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**

<table>
<thead>
<tr>
<th>Time (s)</th>
<th>Heat Release Rate (kW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>210</td>
<td>0</td>
</tr>
<tr>
<td>300</td>
<td>5</td>
</tr>
<tr>
<td>360</td>
<td>10</td>
</tr>
<tr>
<td>460</td>
<td>25</td>
</tr>
<tr>
<td>560</td>
<td>40</td>
</tr>
<tr>
<td>610</td>
<td>40</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Pan Diam</th>
<th>Time to Ignition</th>
<th>HRR max</th>
<th>Oil</th>
<th>Stove</th>
</tr>
</thead>
<tbody>
<tr>
<td>4&quot; pan</td>
<td>18</td>
<td>70 to 100</td>
<td>corn</td>
<td>electric</td>
</tr>
<tr>
<td>4&quot; pan</td>
<td>18</td>
<td>65</td>
<td>peanut</td>
<td>gas</td>
</tr>
<tr>
<td>10&quot; pot</td>
<td>78</td>
<td>400</td>
<td>corn</td>
<td>electric</td>
</tr>
<tr>
<td>10&quot; pot</td>
<td>145</td>
<td></td>
<td>peanut</td>
<td>gas</td>
</tr>
<tr>
<td>13&quot; skillet</td>
<td>&gt;93*</td>
<td>-</td>
<td>peanut</td>
<td>gas</td>
</tr>
<tr>
<td>13&quot; skillet</td>
<td>61</td>
<td>&gt;100**</td>
<td>peanut</td>
<td>electric</td>
</tr>
<tr>
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<td>57</td>
<td>&gt;100**</td>
<td>corn</td>
<td>electric</td>
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<tr>
<td>18 x 21 pan</td>
<td>24</td>
<td>&gt;100**</td>
<td>corn</td>
<td>gas</td>
</tr>
</tbody>
</table>

* Ignition not observed
** stopped before maximum achieved

UL 300A Fire Characterization
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