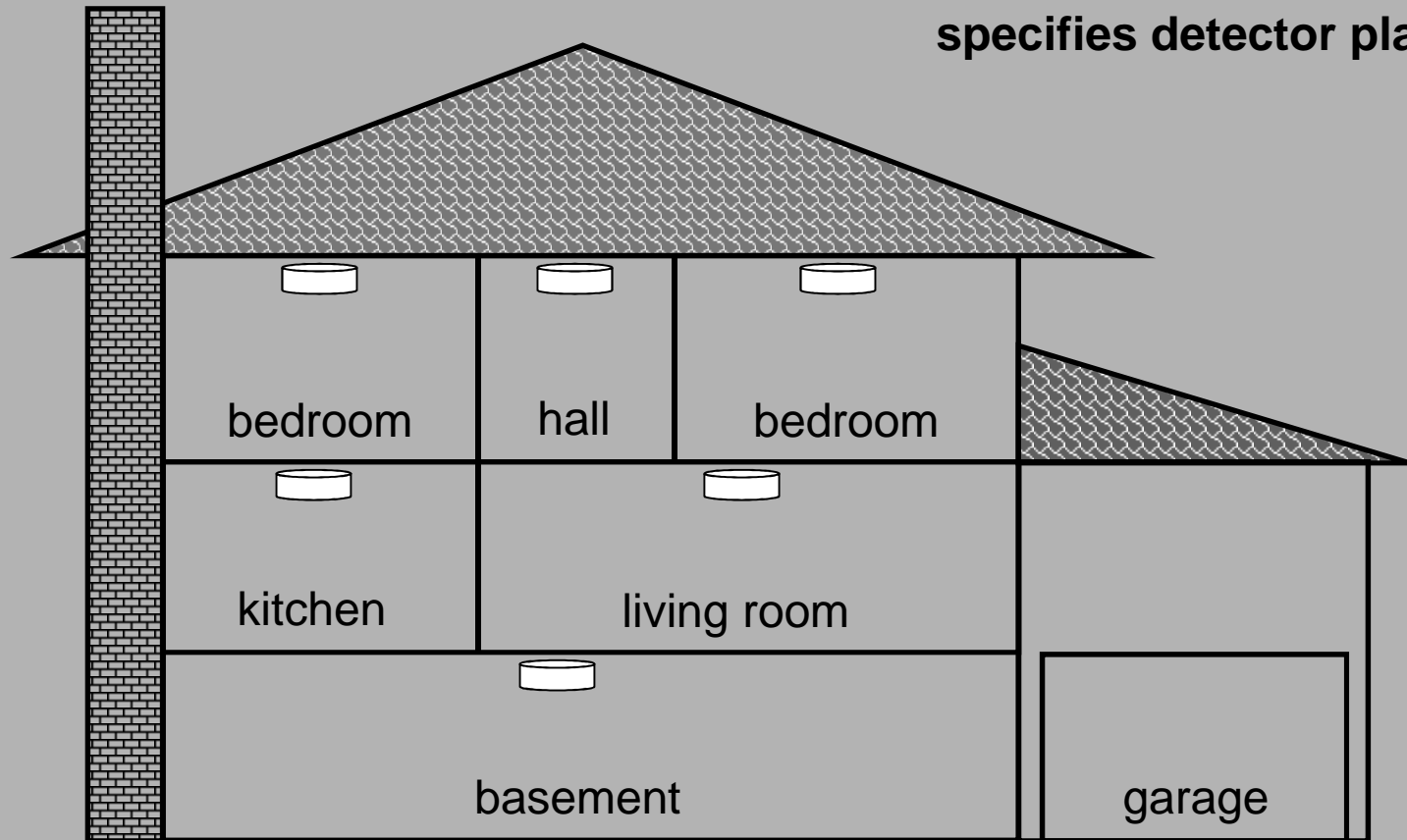
- Initial compliance testing is conducted by UL
- UL follow-up service verifies compliance of subsequently produced units

## Alarm and Detector Usage

- CA BML: UL 217/268 compliant & follow-up service

# Smoke Alarm/Detector Placement

**NFPA 72 “National Fire Alarm Code”  
specifies detector placement**



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# NFPA 72 – 2010 Placement

- **Every bedroom**
- **Within 21 ft of each sleeping area**
- **Every floor, including basements but not crawl spaces**
- **No alarms within 10 ft of fixed cooking appliance**
  - Alarms 10-20 ft are required to have a hush feature or be photoelectric
  - Photoelectric can be installed within 6 ft if certain additional requirements are met
- **Cannot install within 36 inch of:**
  - Bathroom door for tub/shower
  - Air handling register
  - Ceiling fan blade
- **Additionally for areas greater than 1,000 ft<sup>2</sup>, no further apart than 30 ft/ one per 500 ft<sup>2</sup>**



# UL 217 & 268 Standards

**UL 217 Single and Multiple Station Smoke Alarms  
6<sup>th</sup> Edition, August 25, 2006**

**UL 268 Smoke Detectors for Fire Alarm Systems  
6<sup>th</sup> Edition, August 14, 2009**

**STP includes 40 voting members and 3 non-voting members**

- **7 AHJs**
- **13 Producers**
- **6 Testing & Standards (inc. UL)**
- **11 General**
- **3 Consumer and Government**



# UL 217/268 Sensitivity Test

(UL 217 Sec. 37, UL 268 Sec. 30)

Performance limits are 0.5 – 4.0 %/ft obscuration



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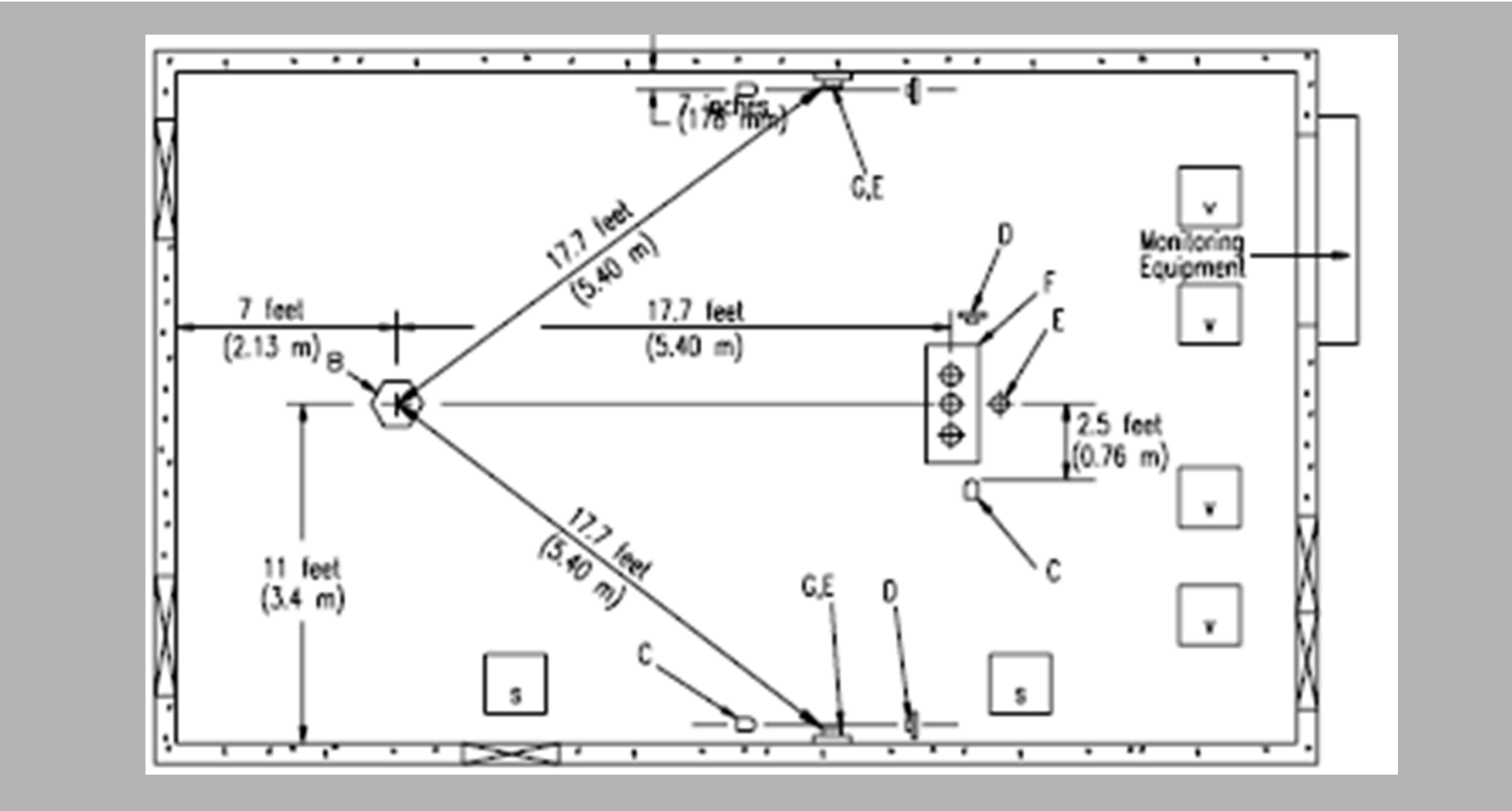
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# UL 217/268 Fire Test Room

(UL 217 Sec. 44 & 45, UL 268 Sec. 38-40)



# UL 217/268 Fire Test Room Schematic





# UL 217/268 Fire Test Room Tests

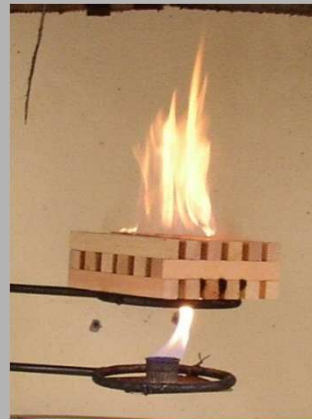


**Flaming Test A:  
Paper fire**

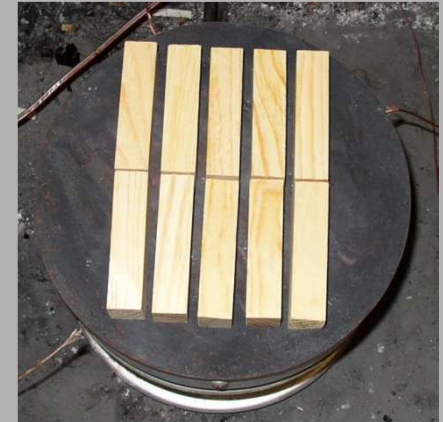


**Flaming Test C:  
Flammable liquid fire**

**Flaming Test B:  
Wood fire**



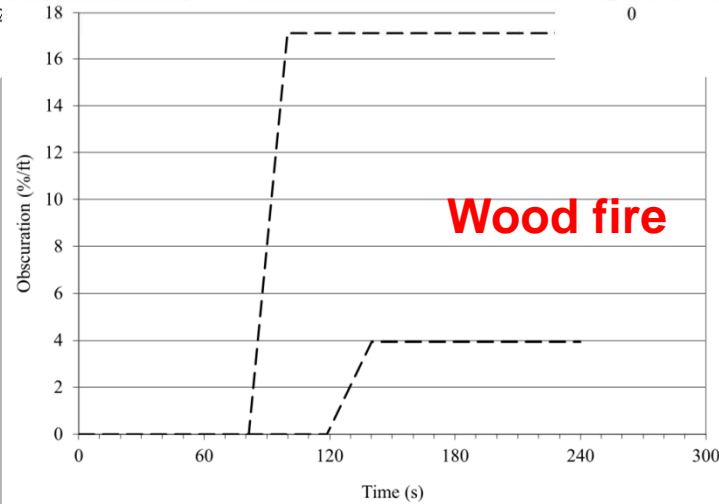
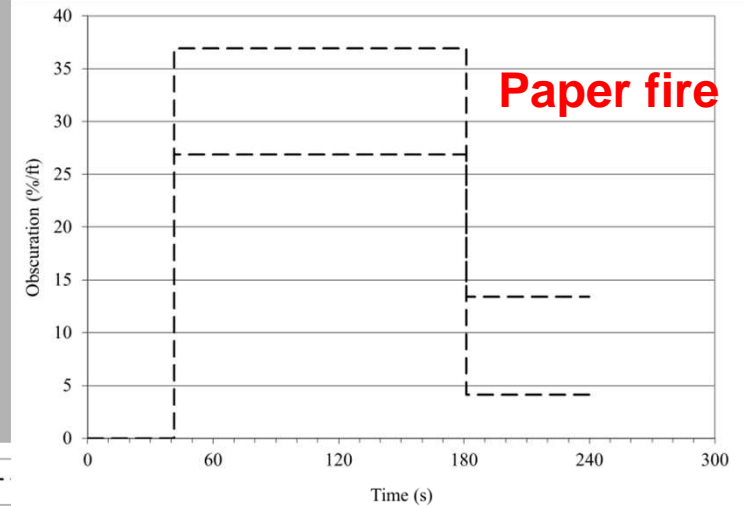
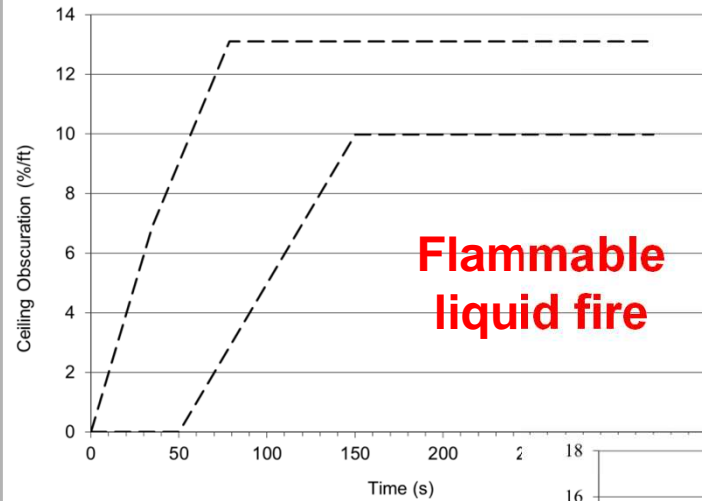
**Smoldering Test:  
Ponderosa pine**



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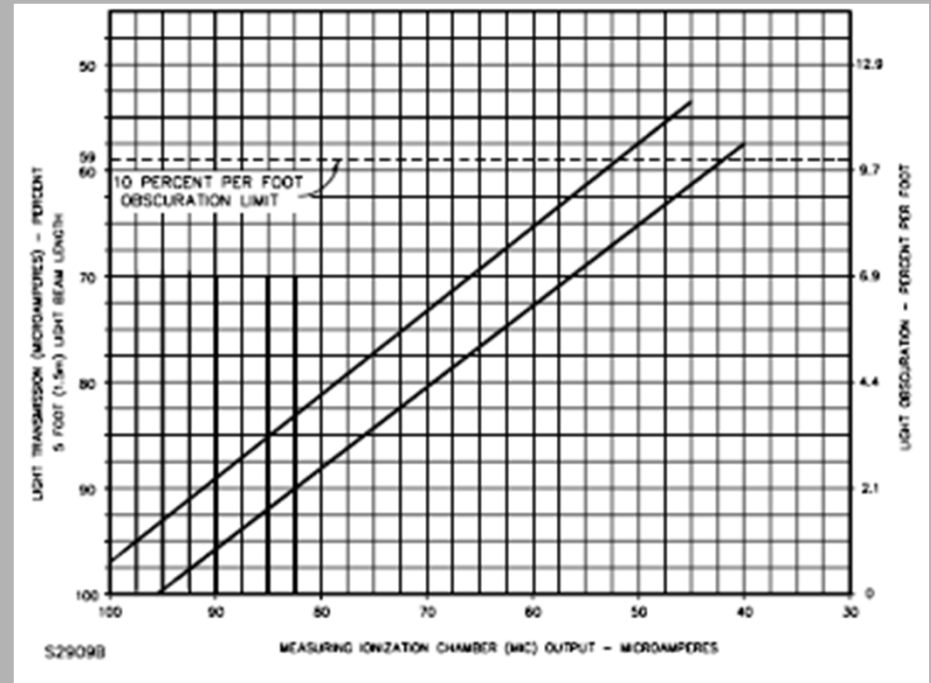
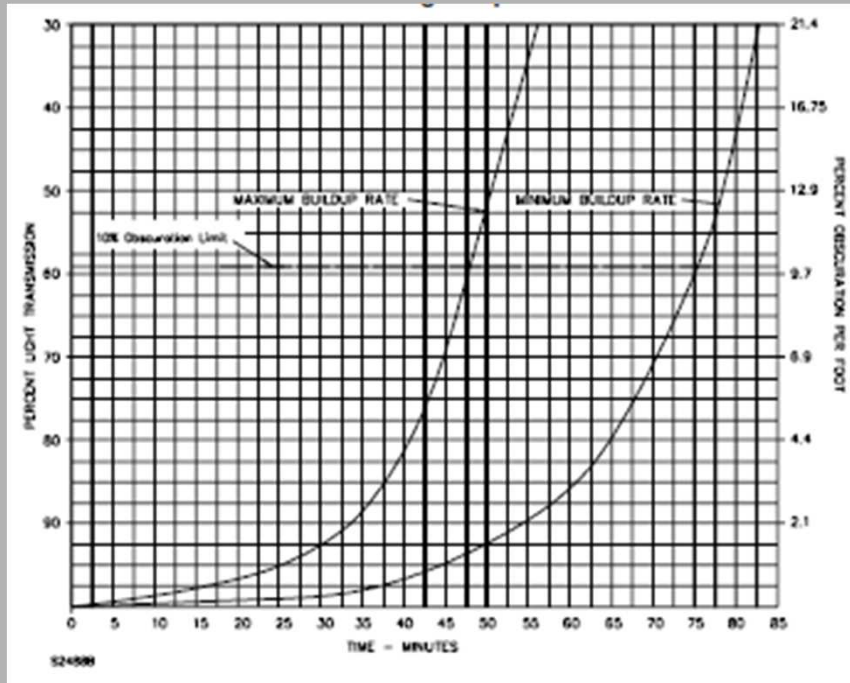
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# UL 217/268 Flaming Fire Tests



Must activate within  
240 seconds

# UL 217/268 Smoldering Test



Must activate between 0.5 and 10 %/ft obscuration



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# Fire Formula of Modern Homes



Larger Homes



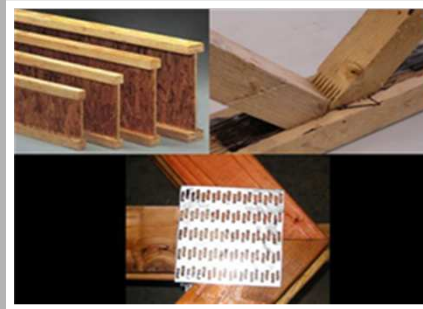
Open Spaces



Inc. Fuel Loads



Void Spaces



Changing Bldg  
Materials



- Faster fire propagation
- Rapid changes in fire dynamics
- Shorter escape times
- Shorter time to flashover
- Shorter time to collapse



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# Room Furnishing Effect on Fire Growth

([www.ul.com/fireservice](http://www.ul.com/fireservice))

## Comparison of Room Furnishings

Legacy Room

Modern Room



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# Dunes I and II: Escape Time Differences

## Flaming Fire Scenarios

	Alarm Times	Tenability Times	“Escape” Time
Dunes I	140 ± 94 s	1043 ± 365 s	903 s
Dunes II	43 ± 20 s	169 ± 37 s	126 s

⇒ Shorter escape times in Dunes II study attributed to significantly faster fire growth rates.

## Smoldering Fire Scenarios

	Alarm Times	Tenability Times	“Escape” Time
Dunes I	1790 ± 1163 s	4146 ± 1961 s	2356 s
Dunes II	1983 ± 894 s	3303 ± 1512 s	1320 s

⇒ Smoldering times are statistically the same.

# Follow-Up Activities

**Safety focused goal:**

**Increase available egress time to non-specific fires.**

**Potential solutions must be:**

- **Performance-based and not technology-based**
- **Open to existing, refined, and innovative methods**



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# Increasing Available Egress Time

**How can the available egress time for a non-specific fire be increased?**

**Reduce fire risk and growth rate**

**1. Reduce room content.**

- **Fewer ignitable items**
- **Less fuel**

**Food for thought**

**Can “spring cleaning” save lives?**



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# Increasing Available Egress Time

**How can the available egress time for a non-specific fire be increased?**

**Reduce fire risk and growth rate**

- 1. Reduce room content.**
- 2. Reduce flammability of room contents.**

⇒ **UL-FPRF Smoke Characterization Project demonstrated synthetic materials burn more intensely and produce greater amounts of smoke than cellulosic materials. The report can be used as guide for materials developers to reduce product flammability:**

- Material data generated**
- Test methods developed**



# Increasing Available Egress Time

**How can the available egress time for a non-specific fire be increased?**

## **Reduce fire risk and growth rate**

- 1. Reduce room content.**
- 2. Reduce room content flammability.**

## **Alert occupants earlier**

- 1. Improve effectiveness of alarm alerting signal.**
  - Hearing impaired, Children, College students**

**⇒ R& D efforts worldwide in light, sound, voice, vibration alarm modes**



# Increasing Available Egress Time

**How can the available egress time for a non-specific fire be increased?**

## **Reduce fire risk and growth rate**

1. Reduce room content.
2. Reduce room content flammability.

## **Alert occupants earlier**

1. Improve effectiveness of alarm alerting signal.
2. Earlier alarm activation.



# Increasing Available Egress Time

**How can the available egress time for a non-specific fire be increased?**

## **Reduce fire risk and growth rate**

1. Reduce room content.
2. Reduce room content flammability.

## **Alert occupants earlier**

1. Improve effectiveness of alarm alerting signal.
2. Earlier alarm activation.
3. Expand alarm responsiveness to other smoke signatures.



# Earlier Alarm Activation

## UL-FPRF Smoke Characterization Study

- Alarm technology sensitivity varies for different types of smoke.
  - ⇒ Ionization alarms triggered earlier for flaming fires
  - ⇒ Photo alarms triggered earlier for non-flaming fires

## Goal

Performance-based solutions may include:

- Single combination technology unit
- Multiple single technology units
- Different technologies that exhibit comparable performance

**Formation of STP Task Group for Multi-Criteria**



# Expand Alarm Responsiveness

## **UL 217 STP Task Group formed**

### **Goal**

**Expand UL 217 flaming and smoldering tests to include materials that generate smoke with characteristics outside of the current range of tests.**

### **Rationale**

- **Expand range of smoke particle sizes currently tested.**
- **Synthetic materials generate greater heat and smoke release rates than natural materials.**
- **Prevalence of material in residential settings.**



# Why Polyurethane Foam?

## **From the Smoke Characterization Project –**

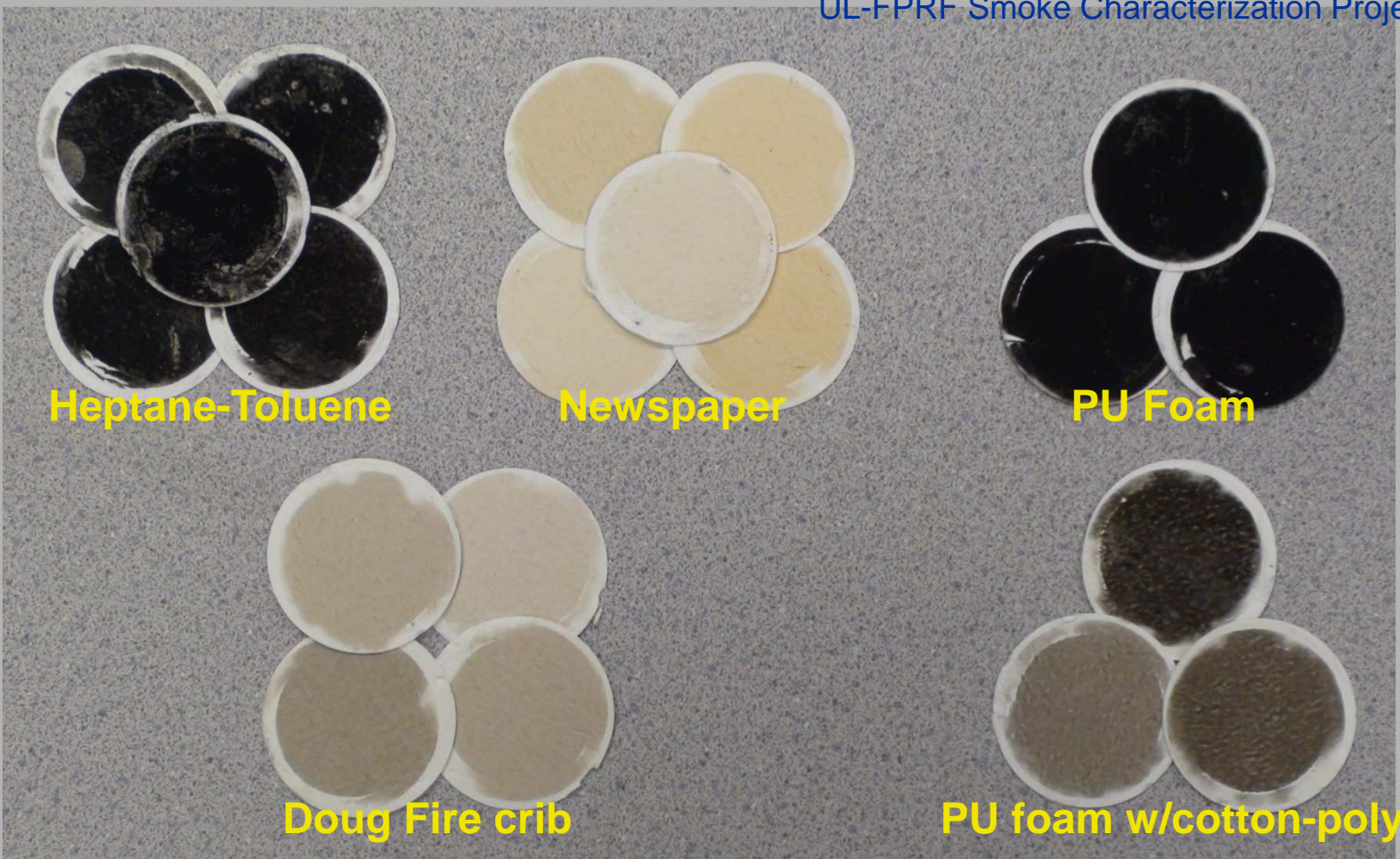
- **Fast ignition**
- **Generate greater heat and smoke release rates than natural materials**
- **Generate smaller sized particles than most UL 217 test materials**
- **Produce accumulated smoke comprised of smaller particles than for the UL 217 test materials**
- **Produce darker color smoke than UL 217 newspaper or wood**

**Prevalence in residential settings (mattresses, upholstered furniture, *etc.*)**



# UL 217/268 Fire Test Room Tests: Flaming test smoke color

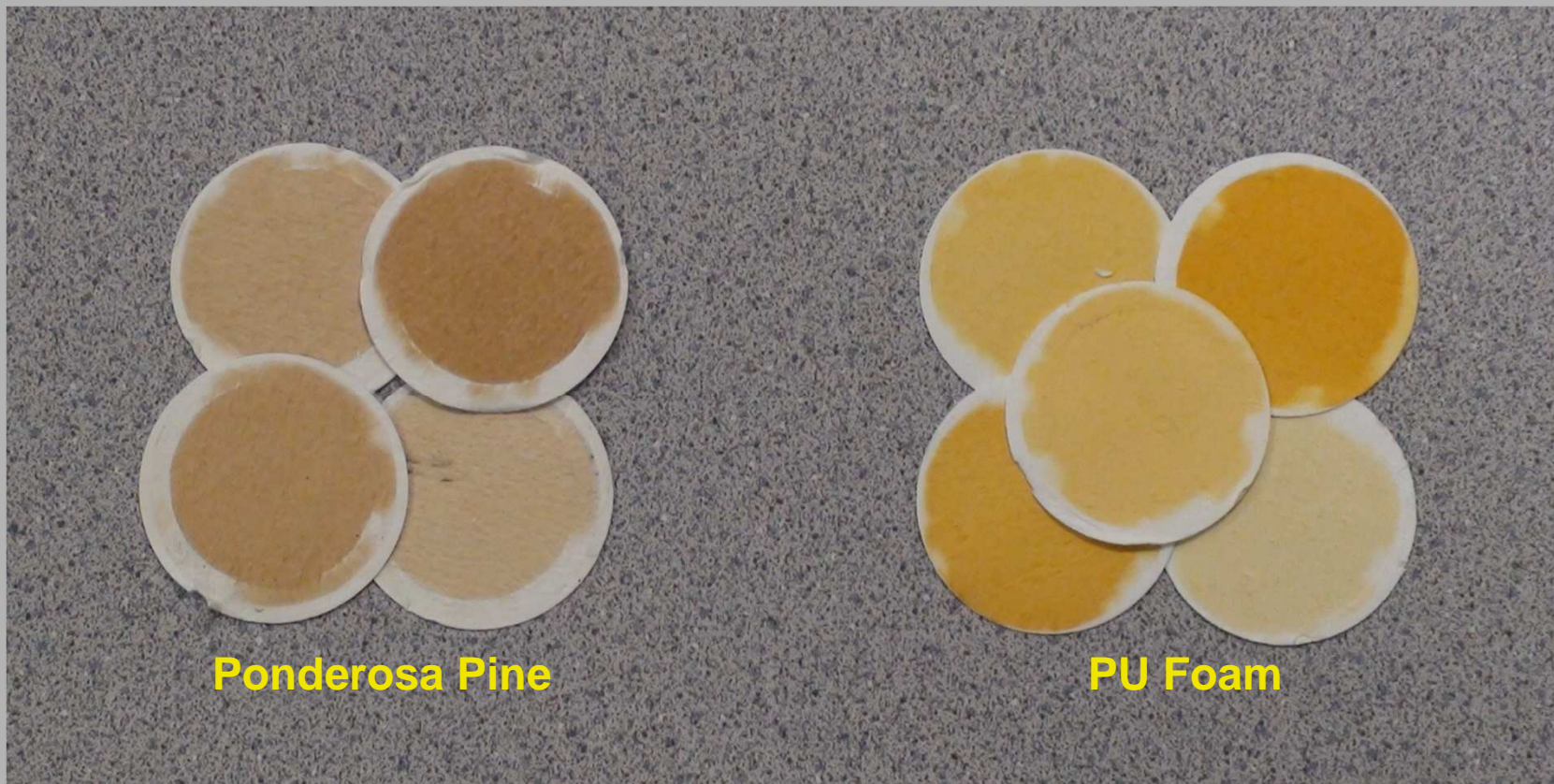
UL-FPRF Smoke Characterization Project (2007)





# UL 217/268 Fire Test Room Tests: Smoldering test smoke color

UL-FPRF Smoke Characterization Project (2007)



**Ponderosa Pine**

**PU Foam**



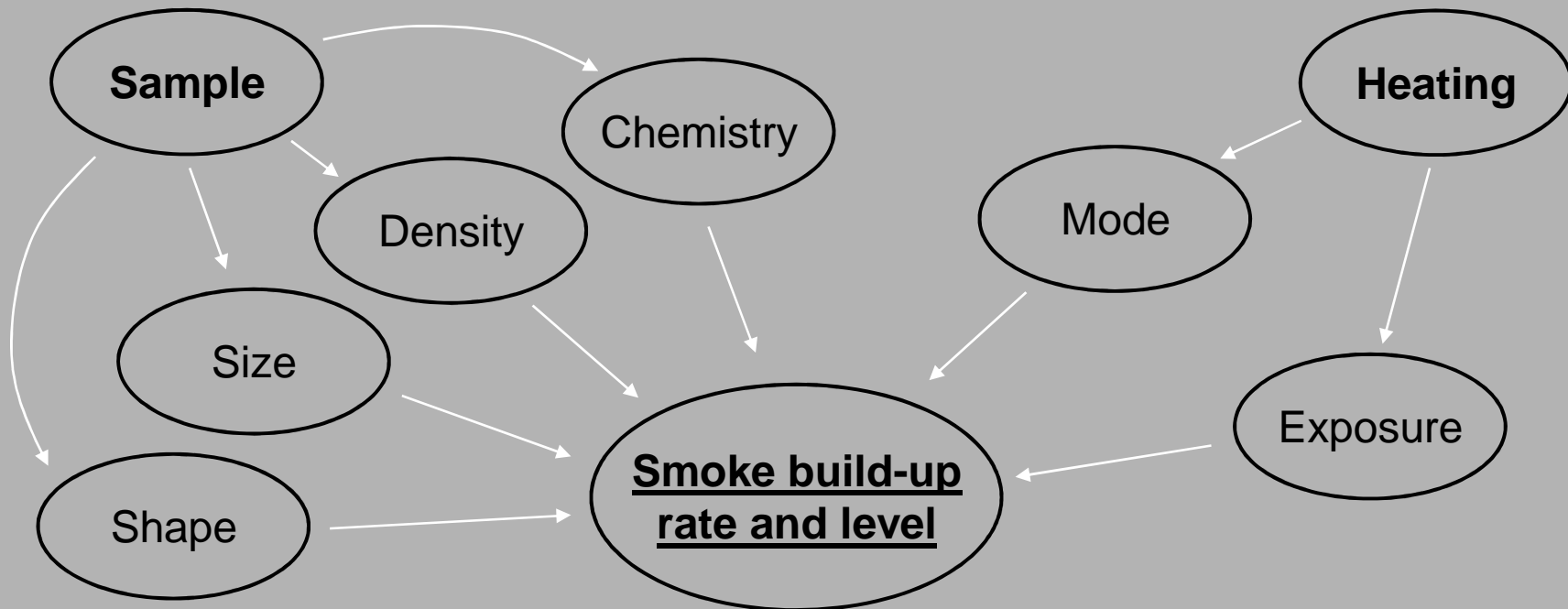
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# Foam Fire Test Scenario Development

## Task Objectives:

- Develop flaming and smoldering foam test scenarios.
- Investigate influence of scenario variables on combustion products.



# Expand Alarm Responsiveness – Flaming Fire

**Material: UL 1626 “Residential Sprinkler” foam**

- **Density: 1.70 to 1.90 lb/ft<sup>3</sup> (27.2 to 30.4 kg/m<sup>3</sup>)**
- **PHRR: 230 ±50 kW/m<sup>2</sup>**
- **HOC: 22 ±3 kJ/g**
- **Others: being determined**

**Test Sample: 14.6×14.6×3 inch square**

**Ignition: 5 mL of isopropanol at corner**

**Height: Floor level (insulated)**



# Expand Alarm Responsiveness – Self-Sustained Smoldering Fire Test

## Materials

**Foam: Material: UL 1626 “Residential Sprinkler” foam**

**Fabric: Polyester microsuede**

## Cushion Sizes

•**Seat: 18 × 6 × 4 inches (l,d,th)**

•**Back: 18 × 9 × 4 inches (l,h,th)**

## Heat Source

•**200W cartridge heater**

•**1/4 inch diameter**

•**4 inch long**

•**18 minutes**



# Reduction of Disabled Alarms

## **UL 217 STP Task Group formed**

### **Goal**

**Evaluate cooking scenarios to determine if a repeatable test(s) can be created to reduce unwanted alarm activation.**

### **Rationale**

**Fewer unwanted alarms will reduce the number of alarms that permanently disabled.**





# CA OSFM Smoke Alarm Task Force

## UL 217 & 268, NFPA 72



**THANK YOU**



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