

# Condensed Aerosol Fire Extinguishing Systems

## Tech Talk

Volume 15

Allianz Risk Consulting

This Tech Talk discusses how condensed aerosol systems work, applications and limitations, and Allianz Risk Consulting (ARC) recommendations for new and existing installations.



Source: Wikipedia

*Discharge of a Condensed Aerosol Fire Extinguishing System.*

## At-A-Glance

- Condensed aerosol fire extinguishing systems offer effective fire suppression in enclosed areas
- Potentially reduced collateral damage compared to traditional dry chemicals
- Concerns with corrosion damage to sensitive electronic equipment
- Clients should contact Allianz Risk Consulting to discuss proposed application prior to installation

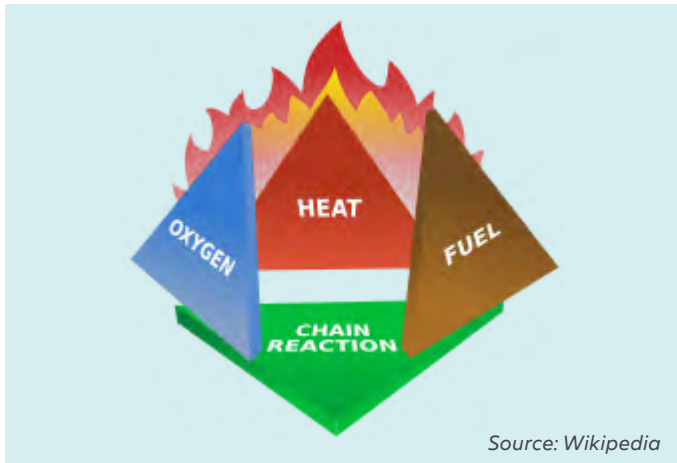
## Introduction

Typical fire extinguishing systems found in commercial and industrial locations include sprinklers, carbon dioxide, clean agent, and dry/wet chemical agents. Another fire extinguishing technology available, but less common, is condensed aerosol. These systems take advantage of the well-established fire suppression capability of solid particulates, with potentially reduced collateral damage associated with traditional dry chemicals. However, there are some concerns in regard to collateral damage to computers and other sensitive electronic equipment.

# How do Condensed Aerosol Systems Work?

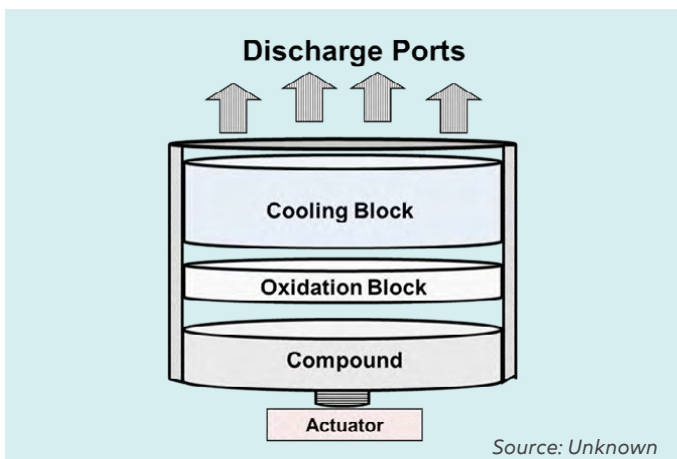
The National Fire Protection Association (NFPA) defines condensed aerosol as an extinguishing medium consisting of finely divided solid particles and gaseous matter, generated by a combustion process of a solid aerosol-forming compound. Dry chemical agents are powder based agents that normally range in diameter from 25 to 150 micrometers, while condensed aerosols are defined by NFPA as particles of less than 10 micrometers in diameter. Both produce large surface areas for reaction and are very effective extinguishants.

The fire tetrahedron (see image below) identifies four elements needed for fire to occur: heat, fuel, oxidizing agent (usually oxygen), and chemical chain reaction. Fire will burn until at least one of these elements is removed. Condensed aerosol mainly interferes with the chain reaction, similar to halocarbon agents, such as Halon 1301. Without the chain reaction, there's insufficient heat necessary to maintain the fire.



The Fire Tetrahedron: four elements are needed for a fire to occur. Condensed aerosols interfere with the chain reaction.

Generally, aerosol generators consist of the casing, initiation device (actuator), aerosol-forming compounds, reaction (oxidation) component, cooling component and discharge ports.



Typical Components of an Aerosol Generator

The major principle of condensed aerosols is in generating solid aerosol particles and inert gases in the concentration required and distributing them uniformly throughout the protected volume, such as an enclosed room, cabinet or compartment. The quantity of aerosol-forming compound needs to be at, or above, the design application density for a specified period of time to prevent reignition. Systems can be actuated electronically by a smoke or heat detection system, thermally by fusible link or manually by pull station.

## Applications and Limitations

All aerosol systems shall be installed to protect hazards within the limitations that have been established by the listing. Condensed aerosol fire extinguishing systems are currently listed for fire hazards involving ordinary combustible materials, such as paper, wood, cloth, rubber and many plastics (Class A surface fires), flammable/combustible liquids (Class B fires) or energized electrical equipment (Class C fires).

Typical potential applications include the following normally non-occupied areas or enclosures:

- Flammable liquid storage (not requiring classified electrical equipment)
- Turbine enclosures
- Electrical cabinets
- Vehicle engine compartments
- Storage vaults
- Marine engine rooms
- CNC machines
- Data centers\*
- Telecommunication facilities\*

**\*Note: although condensed aerosol manufacturers promote use in data centers and telecommunication facilities, ARC recommends using other types of fire extinguishing systems (i.e., clean agent, etc.) based on the potential for damage to sensitive electronic equipment.** Several Allianz clients have experienced corrosion damage to electronic equipment as a result of condensed aerosol system discharge.

Installation in normally occupied areas should be carefully evaluated due to potential hazards including reduced visibility and eye irritation during and after discharge (up to one hour), potential toxic gases generated by the aerosol-generating reaction, and hot products of combustion during discharge. Personnel should not enter the area after a system discharge until the aerosol agent has settled or is properly ventilated.

Condensed aerosol agents shall not be used on fires involving the following materials:

- Deep-seated fires in Class A materials (i.e., paper, wood, cloth, rubber and many plastics)

- Certain chemicals or mixtures of chemicals, such as cellulose nitrate and gunpowder, that are capable of rapid oxidation in the absence of air
- Reactive metals such as lithium, sodium, potassium, magnesium, titanium, zirconium, uranium, and plutonium
- Metal hydrides
- Chemicals capable of undergoing autothermal decomposition, such as certain organic peroxides and hydrazine

In addition, condensed aerosol generators shall not be used to protect classified hazards (i.e., areas handling flammable liquids or combustible dusts) unless the generators are specifically listed for use in those environments.

## ARC Recommendations

Before planning to install an aerosol fire extinguishing system, please contact ARC to discuss the proposed application. In addition, the following should be thoroughly considered:

1. The design, installation, maintenance, inspection and testing should be in accordance with the latest edition of NFPA 2010, **Standard for Fixed Aerosol Fire-Extinguishing Systems**, or equivalent standard. Submit system specifications, working plans, design calculations and manufacturer specification sheets for all equipment to ARC for review and approval prior to installation.
2. Consider the **potential adverse effects of agent particulate residue on sensitive equipment** and other objects. For sensitive electronic equipment (i.e., computer equipment, motor control centers (MCC), etc.), ARC recommends using other types of fire extinguishing systems (i.e., clean agent, etc.) based on the potential for corrosion damage.
3. Select aerosol fire extinguishing systems **listed by a nationally-recognized testing laboratory**. The system shall be installed and used to protect hazards within the limitations established by the listing.
4. Ensure the structural strength and integrity of the protected enclosure in the design of a total flooding system.

5. Install the aerosol generators securely at a minimum safe distance from combustible materials in accordance with the manufacturer's recommendations.
6. Provide audible and visual predischage alarms within the protected area to give positive warning of impending discharge.
7. Develop appropriate procedures for cleaning and restoring the protected area after system discharge.
8. Establish a recorded maintenance program following the equipment manufacturer's guidelines, including the following:
  - a. Monthly – verify the system is operational with no obvious deficiencies.
  - b. Annually – have a qualified contractor inspect the system for proper operation, test the system according to the manufacturer's procedures, and inspect the integrity of the protected enclosure.

## References

NFPA 2010, *Standard for Fixed Aerosol Fire-Extinguishing Systems*

ISO 15779, *Condensed Aerosol Fire Extinguishing Systems*

ANSI/UL 2775, *Standard for Fixed Condensed Aerosol Extinguishing System Units*

CEN/TR 15276-1/2, *Fixed firefighting systems – Condensed aerosol extinguishing systems*

## Questions or Comments?

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