

EUROFEU



Fixed Extinguishing Installations Section

**POSITION PAPER
ON PARTICULATE / CONDENSED AEROSOLS
FOR FIRE EXTINGUISHING**

REV2

Eurofeu position paper on Particulate Aerosols

1 Scope

The aim of this document is to give basic information to non-specialists needing to evaluate the use of Particulate Aerosols in fire fighting. It discusses the benefits of Particulate Aerosols and points out possible limitations, restrictions of use, or disadvantages compared to alternatives. These are general observations that may not apply to all systems or to future product developments. For example, pyrotechnically generated nitrogen.

The Eurofeu Fixed Extinguishing Installations (FEI) section has representation from suppliers of Water Mist systems, CO₂ system, Halocarbon systems, Inert gas systems, and Particulate Aerosol products, and it is the purpose to provide advice without the influence of commercial interest. Particulate Aerosols may also be referred to as Condensed Aerosols.

2 Introduction

Particulate Aerosol systems have been known since the early 1990's, and have been marketed under several different trademarks and in different forms. The technology originates from Russia, where it is a spin-off product of the Russian solid fuel missile and rocket program. Later on it has appeared in several derivatives from numerous suppliers, and other variations of the concept have been developed based on different technology.

Condensate Aerosol is manufactured using different containers with different agent quantities depending on the manufacturer.

Thermal hazard: The commonly used condensed aerosols discharge at elevated temperatures. Depending on the intended application(s) of the aerosol system, the temperature at the reasonable minimum clearance from the discharge outlet, as specified by the manufacturer of the aerosol generators, should not typically exceed 75 °C for direct personnel exposure, 200 °C for combustible material and 400 °C for construction structures. Immediately after the discharge the aerosol generators can be hot, therefore, protective gloves shall be worn before handling generators up to 15 minutes after discharge.

Heat profiles are specific to each manufacturer and unit size. Generators must not be installed in variance to the limitations contained in the manufacturers' listing.

3 Applications for Particulate Aerosol

Aerosol extinguishants can be suitable for suppression of Class A, Class B, and Class C fires (EN 2).

3.1 to 3.4 provide criteria to assess the suitability of the application.

3.1 Space

The main advantage of Particulate Aerosol is the extinguishing efficiency relative to the weight and volume of agent and storage equipment. These features enable the use in a variety of applications such as engine spaces in vehicles where only a few, if any, of the other extinguishing alternatives are suitable due to weight and/or space restrictions.

3.2 *General conditions of use*

Due to the thermal stratification of Particulate Aerosol, it should not be used in applications exceeding the original test conditions of the approval tests. Particularly the enclosure height should not be exceeded, and it should in no case be accepted that the effect of a smaller unit is extrapolated to give the effect of a larger unit.

The design of a system to protect an enclosure should take in to account the amount of agent necessary, number and type of aerosol units, discharge coverage and safety margin.

Guidance in the form of CEN technical reports (CEN_TR_15276-1, CEN_TR_15276-2) & International standards ISO 15779 have been published.

It is important to ensure that the specified systems are compliant with the guidance contained in the above standards. In particular:

- The extinguishing concentration is to be determined in a volume $\geq 100\text{m}^3$
- Thermal clearance considerations
- Service life especially in respect to aerosols using pyrotechnic devices
- Suitability for use in occupiable areas

If Particulate Aerosol is used in an application that is not represented by an established test procedure and cannot be interpolated as valid, the user should require an applicable full scale test. The user should require the manufacturer to provide certification of Particulate Aerosol for the specific risk protected.

3.3 *Direct impact*

During discharge the heat expansion of most commonly used Particulate Aerosols, is likely to create an over pressure in the enclosure if there are no over pressure vents (vents that will open and bleed off pressure during the pressure increase and close automatically afterwards).

The Aerosol is primarily using particulates in the range of 1 to a few microns.

The discharge of Particulate Aerosols produces fine particles which eventually will settle on surfaces and equipment.

During the combustion forming the Aerosol there may be variation in composition due to numerous factors. These variations (of basic material) will influence the composition of the Aerosol, but it should generally be taken into account that concentrations of N₂ (Nitrogen), CO (Carbon Monoxide), NO_x (Nitrogen Oxides) and NH₃ (Ammonia) are produced.

The potential adverse effects, which will be specific on the aerosol type, should be considered when selecting this technology.

It should also be considered that Particulate Aerosol and propelling gases escaping from enclosures during discharges may affect adjacent fire detection and alarm systems.

3.4 *Ventilation considerations*

Ventilation must be stopped and enclosure integrity should be fairly tight. If a continuous supply of air to the enclosure cannot be avoided, Particulate Aerosol may not be suitable for the application, or it may be necessary to considerably increase the available agent mass to compensate for losses.

3.5 Speed of extinguishment

Particulate Aerosol extinguishes fires rapidly and efficiently. The discharge is usually ranging from 2-120 seconds.

4 Safety for people

4.1 Exposure without fire

Particulate Aerosol should not be used in normally manned enclosures unless specifically validated for use in such enclosures, subject to approval by the Authority in the applicable territory. Taking into account the following:

- Type and model and size of aerosol generator
- The concentration and size distribution of fine particles
- The concentration of gases.
- The toxicology of the resulting environment in the enclosure

Note: Some reports indicate that the exposure to a (low) concentration is not lethal for a 10 minutes exposure, but the necessary extinguishing concentration is often much higher than the exposure tests have used.

4.2 Exposure with fire

There are no significant amounts of thermal decomposition products.

4.3 Visibility during and after discharge.

Visibility is significantly reduced during and after discharge and it may be difficult for people present in an enclosure to evacuate during this period.

5 Environmental impact

Most Particulate Aerosol's do not appear to have any significant environmental effect. For more information refer to the Safety Data Sheet.

6 Conclusions

There have been negative experiences from applications where systems were installed by suppliers not taking notice that the application was unsuitable for Particulate Aerosol. However, when it is used in accordance with applicable standards/guidance within its limitations, and with sound engineering practices applied, Particulate Aerosol is a technology with a number of suitable applications.