• **FM-200®** was the first agent brought to market as an alternative agent in 1994.

• **Chemours (formerly DuPont)** holds the trademark of **FM-200** along with **FE-227**.

• If the agent is described as **HFC-227ea**, it is produced by someone other than Chemours.
Agent Characteristics

- Chemical name – Heptafluoropropane
- ASHRAE Designation – HFC-227ea
- Vapor Pressure – 65.7 psi
- Molecular Weight – 170.3
- Boiling Point – 2.5°F
- Design Concentration, occupied spaces 6.25% - 10.5%
- Maximum Human Expose Time – 5 minutes
- ZERO Ozone Depletion Potential
EXTINGUISHING METHOD - HFC-227ea

- HFC-227ea extinguishes a fire primarily through Heat Absorption that occurs as the agent changes from a liquid to a vapor during discharge.
- In addition, HFC-227ea also disrupts the combustion reaction which aids in the extinguishment of a fire.
- It is important to note, HFC-227ea does not use the depletion of oxygen to extinguish a fire.
• FM-200® is the leading choice for clean agent fire protection with hundreds of thousands of system installations worldwide.

• U.L. and Factory Mutual listed systems are engineered to discharge FM-200® in 10 seconds or less.

• FM-200® provides the margin of safety and performance that only time can buy.
How Safe?

• If you’re waiting for an agent that is safer for people and the environment, don’t hold your breath.
• FM-200® is the most widely tested product of its kind.
• FM-200® (ASHRAE designation HFC-227ea) is approved worldwide to replace CFC’s in pharmaceutical inhalers, like those used for dispensing asthma medication.
INNOVATIVE SOLUTIONS FOR LIFE SAFETY AND BUSINESS CONTINUITY
• ECARO-25 (FE-25) was brought to market as an alternative agent in 2004 by Fike.

• ECARO-25 is an acronym for “Extinguishing Clean Agent Retrofit Option”

• Chemours (formerly DuPont) produces the agent and holds the trademark of FE-25.
Agent Characteristics

- Chemical name – Pentafluoroethane
- ASHRAE Designation – HFC-125
- Vapor Pressure – 200.4 psi
- Molecular Weight – 120.02
- Boiling Point – -54.7F
- Design Concentration, occupied spaces 8.0% - 11.5%
- Maximum Human Expose Time – 5 minutes
- Zero Ozone Depletion Potential
EXTINGUISHING METHOD - HFC-125

- HFC-125 extinguishes a fire primarily through Heat Absorption that occurs as the agent changes from a liquid to a vapor during discharge.
- In addition, HFC-125ea also disrupts the combustion reaction which aids in the extinguishment of a fire.
- It is important to note, HFC-125 does not use the depletion of oxygen to extinguish a fire.
• As a clean agent, FE-25 mixes thoroughly in air and does not leave behind any residue which would cause damage or pose a fire clean up problem.

• This means no collateral damage and minimal business interruption.
• FE-25 offers an easy, cost-effective option to retrofit many existing systems.

• FE-25 requires minimal system modifications, minimizes downtime, reduces cost of conversions.

• FE-25 has a hold time superior to all other alternative agents.

• Example in a 5,000 Cu. Ft Room the hold times are:
  – ECARO-25  27 minutes
  – FM-200  12 Minutes
  – Novec-1230  10 Minutes
LIQUID CLEAN AGENTS

Novec™ 1230 Fire Protection Fluid

Sapphire®  FORCE500 ®
Novec™ 1230

- Novec 1230 was brought to market as an alternative agent in 2005 by 3M.
- Stored in cylinders in its fluid form, the agent vaporizes upon discharge as friction within the pipe creates heat.
- Clear, colorless, low odor, liquid that is superpressurized with nitrogen and stored in low pressure cylinders.
Novec™ 1230

Agent Characteristics

- Chemical name – dodecafluoro-2-methylpentan-3-one
- ASHRAE Designation – FK-5-1-12
- Vapor Pressure – 5.85 psi
- Molecular Weight – 316.04
- Boiling Point – 120.6F
- Design Concentration, occupied spaces – 4.5% - 6%
- Maximum Human Expose Time – 5 minutes
- Ozone Depletion Potential - 0
Novec™ 1230

EXTINGUISHING METHOD – FK-5-1-12

• Novec 1230 fluid extinguishes fire principally by removing heat from the fire.
• Upon discharge, Novec 1230 fluid creates a gaseous mixture with air. This agent/air mixture has a heat capacity much larger than that of air alone. A higher heat capacity means that this gas mixture will absorb more energy (heat) for each degree of temperature change it experiences.
NOVEC Suppression Performance

- Lowest GWP of manmade agents
- 5 day atmospheric lifetime
- Liquid at room temperature, it vaporizes within pipe as friction creates heat
- Installation errors or deviations could impact vaporization of the fluid resulting in Liquid discharge
- Liquid state **will not** suppress a fire
- 500 psi or greater systems will eliminate any concerns for liquid discharges
Inert Agents

100% Green Fire Protection

Argonite®
Inert Gases

EXTINGUISHING METHOD – IG-541 & IG-55
IG-541 and IG-55 extinguishes a fire by reducing the oxygen concentration to a level that will no longer support combustion.
INERGEN

- Launched in 1994 by Ansul.
- Is a mixture of three natural occurring gases: nitrogen, argon & carbon dioxide.
- Environment-friendly, people-safe agent with ZERO ozone depletion potential, ZERO global warming potential, and ZERO atmospheric lifetime.
Agent Characteristics

- Chemical name – Mixture of Inert Gases & Carbon Dioxide
  52% N2, 40% Ar and 8% CO2
- ASHRAE Designation – IG-541
- Molecular Weight – 34
- Boiling Point – -320.8F
- Design Concentration, occupied spaces – 38.5% - 52%
- Maximum Human Expose Time – up to 43% is 5 minutes
- Maximum Human Expose Time – 43 to 52% is 3 minutes
- Zero Ozone Depletion Potential
- Zero Global Warming Potential
• ProInert2 was launched in the US market in 2008 by Fike.

• Inert systems for Fike make up 90% of their clean agent fire systems sold in Europe.

• ProInert2 does not use CO2 in its mixture.

• The mixture of 50% Argon & 50% Nitrogen is the same as you will find in Argonite.
Agent Characteristics

- Chemical name - N²/Ar (50% - 50% blend of Nitrogen & Argon)
- ASHRAE Designation – IG-55
- Molecular Weight – 33.95
- Boiling Point – -310.2°F
- Design Concentration, occupied spaces – 39% - 52%
- Maximum Human Expose Time – up to 43% is 5 minutes
- Maximum Human Expose Time – 43 to 52% is 3 minutes
- Zero Ozone Depletion Potential
- Zero Global Warming Potential
Gas Percentages in Air and with Inert Agent

**Air**
- **N₂** – 78%
- **O₂** – 21%
- **Ar** – 1%
- **CO₂** – 0.3%

**Air w/ 39.3% Inert Gas**
- **N₂** – 69%
- **O₂** – 12.7%
- **Ar** – 18%
- **CO₂** – 0.3%
Where is Pike’s Peak?

Where is Mount Whitney?
Inert Agents

• Benefits:
  – Equipment and installation costs close to other clean agents
  – Similar maintenance costs to other clean agents
  – Full height walls not an issue
  – Remote agent storage capability up to 200’ ++ away
  – Upgrade Any Existing Halon or Clean Agent System Utilizing All Original Piping
  – Low refill costs
Carbon Dioxide (CO2)

- Only used in unoccupied spaces
- Lowers oxygen in room below levels for humans to breathe
- Must be disarmed before entering protected space.

Photo courtesy of Intellitech
Agent Comparisons & Approvals
## Agent Comparisons

<table>
<thead>
<tr>
<th>Agent</th>
<th>ASHRAE</th>
<th>Molecular Weight</th>
<th>Vapor Pressure</th>
<th>Boiling Point</th>
<th>Concentration %</th>
<th>Ozone Depletion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Halon</td>
<td>n/a</td>
<td>148.9</td>
<td>235 psi</td>
<td>-72 F</td>
<td>5 – 7%</td>
<td>16</td>
</tr>
<tr>
<td>FM-200</td>
<td>HFC-227ea</td>
<td>170.3</td>
<td>65.7 psi</td>
<td>2.5 F</td>
<td>6.25 – 10.5%</td>
<td>0</td>
</tr>
<tr>
<td>ECARO-25</td>
<td>HFC-125</td>
<td>120.2</td>
<td>200.4 psi</td>
<td>-54.7</td>
<td>8 – 11.5%</td>
<td>0</td>
</tr>
<tr>
<td>NOVEC-1230</td>
<td>FK-5-1-12</td>
<td>316.04</td>
<td>5.85 psi</td>
<td>120.6 F</td>
<td>4.45 – 4.55%</td>
<td>0</td>
</tr>
<tr>
<td>Inergen</td>
<td>IG-541</td>
<td>34</td>
<td>n/a</td>
<td>-320.8 F</td>
<td>38.5 – 52%</td>
<td>0</td>
</tr>
<tr>
<td>ProInert2/Argonite</td>
<td>IG-55</td>
<td>33.95</td>
<td>n/a</td>
<td>-310.2 F</td>
<td>39.3 – 52%</td>
<td>0</td>
</tr>
</tbody>
</table>
Agent Comparisons
Man Made Agents

- **ECARO-26**
  - 156lb protects 5000 cubic feet
- **HFC-227ea**
  - 158lb protects 4550 cubic feet
- **FK-5-1-12**
  - 158lb protects 3650 cubic feet
Installed System Cost Comparison

- Water Mist: $149,000
- Inergen: $68,000
- NOVEC: $47,000
- ProInert2: $45,000
- FM-200: $43,000
- ECARO-25: $39,000

1500 sq ft. Enclosure
Impact of Clean Agents on Global Warming
The Rumor

“HFCs have a large impact on climate change/global warming because they have a high GWP value”

• What are the Facts?