

# DuPont™ FE-36™ Use as a Fire Suppressant in Surgical Operating Rooms

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## Introduction

Halon fire suppressants were in popular use for decades to protect high-value assets, including hospitals, airplanes, museums and computer rooms. While Halon provided excellent protection for people and facilities, ozone depletion resulted from its use. DuPont™ FE-36™ is a widely used clean agent that is an effective Halon replacement. FE-36™ is safe for people does not leave a residue, is electrically nonconductive and non-corrosive, and has no ozone depleting properties. In addition, FE-36™ is effective on Class-A, -B and -C fires. FE-36™ has much lower toxicity than both Halon 1211 and Halon 1301, and can be safely used in small spaces and around susceptible (high risk) populations.

## General Exposure Considerations

Human exposures to fire suppressants can be generally characterized as high concentration, short duration exposures. The two primary types of applications are handheld and total flood fire suppressant systems. When using either handheld or total flood systems, people in a fire area should egress as quickly as possible and return only after the area is declared safe for occupancy.

In total flood applications, a protected room or enclosed area is “flooded” with sufficient fire suppressant agent to achieve and maintain an agent concentration to quickly manage the fire, while providing an appropriately safe environment for those people who could not egress prior to agent discharge. The National Fire Protection Association has documented flooding agent safe exposure concentrations and exposure durations in its NFPA 2001 document. Flooding agents used in normally occupied spaces are predominantly fluorocarbons. Carbon dioxide is generally excluded from use in total flood applications where people are present since it is lethal at the minimum concentrations needed for fire suppression.

In handheld applications, a user-controlled or portable fire extinguisher is used to apply the fire suppressant directly to the source of the flame. Unlike the total flood application, streaming agent applications may create a large agent concentration difference at the source of the flame as compared to the breathing zone of people involved in agent discharge or who are in the area of the discharge. Further, agent concentrations in the breathing zone may be lower and exposure times briefer than in total flood applications.

Clean agent halocarbon fire suppressants provide excellent protection against the damage and injury associated with fire events. Like all fire suppressants, there are important health and safety properties to consider when deciding on a fire suppression agent for a particular application.

FE-36™ is well suited for use as a fire suppressant in handheld fire extinguishers. FE-36™ has much lower toxicity than Halon 1211 and can be safely used in small spaces and around susceptible (high risk) populations. The HCFCs used or considered for use in fire suppressant applications (Halon 1211) have considerably greater cardiac sensitization potential than the HFC suppressants (e.g. HFC-236fa, a.k.a. FE-36™).

For comparative purposes, Halon 1211 has cardiac sensitization LOAELs of 1% v/v in epinephrine challenged dogs, a highly sensitive model. The LOAEL (Lowest Observable Adverse Effect Level) is the lowest concentration at which an adverse physiological or toxicological effect has been observed. In contrast, HFC-236fa has a cardiac sensitization LOAEL of 15% v/v in epinephrine challenged dogs. Further, HFC-236fa is designed to be an effective fire suppressant at concentrations well below any concentration associated with cardiac sensitization. It is also worth noting that the safe exposure times published by NFPA were designed to protect even sensitive human sub-populations.

In addition to the potential health effects associated with direct exposure to high concentrations of the fire suppressant agents, there may be considerable health risks associated with the by-products of combustion in a fire. In situations where items such as building materials (e.g., wood), clothing, fuels, etc., are burned, the human health risk is most likely due to smoke and combustion products of those things being burned in the fire, rather than fire suppressants.

### **Consideration of FE-36™ Use in Operating Rooms**

FE-36™ is a fire suppressant that effectively extinguishes Class-A, -B and -C fires and provides protection against re-ignition.

FE-36™ has very low toxicity at the concentrations used in fire suppressant systems. Based on National Fire Protection Association standards, even sensitive human subpopulations can be safely exposed via inhalation to 125,000 ppm FE-36™ for up to 5 minutes. The low toxicity and high efficiency of FE-36™ combine to provide superior fire protection, while maintaining an exposure profile that does not contribute to cardiac or central nervous system health effects in operating room personnel and patients.

FE-36™ is a gas at temperatures above -1.4°C (39°F) and no unique toxicity would be expected as a result of FE-36™ physical properties (e.g., no embolus formation).

When combusted, FE-36™ may form some hydrogen fluoride. The amount of hydrogen fluoride formed is dependent on several factors, including size and temperature of the fire, agent concentration and fire fighting technique. In virtually all cases, smoke and the products of combustion of plastics, fibers, fuels, etc., burned by the fire present a much greater risk than the by-products of FE-36™.

Since it is likely that highly toxic combustion products may form in a fire, individuals should evacuate the fire area immediately. Unprotected personnel should not return to the area until declared safe to do so by qualified individuals.

## Conclusion

Individuals should always exit the area where a fire takes place as soon as possible since smoke and combustion materials are dangerous. Use of DuPont™ FE-36™ in areas where people are present does not increase the chemical hazard to the occupants, including the patients in a healthcare situation. Fire suppressant systems using FE-36™ provide users the benefits of efficient and effective fire suppression (limiting the amount of combustion products formed), and cause little to no collateral damage to the assets. In addition, FE-36™ has no ozone depletion potential, making it the preferred replacement for Halon 1211 as a fire extinguishant in operating rooms. FE-36™ is safe for people, assets, and the environment. FE-36™ is the smart choice.

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