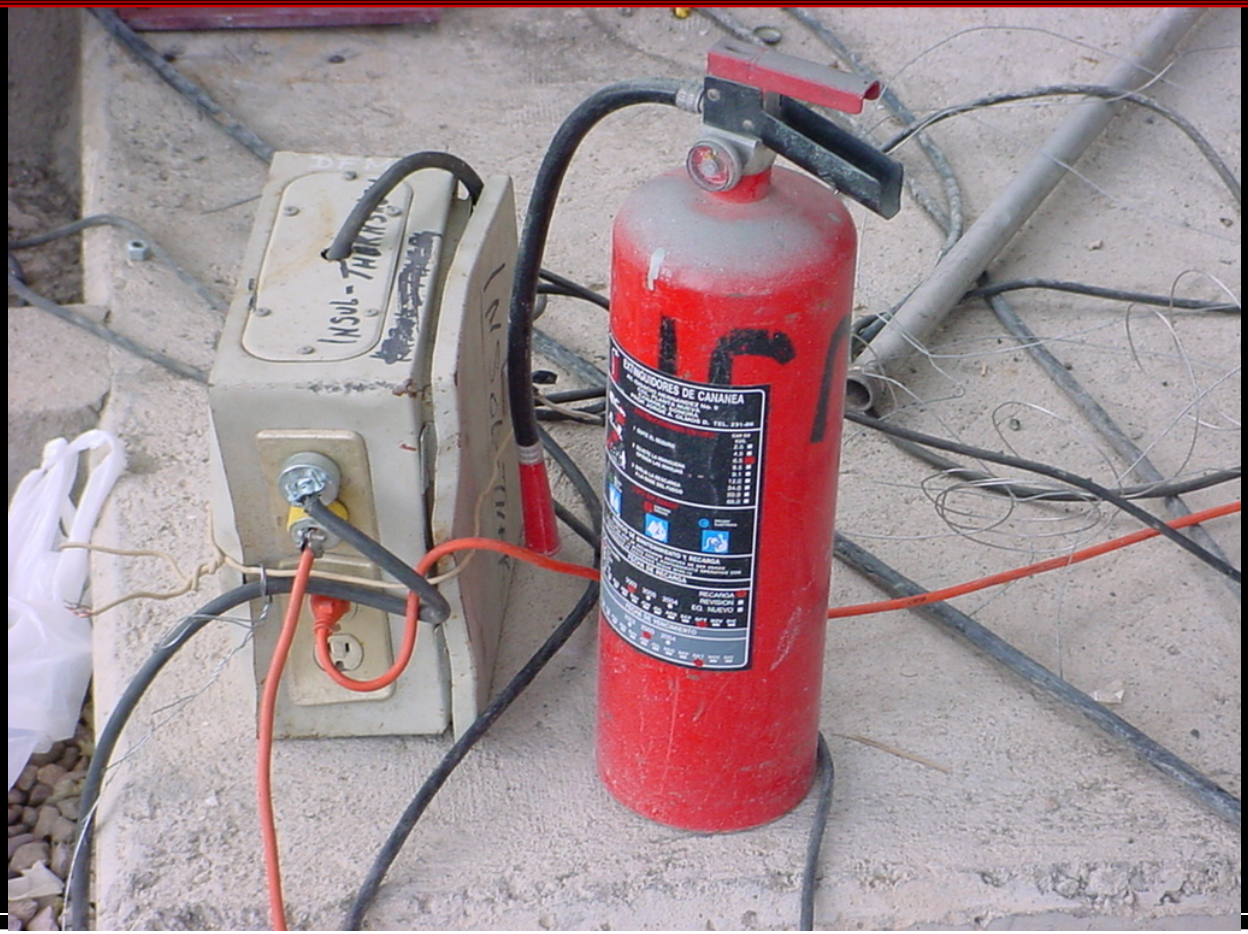

AMERICAN FIRE TECHNOLOGIES
FIRE AND LIFE SAFETY SPECIALIST
Alarm and Detection/Suppression
JE JACOBS

Fire Safety



American Fire Technologies

- To provide special hazard services world wide to the industrial market through the integration of components and services

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Clean Agent

- What are our goals today?
  - How does a Clean Agent extinguish a fire
  - Types of Clean Agents systems
  - Halon?
  - Design Considerations of a Clean Agent System
  - System Components
  - Sequence of Operation

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How Does a Clean Agent System Work?

- Most clean agent's work by chemically extinguishing a fire at the molecular level.
  - In order to extinguish a fire, the agent decomposes.
  - When a Clean Agent decomposes, toxic gases are released. (Does not apply to inert gasses: CO_2, Inergen)
  - To avoid high levels of decomposed gasses, systems are designed for quick discharges (UL requires <10 seconds).

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How Does a Clean Agent System Work? (cont)

- Agent Storage
  - Agent is a liquid, stored in cylinders, pressurized with N2.
  - Agent is super pressurized with N2 to a pressure of 360 psi.
  - Agent is distributed to discharge nozzles, drilled to allow a specific flow rate.
  - Discharge nozzles are located in the room area and below under floors.
  - Cylinders are furnished with low-pressure switches to monitor agent pressure.

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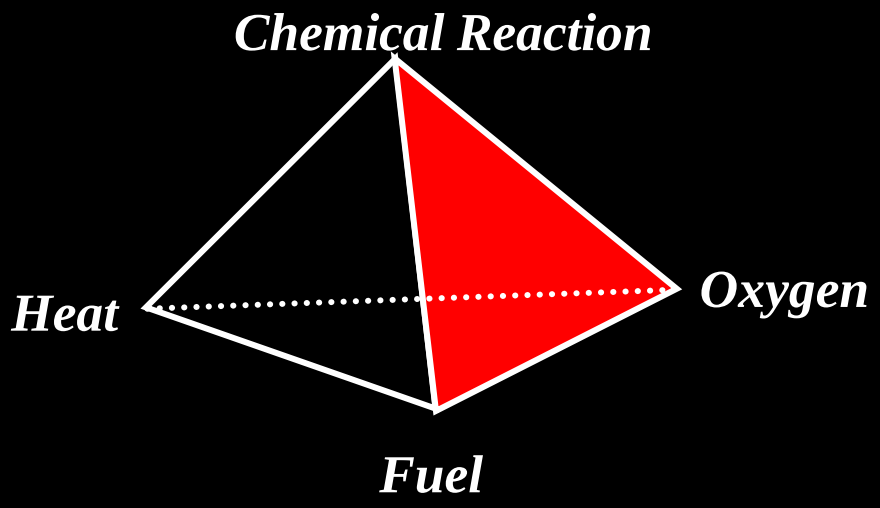
How Does a Clean Agent System Work? (cont)

	Halon	*HFC's*	*Inert Gas*
Oxygen Depletion			Primary
Heat Absorption	Secondary	Primary	
Reaction Interruption	Primary	Secondary	



How Does a Clean Agent System Work? (cont)

- Physical
  - Heat absorption - remove heat faster than generated
  - Reduces flame temperature below that necessary to maintain combustion
- Chemical
  - Interruption of chemical chain reactions of combustion process by halogenated atoms (Fl, Cl, Br)

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Physical Properties

Property	Halon 1301	FE-25™	HFC-227ea	Novec	Inergin
Chemical Formula	CF3Br	CHF2CF3	CF3CHFCF3		
Molecular Weight	148.9	120.02	170.0	316.4	34
Boiling Point	-72º F	-55º F	3º F	120º F	
Vapor Pressure	200 psi	195 psi	66 psi	5.87 psi	2175
ODP	12	0	0	0	0
GWP	6900	2800	2900	1	0

- Zero Ozone Depletion Potential (ODP)
- Very low Global Warming Potential (GWP)
- GWP is calculated of a 100 year time horizon and represents mass of CO2 equivalent to emission of one unit of this compound

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Different Types of Fire Suppression Systems

- FM-200 (HFC-227ea) **CF3CHFCF3**
  - Most common agent used.
  - Works by chemically inhibiting fire propagation.
  - Poor flow characteristics.
  - Supports 12 nozzles max

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Different Types of Fire Suppression Systems (cont)

- Novec 1230 (Sapphire) **CF3CF2C(o)CF(CF3)2**
  - Fairly new agent.
  - Works the same as FM-200.
  - Short after life in the atmosphere (days).
  - Poor flow characteristics.
  - Pressurized with Nitrogen

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Different Types of Fire Suppression Systems (cont)

- Ecaro 25 (Dupont FE-25) **CHF2CF3**
  - Closest to replacing Halon 1301
  - Works by removing O2 at the molecular level.
  - Superior flow characteristics.
  - Required 25% less agent than FM-200.
  - Most economical of Clean Agents.
  - No pressurization concerns
  - No venting required
  - Support 30 to 40 Nozzles

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Different Types of Fire Suppression Systems (cont)

- Inergen (Argonite. Same as Inergen without any CO2)
  - Inert gas (52% nitrogen, 40% argon, and 8% carbon dioxide)
  - Lowers the oxygen in the room to a level that won't support a fire, but still enough oxygen to breath.
  - Design is critical.
  - Must vent room due to pressure build up.
  - Doesn't leak from the room because of low density.
  - Economical to recharge (Hard to find recharge locations).

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Different Types of Fire Suppression Systems (cont)

- Water Mist (Micro Mist)
  - Non-Chemical.
  - Micron size water droplets.
  - Best used for generator rooms or areas with high leakage.
  - Very economical to recharge.

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Different Types of Fire Suppression Systems (cont)

- CO2 (Carbon Dioxide)
  - Not classified as a Clean Agent.
  - Can be lethal to humans.
  - Operates by removing the oxygen from the air.
  - Good for non-occupied hazards.

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United States Position - Halon

- Montreal Protocol - ban on Halon production - 12/31/93
- No current restrictions on use of reclaimed or recycled Halon
- No current restrictions on existing installed systems
- Halon market value decreasing

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Halon Retrofit Objectives

- Maintain an equivalent level of protection
- Utilize the existing Halon 1301 piping network
- Minimize business interruption
- Environmentally preferred
- Realize the most cost effective solutio
- Is Green important?

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Halon Replacement

- No reason to remove Halon, but difficult to recharge if dumps
- FM200/Ecaro/Inert Gases/Green Gases
- Ecaro best one for one replacement.

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System Design

- Define Hazard
  - Determine volume of area(s) (L X W X H).
  - Areas may include room, under-floor, and above ceiling.

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Agent/Quantity

- Determine which agent to use.
  - Try to use the same agent/mfg that is currently used in the facility.
  - Determine quantity of agent to use.

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Design Concentrations Comparison

ECARO-25	8.0%	685 lb.	1
Halon 1301	6.0%	623 lb.	1
HFC-227ea	6.25%	765 lb.	1
Inergen	37%	357 m^3	21
Novec	4%	948 lb.	2

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Systems Design

- Automatic and Manual Operation
  - Smoke Detectors are used for automatic operation
  - Manual release stations are used for manual operation.
- System Alarms
  - Alarm bells
  - Horn strobes
  - Strobes

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Systems Design

- Releasing Panels
  - System controls
    - Main Control Panel (**UL9th Must be listed to release specific**)
      - Operates on 24 volts DC from a 120-volt AC input power source.
      - Contains batteries for DC back up.
      - Monitors and controls all input and output circuits.
      - Includes replays for connections to building alarm panels and remote monitoring

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Systems Design

- Discharge Nozzles
  - Determine quantity and location for nozzles.
    - Limit nozzles to a maximum flow of 20lbs./second.
    - Locate nozzles in each protected area (Room/U/Floor).
    - Try to locate nozzles away from exit doors.

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System Components

- Main Control Panel
  - Is “Conventional” or “Intelligent”.
  - Used to monitor and control input and output devices.
  - Supplies power to the field devices.
  - Supervises field wiring
    - INPUTS – Opens, Grounds
    - OUTPUTS – Opens, Grounds, shorts
  - Displays alarms and troubles.
  - Contains timers for time delays for agent release.

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System Components (cont)

- Ionization Smoke Detector
  - Detects 1-2 micron particle size.
  - Should be used in room areas only (airflow issues)

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System Components (cont)

- Photoelectric Smoke Detector
  - Detects visible particles (4+ microns) (Visible)
  - Good for under floor areas.
  - Normally not as sensitive as an ionization detector.

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System Components (cont)

- Heat (Thermal Detector)
  - Operates when temperature reaches set point.
  - Not good for early warning detection
  - Best suited for harsh areas (Smokey/Dirty).

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System Components (cont)

- Air Sampling System
  - Detects “Sub-micron” size particles.
  - Good for ultra early warning of a fire condition.
  - Detects “Thermal degradation” of the item.
  - Allows you to be “Pro-Active” to alarms. You can find the source of the problem before needing the suppression system.
  - Fairly expensive, but could save the cost of a systems recharge.

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System Components (cont)

- Manual Release Station
  - Used to manually discharge the system.
  - Instant release, bypassing any time delays.
  - Normally located near exit doors.
  - Code requires every system to have a manual release.

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System Components (cont)

- Abort Station
  - Used to bypass a pending discharge.
  - Located next to the manual release station.
  - Must be depressed (operated) in order to bypass a discharge.
  - Must be operated prior to a system release.

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System Components (cont)

- Alarm Devices
  - Alarm Bells.
    - Used for “1st” detection zone alarms.
    - Used for Air sampling system alarms.

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System Components (cont)

- Horn Strobes
  - Can be used for “1st”/”2nd”/”Discharge” alarms
  - Normally are pulsed to indicate type of alarm.
    - Slow pulse – 1st zone alarm
    - Fast pulse – 2nd zone alarm (pre-discharge”
    - Steady – Discharge alarm.

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System Components (cont)

- Strobe Lights
  - Normally used to indicate a system discharge.
  - Located outside exit doors.
  - Attached to a horn inside the hazard area, a strobe indicates a general alarm condition.

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System Components (cont)

- Agent Storage Cylinders
  - Used to store Clean Agent.
  - Is supplied with pressure gauges and low-pressure switches.
  - Are supplied with valves or bursting disc.
    - Solenoids used to actuate valves.
    - Actuators used for bursting disc type.

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System Components (cont)

- Discharge nozzles.
  - Used for distribution of agent.
  - Located in protected areas.
  - Sidewall and center room type.
  - Maximum flow rate of 200 lbs (20 lbs. second)

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System Components (cont)

- Actuators
  - GCA (Compressed Gas Actuator).
    - Triggered by small charge.
    - Requires special handling.
    - Used on cylinders with rupture disc.
  - Solenoid
    - Activated by applying voltage to coil.
    - Used on cylinders with valves.
    - Can also be used on N2 (Nitrogen Actuators)

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System Components (cont)

- Special Detection Systems
  - Early Warning Fire Alarms (VESDA/SAFE)
    - Used for very early warning of a fire.
    - Monitors particle size of .01 micron (Invisible)
    - Works by taking air samples in the room and counting the particulate.
    - Allow personnel to be pro-active in finding a potential fire hazard and eliminating the need to use the suppression system.

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EARLY WARNING SMOKE DETECTOR

- Particles of Combustion are Found in Air Samples
  - Control Panel Indicates “Pre/Alarm” Condition
  - Control Bar Graph Indicates Level of Particle Count
  - Control Panel “Alarm Level” Contacts Operate
  - Alarm Bells in Ground Floor Area Are Activated

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Detection Devices

- Determine quantity of smoke detectors.
  - Use a spacing of 250 sq. ft. per detector.
  - In room areas use a combination of ionization and photoelectric smoke detectors.
  - In under-floor spaces, only use photoelectric smoke detectors.
  - Located a manual release and abort station at the primary room exits. Normally, these are installed inside the hazard area.
  - Locate audible and visual devices in the room so all personnel can hear/see the alarms.
  - Locate discharge strobes outside of the main exit doors.

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Sequence of Operation

- Single Smoke Detector In Alarm
  - Control Panel Indicates “Alarm” Condition
  - Control Panel Alarm Contacts Operate
  - Control Panel Displays Device and Location of Alarm
  - L.E.D. On Smoke Detector Illuminates Steady “On”
  - Alarm Horn in Hazard Area Starts a Slow Pulse Signal
  - Alarm Strobe in Hazard Area is Activated

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Sequence of Operation (cont)

- Two Smoke Detectors in Alarm (Same Hazard Area)
  - Control Panel Displays Device and Location of Alarm
  - L.E.D. on Smoke Detector Illuminates Steady “On”
  - Alarm Horn in Hazard Area Changes to a Fast Pulse Signal
  - Control Panel Pre-Discharge Delay Timer is Activated
  - Equipment Shutdown Contacts Are Activated

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Sequence of Operation (cont)

- Note:
  - At the end of 30 seconds, the system is discharged into the hazard area.
  - If the abort station is operated prior to the 30-time delay, the system will not discharge. The abort is a “Dead Man” type, and must be continually depressed in order to bypass a discharge. Releasing the abort station will cause the time delay to restart.

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Sequence of Operation (cont)

- System Discharge
  - Control Panel Displays System Has Released
  - Discharge Strobe Outside Exit Door is Activated
  - Alarm Horn in Hazard Area Changes to a Steady Tone
  - Discharge Strobe Outside of Exit Door is Activated
  - Shutdown Relays are Energized

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Sequence of Operation (cont)

- System Alarms and Troubles
  - Control Panel will Display Either “Alarm” or “Trouble”
  - Control Panel will Display Cause of the Alarm or Trouble
  - Control Panel Sonalert Will Sound

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Sequence of Operation (cont)

- Note:
  - Depressing “Acknowledge” button on front panel can silence the control panel sounder.
  - Alarm devices in the field can be silenced by depressing the “Alarm Silence” button on front panel.
  - Depressing “Reset” button will return panel to “Normal” condition.

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Sequence of Operation (cont)

- FIRE ALARM
  - Operation of Any Smoke Detector or Fire Alarm Pull Station
    - Control Panel Indicates “Alarm” Condition
    - Control Panel Alarm Contacts Operate
    - Control Panel Displays Device and Location of Alarm
    - L.E.D. on Smoke Detector Illuminates Steady “On”
    - Alarm Horns in Hazard Area Starts a Pulse Signal
    - Shutdown Contacts Operate

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Sequence of Operation (cont)

- NOTE:
  - Depressing “Alarm Silence” button on control panel door will silence alarm bells.
  - Depressing “Reset” button will reset panel to normal condition.

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The End

“Thanks” For Taking The Time To See This!!

We Hope This Will Help

Questions

- ?
- Leave me your card/email or email me if you would like additional information on any of the additional detail

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