2020 EDUCODE

- Commercial Cooking Protection
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  Fire Protection Engineer

• Five Year Average number of fires each year in Eating and Drinking Establishments = 11,025
• Equivalent to 212 Fires per WEEK.
• Before the end of today, 30 fires will have occurred in Eating and Drinking Establishments

Source: US Fire Administration Fire Loss Data - Published by the National Fire Protection Association - June '03

Today:

Morning Session:
- Combustion / Fuels
- Mechanisms of Extinguishment
- Types of Agents
- BREAK
- Types of Systems
- Detection and Actuation
- Fire Alarm and Interlocks
- BREAK
- Appliances
- Nozzle Placement
- Sample Plan Review
- LUNCH

Afternoon Session
- Duct and plenum systems
- Fara
- Filters and grease extractors
- Pollution control units
- High production frying
- BREAK
- Mobile food preparation vehicles
- Commissioning inspections
- Maintenance
Basics will be covered

- At the end of the day you will understand the goals of the regulations and begin enforcement activities.

Cooking Equipment Cause Breakdown

<table>
<thead>
<tr>
<th>Cause</th>
<th>Fires</th>
<th>Property Damage ($M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooking Equipment Totals</td>
<td>5500</td>
<td>$55.3 (12.7%)</td>
</tr>
<tr>
<td>Ranges</td>
<td>1900</td>
<td>$7.4 (3.7%)</td>
</tr>
<tr>
<td>Deep fat fryers</td>
<td>1600</td>
<td>$7.4 (3.7%)</td>
</tr>
<tr>
<td>Ovens or Rotisserie</td>
<td>500</td>
<td>$1.6 (0.8%)</td>
</tr>
<tr>
<td>Grease hoods or ducts</td>
<td>400</td>
<td>$4.5 (2.3%)</td>
</tr>
<tr>
<td>Grill, Hibachi, Barbecue</td>
<td>300</td>
<td>$1.1 (0.5%)</td>
</tr>
<tr>
<td>Portable cooking</td>
<td>100</td>
<td>$0.7 (0.3%)</td>
</tr>
</tbody>
</table>

Source: NFIRS, NFPA Survey – June 2003

Ignition sources:
- Ranges
- Deep fat fryers / woks
- Ovens or Rotisserie
- Grease hoods or ducts
- Grill, Hibachi or barbecue
- Food warming appliances

Source: NFIRS, NFPA Survey – June 2003
Combustion

- In order for anything to burn it must first become a _______.

Hydrocarbon fuels

- Natural Gas  $\quad \text{M} = 1$
- Liquified Petroleum Gas  $\quad \text{E} = 2$
- Butane  $\quad \text{P} = 3$
- $\quad \text{B} = 4$

Why are the holes different sizes?
LPG Tank Overfilling

- Overfilling valves are required by federal law.
- Prevents a discharge of LPG due to elevated temperature.

Easy to tell if the tank has an Overfilling Protection Device

- The star shaped valve knob is obsolete.
Combustion

- What's burning here?
- What's incomplete combustion?
- What is CO?

How to Balance:
\[ C_3H_8 + O_2 \rightarrow CO_2 + H_2O \]

A word about CO.

Complete Combustion
\[ CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O + \text{energy} \]

Incomplete Combustion
\[ 4CH_4 + 7O_2 \rightarrow 2CO + 2CO_2 + 8H_2O \]

Wood Burning Appliances

- NFPA 96-2017

1433. Except as permitted in 1434, exhaust systems serving solid fuel burning equipment, including gas or electrically operated equipment, shall be separated from all other exhaust systems.
What is charcoal?

Wood Burning Appliance?
NFPA 96-2017

14.3.14 Gasoperated equipment utilizing solid fuel for heating that meets all the following conditions shall not be required to have a separate chime system:

1. The solid fuel holder (smoker box) shall be listed with the gas-operated equipment.
2. The solid fuel holder shall be located underneath the gas burners.
3. Spark arresters conforming with 14.1.6 shall be provided.

NFPA 96-2017 continued

4.17 The maximum quantity of solid fuel consumed shall not exceed the 60% of the maximum per hour for 200,000 Btu/hr (100,000 Btu/min) of gas burner capacity.
5. The gas-operated equipment shall be protected by a fixed suppression system located on the equipment, including the solid fuel holder.
6. Each solid fuel holder shall be located in such a way that the gas burner capacity shall be utilized to protect the solid fuel holder.
7. The fixed suppression system must be designed and labeled to protect the entire cooking operation.
8. Each solid fuel holder shall be located not more than 25 ft (7.6 m) from the gas burners, or protected otherwise, of burner capacity shall be permitted.
9. Solid fuel shall be stored in secure boxes or protected otherwise, prior to being placed in the cooking equipment.
10. The inspection equipment shall be the same as for solid fuel cooking equipment in Table 11.1.
Not a smoker

Do we use butane for cooking?
Butane Stoves

UL LISTING of THE CANISTER
CSA LISTING

Listed for this stove?
**Fire triangle - tetrahedron**

Mechanisms of:
- Dry Chemical
- Wet Chemical
- Gaseous Agents
- CO2
- Foam

**TYPES OF SYSTEMS**

- Dry Chemical – NFPA 17
- Wet Chemical
- Wet Chemical & Water
- Water
- Carbon Dioxide
- Foam

**Combo - Water System**

What kind of system is this?
Fire Suppression Systems / Agents
- Wet Chemical
- Wet Chemical / Water (Hybrid)
- Dry Chemical (Older & Obsolete)
- Sprinkler (De-listed)

Sprinkler Systems
("Quencher", "Mistifier", "Economist", etc.)
Type EA-1 Protectorspray Nozzles manufactured after October 9, 1997 are NO LONGER UL LISTED for the water spray protection of the cooking surface of deep fat fryer commercial cooking equipment.

Water Sprinkler Systems
- Water alone, intensifies the fire.
- Extinguishment may not result for several minutes, as the nozzles are intended for area containment and not necessarily extinguishment.
Break # 1

Summary of First Course Segment

- Fuels
- Extinguishment

1960's – Restaurants Protected with Dry Chemical Systems (Hood & Duct)

1970 – Subject UL 300 Created to Use as a Test Standard Including Appliances
1982 - Wet Chemical Systems Introduced
   - Better Cooling, Clean-up

1994 - UL 300 Standard Approved and Implemented. All systems - Retested. Obsolete all Dry Chemical Systems

1990's - All Manufacturers Stop Supporting Dry Chemical System Components

2006 - Replacement of Non UL 300 Systems very Active - 12 years after UL 300 adopted.
Appliances affected:

- Fryers
- Griddles
- Ranges
- Charbroilers
- Woks

Range Guard was the first wet-chemical system.
Major revisions to latest UL 300

- New appliances with specific heat up and cool down rates
- Use of vegetable shortening with higher auto ignition temperature (685 F)
- Increased pre-burn time from 1 minute to 2 minutes and continued heat source.

1) Energy Efficient Cooking Equipment
- Gas Burners
- Electrical Heating Elements
- Insulation

2) Vegetable Oil vs. Rendered Animal Fat
- Higher Auto-Ignition Temperatures 500° vs. 685°
- Lower Levels of Fatty Acid, Result in Reduced Saponification.
3) Vegetable Oil vs. Rendered Animal Fat
- Pre-Burn with fuel on.
- Longer burn time = higher oil temperatures.

Result:
Up to five times more agent is required by protection per the latest revision of UL 300.
Pre-Engineered Fire Suppression Systems

Cartridge Operated

Stored Pressure Systems

- Tanks are agent filled and generally pressurized with N₂ to a pressure of approximately 350 psi.
- The discharge outlet is contained within the tank valve, generally located at the top of the tank.
- A mechanical releasing device is attached to the tank, or to N₂ cylinder for multiple tank operation.

Cartridge Operated Systems

Tanks are agent filled and non-pressurized until system actuation.

A sealed CO₂ cartridge (800 psi) or N₂ cartridge (1800 psi) supplies the expellant gas pressure at the time of actuation.

A regulated mechanical releasing device, attached to the cartridge, allows regulated pressure to pressurize the tank.
A UL300 approved Restaurant Fire Suppression System has specific pipe sizes with maximum number of fittings. The system also includes maximum and minimum pipe lengths, numbers of fittings, temperatures, discharge heights, and number and types of nozzles needed for each hazard.

Intended Protection
- Grease Fires on Griddle Platens
- Grease or Oil Fires in Skillets or Pots on Open Burner or Covered Burner Ranges
- Overheated Fryers, Woks, or Tilt Skillets
- Flare-Ups on Char-Broilers or in Upright Broilers/Salamanders
- Plenums and Ducts

Wet Chemical System Agents
- An aqueous solution of organic salt, interrupts the chain reaction of the combustion process.
- The mixture of the alkaline solution & the hot grease creates a dense foam blanket (Saponification), which isolates the flammable cooking grease vapors from oxygen.
- Water in solution, as well as resulting steam help to cool the grease.
An aqueous solution of inorganic salts interrupting the chain reaction of the combustion process.

Saponification - foam blanket with larger bubbles (less dense).

Water in solution, as well as the resulting steam help to cool the grease.

After the chemical is fully discharged, water from domestic or sprinkler lines continue to cool heated oils and surrounding areas (15 x faster than conventional wet chemical systems).

Commercial cooking protection.

Typical System.
Manual Pull Station

- Where is it placed?
- When should it be used?
- How does it work?

Fans

Do the fans have to shut down?

What about make-up air?

Fans part of a smoke control system.

Fire Alarm

Does the system have to be connected to the fire alarm system?

Does it send an alarm signal?

Do the horn/strobes and voice alarm actuate?
Gas Valve / Fuel Shut-Off

Fans interlocked to be running before any gas flows per 2017 NFPA 96.

How is this enforced?

What about electricity?

Lights under the hood?

Break # 2

Summary of First Course Segment

- Types of Systems
- Fire Alarm and Interlocks
Plenum nozzles

Nozzle flow numbers

Similar design approaches

Ansul

Pyro Chem
GENERAL NOTES:
1. ACHATION OF SYSTEM WILL
   START BY GAS AND ALL ELECTRIC
   UNDER HOOD AND START EXHAUST FANS.
2. ALL PIPING TO BE 3/4" SLIP 40 BLANK.
3. DESIGN & INSTALLATION SHALL COMPLY
   WITH IRC 2010, NFPA 17A, 2010
   AND STATE AND CLARK COUNTY FIRE CODES.
4. DESIGNED TO RFU.
5. CARTRIDGE 101-20
6. ALL IS CLARK COUNTY FIRE DEPARTMENT

Plan review 1 of 3

- List of items requiring attention
- Details of notes and actions

Plan review 2 of 3

- Additional notes and actions
- Specific requirements for installation
- Instructions for maintenance
Plan review 3 of 3

9. The range coverage is shown as being protected with a 1F and 2F nozzle. Provide a reference in the Arrival manual that allows for two different types of nozzle to be used over a range.

10. The drawing does not clearly show that the pull station is in the path of egress from the building. Add more detail of the floor layout.

11. It is noted that the deep fat fryer will be separated by 10 inches of a 16 inch stainless steel splash guard. A 16 inch stainless steel splash guard will be used. Both of these are acceptable; however, note which method of protection will be used for inspection and future reference.

Lunch

Do you see a problem?
What is a Type I Hood?

- The UMC has hood construction requirements, but if the hood is listed per UL 710 it complies.
What requires a hood?

Ventless Fryers.

Would Require a Hood
Wells HEPA filter
2020 list price
$759.00

Typical filters
With spark arrestor  Typical
Food processing protection

- Foods are completely or partially cooked for general public home consumption or retail sales,

Guess where .......

Break # 3

Summary of Fourth Course Segment
- Duct and Plenums
- Filters and Grease Extractors
- PCU’s
- High Production Cooking

Class "K" Extinguisher NFPA 10 Changes August 2002
- Discharge Device
  - Wand vs. Hose
  - Some concern that if the wand was dropped into cooking oil there was potential for personal injury

NEW to 2018 IFC
Fuel & Power Sources Checklist
- Verify that fuel tanks are filled to the capacity needed for uninterrupted operation during normal operating hours. (305.34.1.2 for contracts only) [F3a]
- Ensure that refueling is conducted only during non-operating hours. (305.34.1.2)
- Check that an engine-driven source of power is separated from the public by barriers, such as physical barriers, fencing, or enclosures. (305.34.2.2) [F3a]
- Ensure that any engine-driven source of power is shut down prior to refueling from a portable container. (305.34.2.2.2) [F3a]
- Ensure that any engine-driven source of power are cool to the touch prior to refueling from a portable container. [F3a]
- Make sure that exhaust from engine-driven sources of power comply with the following: [F4a]
  - At least 10 ft in all directions from openings, need not be adjacent. (305.34.1.1) [F4a]
  - At least 10 ft from every source of spark. (305.34.1.3) [E4a]
  - Directed away from all building doors, windows, and openings. (305.34.2.2) [E4a]
  - Directed away from all other heating devices and equipment, and wiring comply with the NFPA. (707.965.18) [F5a]

Propane System Integrity Checklist
- Check that the main shut-off valve on all gas containers is readily accessible. (305.34.4.1.2) [F1a]
- Ensure that portable gas containers are in an upright position and secured to prevent tipping over. (305.34.3.1) [F2a]
- Inspect gas systems prior to use or re-use. (305.34.3.2) [F3a]
- Perform leak testing on all new gas connections of the gas system. (305.34.6)
  - Performed testing on all gas connections affected by replacement of an exchangeable container. (305.34.8) [F3a]
  - Document leak testing and make documentation available for review by the authorized official. (305.34.10) [F3a]
- Ensure that gas systems are installed between the regulator outlet and the feeding system. (305.34.5.1.2) [F7a]
- Where a gas isolation system is installed, ensure that it has been tested in accordance with the manufacturer's instructions. (305.34.2.2) [F8a]

Solid Fuel Safety Checklist (Where Wood, Charcoal, or Other Solid Fuel is Used)
- Fuel is not stored above any heat-producing appliance or vent. (305.4.9.2.2) [S9a]
- Fuel is not stored closer than 3 ft to any cooking appliance. (305.4.9.2.2) [S9a]
- Fuel is not stored near any combustible flammable liquids, ignition sources, chemicals, and food supplies and packaged goods. (305.4.9.2.7) [S9c]
- Fuel is not stored in the path of the stove in the absence of the heat. (305.4.3.1) [S10a]
- Ash, cinders, and other fire debris should be removed from the firebox at regular intervals and at least once a day. (305.4.3.1) [S10a]
- Removed ashes, cinders, and other removed fire debris should be placed in a does, metal container located at least 3 ft from any cooking appliance. (305.4.3.3) [S9a]
Excerpt from instructions

Maintenance

Table 11.6: Schedule of Inspection for Various Buildings

<table>
<thead>
<tr>
<th>Type of Venues</th>
<th>Inspection Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systems serving solid fuel cooking operations</td>
<td>Monthly</td>
</tr>
<tr>
<td>Systems serving high-volume cooking systems</td>
<td>Quarterly</td>
</tr>
<tr>
<td>Systems serving moderate-volume cooking operations</td>
<td>Semiannually</td>
</tr>
<tr>
<td>Systems serving low-volume cooking operations</td>
<td>Annually</td>
</tr>
</tbody>
</table>

*High-volume cooking operations include 24-hour cooking, restaurant-style eating establishments, day-care centers, day-care centers, day-care centers, and similar institutions.
Replacement Parts Must Be from OEM

A new control head was needed. The manufacture no longer supports this system with replacement parts. Parts from other systems of the same model should not be used.

Basic NFPA 70

- Compliance with the Electrical Code is also assumed.
Regulatory issues

- “903.2.11.5 Commercial cooking operations” is sometimes amended to read as follows:
  - 903.2.11.5 Commercial cooking operations. An automatic sprinkler system shall be installed in a commercial kitchen exhaust hood and duct system where an automatic sprinkler system is used to comply with Section 904, and for the entire length of duct when the duct length exceeds 75 feet.

Report available from NFPA web-site
Abstract

Non-hazardous materials fire fighting systems were the most prevalent in 20% of U.S. reported large fires in 2020. The percentage was higher in places where commercial cooking is common, including most urban areas (62%) and areas with history or convention halls (18%). Non-hazardous materials fire fighting systems were also prevalent in most of these fires, and other specialty hazard systems were the systems that were most of the rest.

Drainage, adequately maintained systems in the area, fire extinguishing systems were in operation in 20% of reported structure fires large enough to activate operational equipment, and the equipment was initially used by 39% of these fires. For systems that were activated, performance was deemed effective in 42% of the cases. For fires large enough to activate systems, systems were activated 90% of the fires (56% were direct).

Because the proposed application by (and possibly) wet chemical systems was seen as a problem for connecting covering requirements, it may be more appropriate to find an alternative for this situation. If this is a factor, the threshold for operating access from 20% to 100% for the threshold of effective operation increases from 69% to 100%.

Key words: wet chemical systems, dry chemical systems, foam systems, automatic systems, automatic suppression systems, fire systems.