Localized Residential Fire Suppression Systems

- Kitchen fire hazard characterization
- Investigate “passive” and “active” fire protection systems
- Full-scale demonstrations/ evaluations

Sponsors: USFA, HUD & NIST

Kitchen Fire Hazard Characterization

- Cooking Oil Fires
  - Canola
  - Corn
  - Olive
  - Peanut
  - Sunflower
  - Vegetable
  - Heptane

Kitchen Fire Hazard Characterization

- Appliance Fires
  - Coffeemakers
  - Toasters
- Measurements
  - Heat release rate
  - Heat flux
  - Mass loss

Coffeemaker Heat Release Rate

210s 0 kW

300s 5 kW

360s 10 kW

460s 25 kW

560s 40 kW

610s 40 kW

Passive Fire Protection

- Spacing
- Coverings
- Materials
- Coatings
  - Intumescent Paints
    - Significantly reduced HRR in bench scale testing

Intumescent Paint Results

- Full-scale fire experiments
  - Limited delay of fire spread
  - Similar measured temperatures in kitchen with and without intumescent paint
  - Paint delaminated in some cases

Active Fire Protection

- Range Hood Systems
  - Dry Chemical
  - Wet Chemical
- Localized Suppression Systems
  - Single low flow sprinkler in kitchen
    - Pendent
    - Sidewall

Dry Chemical Results

- Fire extinguished
- Flames need to impinge on device to activate
- Pilot out
- Area protected limited to stove top

Splash

Wet Chemical Results

- Fire extinguished within seconds of auto-ignition prior to full pan fire development.
- Potential for re-ignition
- Protected area limited to stove top

Single Sprinkler Results

- Fire suppressed
- Larger fire required to activate sprinklers compared to range units
- Protects entire kitchen area

Single Sprinkler – Small Kitchen

Single Sprinkler – Large Kitchen

No Sprinkler in Kitchen

II. Research Plan for FY2006

- A workshop of interested stakeholders –April 11, 2006
- Technical challenges:
  - review and evaluate UL 300A
  - compare method with a representative hazard.
  - examine repeatability
  - examine suppression systems

III. Impact

• Conduct research that will promote acceptance of retrofit fire suppression technologies for residential applications.
• As the use of localized suppression systems increase in existing housing, the number of fatalities and injuries due to kitchen cooking fires would be expected to decrease.

UL 300A Fire Characterization

- 14 test scenarios including
  - Pan A – 4” dia., 2” deep, SS, 1” of oil
  - Pan B – 13” dia., 2” deep, cast iron, 1” of oil
  - Pan C – 10” dia, 7” deep, SS, 4” of oil
  - Pan D – 3” deep, size of range top, ¼” of oil
- Oil: Vegetable; Peanut
- Stove: electric; gas
- Measurements:
  - heat release rate
  - heat flux (vertical and horizontal)
  - pan temperature (bottom, middle, top)
  - ignition time
  - flame height
  - Stove mass flow

Test 1, March-7-2006

Pan C– 100 mm
187 g Corn Oil (25mm)

Time to Ign ~ 18 min
Peak HRR ~ 70 kW

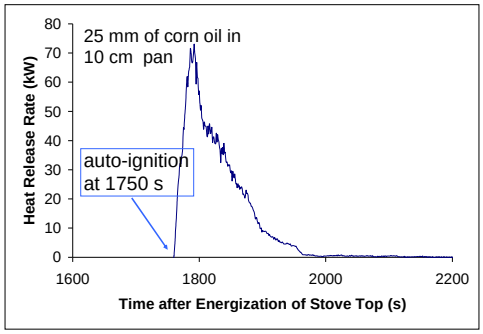
Ignition

9 s

60 s

75 s

180 s



UL 300A Fire Characterization

Pan Diam (in)	Time to Ignition (min)	HRR max (kW)	Oil Type	Stove Type
4” pan	18	70 to 100	corn	electric
4” pan	18	65	peanut	gas
10” pot	78	400	corn	electric
10” pot	145		peanut	gas
13” skillet	>93*	-	peanut	gas
13” skillet	61	>100**	peanut	electric
13” skillet	57	>100**	corn	electric
18 x 21 pan	24	>100**	corn	gas

* Ignition not observed
** stopped before maximum achieved

Oil vapor from 18” x 21” pan

2 min after ignition of oil in 10” pot

What's Next

Your Task

- **What is needed to reduce losses from kitchen fires?**
  - Prevention?
  - Suppression?
  - What research is needed?
  - What is needed to enable mass marketing of retro-fit kitchen suppression systems?

Process

- Work in break-out groups
- Develop priority items in small groups
- Report out to whole group
- Consolidate Priority Items (10-12 Total)

Voting

- Each organization represented has 10 votes (dots)
- Red dots – Fire Service
- Blue dots – Manufacturers
- Green dots - Organizations