



The Uses of Stat-X[®] Aerosol Fire Suppression Systems in Data Centers, Departmental Server Rooms, and Remote Hub/Cell Tower Sites.

By: James F. Lavin, CEO, Fireaway Inc.

The modern data center is an extremely complex environment for fire suppression systems. The needs for extremely high airflow on the data floor to deal with cooling loads in excess of 100 W/sq ft., multi-megawatt switching systems, generator farms, large numbers of CRAC units, compartmentalized hot aisle/cold aisle, and above all the need to keep processing on a 24/7x365 basis create tremendous challenges far beyond code specifications or NFPA 75. Additionally, as all data center operators know, false discharges of clean agent systems due to a fan belt, or a coolant leak mimicking smoke, far exceed discharges due to actual fire conditions, making the cost and speed of restoring fire-systems an important consideration in non-water suppression systems.

While I will outline the proper uses of Stat-X[®] in the data center environment, on a personal note I am a big believer in the use of pre-action water systems for the data floor itself where possible. AHJ's accept them, and in 13 years of operating data centers I haven't seen a false discharge with a pre-action systems as the heads have remained intact, whereas I have seen multiple problems with gas systems and dodged flying floor tiles driven by underfloor discharge nozzles. With pre-action systems I have seen small smoky fires from servers overheating, and those fires being put out locally before a head has melted, resulting in minimal downtime—if a site is manned.

However there are many cases where pre-action is inappropriate or too expensive—and where the cost of repair in the event of a water release is significant, particularly in high rise buildings. Where total flooding special fire protection systems are being considered, Stat-X should be considered as well. Additionally, generator rooms, switchgear rooms, monitoring rooms and electrical panels are almost always more effectively and less expensively protected by Stat-X than other means. For isolated sites, such as cell tower base stations, or telecommunications hubs, Stat-X may be the only right choice.

Stat-X Background

Stat-X is a condensed aerosol fire system, UL listed under NFPA 2010, which is the condensed aerosol fire extinguishing system standard. Stat-X systems are currently protecting a large number of data center and telecom installations worldwide. Condensed aerosol systems work by the activation of a solid non-pressurized aerosol forming compound inside an engineered generator. The burning compound produces a



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carrier gas and heavily ionized, extremely fine, potassium-containing particles. They are total flooding agents similar to FM-200, Ecaro-25, Novec 1230, etc.

On a gram for gram basis, condensed aerosols, and Stat-X in particular are the most effective fire suppressant agents in existence. Aerosols do differ in efficacy and cleanliness/byproducts, with Stat-X generally recognized as the best in both efficacy and cleanliness. The Stat-X UL Class C application density appropriate for a data center environment calls for **67** grams/m³ (35 ft³), vs **550** grams of FM-200. Unlike FM-200 Stat-X has zero GWP in addition to zero ODP. Unlike inert clean agent gas systems which work by massive oxygen dilution requiring large storage space for 2000-4000 psi pressure tanks and careful venting, Stat-X takes up no floor space. Stat-X is particularly appropriate for containerized data centers where space is absolutely critical and the area is compartmentalized.

While both can act as clean agent, total flooding systems, the characteristics of condensed aerosol suppressants differ significantly from that of gas systems. The aerosol creates a small volume of gas and particulate, usually resulting in a peak overpressure of .3 lbs or less for 7-36 seconds. The flow from the generator is at a modest pressure, around 50 PSIG peak vs the 180 PSIG nozzle pressure often found in FM-200 gas systems (or 575 PSIG nozzle pressure in inert gas systems). With minimal pressure differential effects and the particulate rather than gas being the key extinguishing agent, it does not dissipate at the same speed that gas does. This allows the design program to compensate for leakage (subject to the local AHJ), eliminating the requirement for room integrity testing and providing an extended extinguishing time particularly appropriate for energized electrical fires.

Stat-X offers a number of compelling advantages; lower initial cost, lower cost of maintenance, ease of installation, and speed of replacement after discharge. Stat-X installations are based on individual robust generators with considerable flexibility in placement to meet the needs of aisle or cable tray placement and are easy to move in the event of layout changes. Only a small diameter conduit loop to protect the low voltage wiring is required between units. There are no tanks or need for tanks space, valves, piping or pressure testing. After a discharge, only the generators need to be replaced. This usually takes 5 minutes per generator.

Stat-X also produces thermal/manual actuation single units for protection on a set and forget basis inside electrical panels with 10 years between replacement or service. These can be mated to a simple two wire actuation detection sensor. This allows true fire fighting at the source, potentially greatly reducing downtime.

Stat-X is listed only for unoccupied or normally unoccupied areas as once discharged it will create complete obscuration in the space making exiting difficult and thus requires a delay circuit and alarm. Most data centers are generally unoccupied, but if there is a manned office in the data space Stat-X should not be used (Stat-X agent is safe for



limited human exposure however visibility will be temporarily diminished following discharge).

Stat-X installation and Recommendations:

Just as with a gas system where you don't put nozzles next to sensitive electronics, you must provide a space for the Stat-X generator to properly discharge. In the immediate vicinity of the front of the generator, there is a relatively short zone of hot discharge where equipment can either be directly damaged or where particulate will agglomerate on an object in the discharge path. This is a particular consideration in underfloor protection. In general only 500 gram or smaller units should be used in underfloor applications and careful consideration to discharge paths and installation height should be given before using units greater than 500 gram in a data center floor.

Secondly, while gas systems use heavier than air gas and tend to settle before dispersing, Stat-X tends to rise and thus consideration and generator placement and careful review of the manual are required to ensure the agent reaches the lower portions of the space being protected. Common sense and visualizing the discharge paths are a big help in proper installation.



Data Center Stat-X Condensed Aerosol Fire Extinguishing System

Specific Recommendations and Cautions Regarding Data Centers:

- 1) Generator areas are ideal for Stat-X protection. They are normally unoccupied and they are very difficult/impossible to seal. Water systems may be used for back-up, but in the event of a fuel leak and with the potential for damage as water hits a hot engine, Stat-X is a cost effective first line of defense. Fans must be shut down prior to discharge.



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- 2) UPS and non-Lithium battery cabinet areas are also ideal for Stat-X fire protection. Stat-X can be used for in cabinet switchgear and battery protection as well as for the UPS area. Due to the density of cabling and ventilation required in a UPS room, Stat-X individual generators can be much easier to run than gas or water piping. HVAC systems should, of course, be interlocked to shut down upon discharge, but as Stat-X is stable above 26,000 V UPS systems do not need to automatically go off-line on discharge.
- 3) Breaker panels and switchgear rooms can and should be protected with Stat-X.
- 4) For large open floor data centers, gas systems may be less expensive as large scale gas systems are primarily a matter of piping layout and additional nozzles. While generally the cost tends to converge at 3500 sq. ft. of space, the biggest variable is often the cost of creating room the room integrity and room integrity testing required for gas systems.

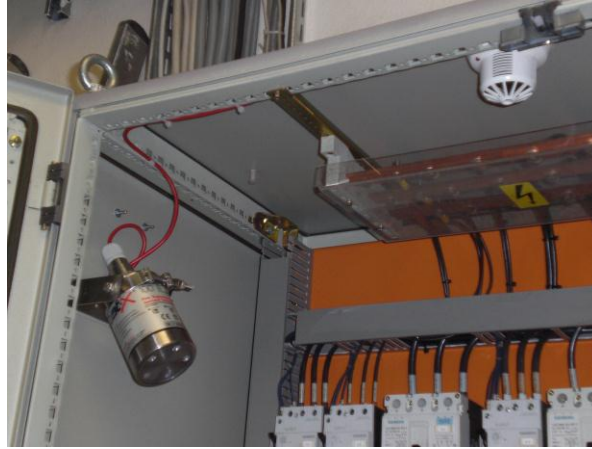


Nexanet GmbH Datacenter Stat-X Fire Extinguishing System

- 5) Where Stat-X is used on the data floor, the smoke exhaust system should be activated after 15 minutes, or at least 2-3 minutes before re-activation of CRAC units.
- 6) As Stat-X may agglomerate on the filters used by CRAC units over time, CRAC units should be interlocked. As Stat-X is designed for maximum 15 minute containment before being exhausted, data centers should be able to avoid overheating issues during this period of AC shutdown.
- 7) Individually isolated aisles, such as APC thermal containment systems with DX units covering the aisle, may cause real fire protection issues. Stat-X generators can be mounted in cabinets (with fans interlocked to shut down upon activation) or in the covered aisles for spot protection.
- 8) Stat-X is an excellent agent inside breaker panels. Thermal units can be installed on a 10 year install and forget basis and for \$200 or less can provide protection to an 800 amp panel, dramatically reducing downtime in the event of a fire. Fighting fire at the source is always the best idea.



- 9) Stat-X can be used inside computer cabinets. Fans will have to be interlocked to shut down prior to discharge and the Stat-X should be mounted in the bottom of the cabinet and allowed to rise. Attention must be paid to providing a proper discharge path.

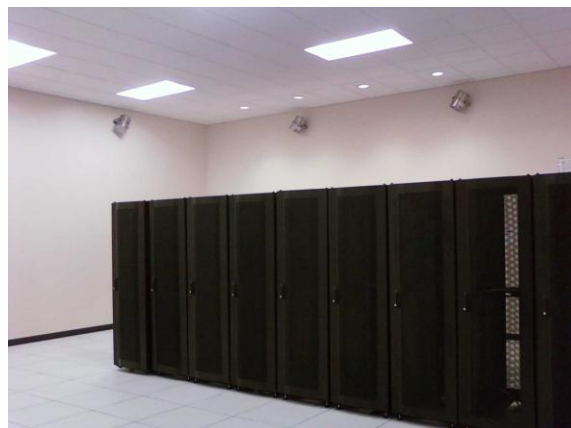


Stat-X Cabinet Fire Extinguishing Unit

- 10) Fire detectors will have to be cleaned and tested after a Stat-X discharge event.
11) After discharge there may be some minimal residue in the immediate vicinity of the generator or underneath it. This should clean up easily with water or detergent as any residue is water soluble.
12) The Stat-X agent does not require hazmat procedures after discharge for cleanup and there are no hazardous materials in the generators themselves.

Comments re: Departmental Server Rooms:

The installation of data equipment in a small closet, or a dedicated space of 100-1000 feet is common inside of office buildings. While my prefatory comment about pre-action sprinkler systems applies, there are a number of additional considerations regarding supplemental fire protection.



Stat-X Server Room Protection



- 1) These installations are not likely to be as well managed as a large data center. Changes in equipment and wiring may be made without consideration of fire systems.
- 2) Cooling systems are often reliant on the building and particularly for a few server cabinets; high levels of heat may build-up on summer weekends.
- 3) Extensive damage to both the tenant equipment and the building will usually result if a water system triggers.
- 4) Small pre-action systems can be quite expensive to install and require regular maintenance and testing.
- 5) Regardless of a supplemental system, most AHJ's will require regular sprinkler systems to remain in place.
- 6) If a supplemental system is desired to reduce the chance of activation and damage caused by a sprinkler system, Stat-X is very cost effective.
- 7) With space at a premium and often limited clear heights the installation of tanks and piping is usually difficult and expensive whereas Stat-X can be installed easily.
- 8) During inspections extra care must be paid to ensure the discharge paths are free of new cabling or equipment.
- 9) Provisions should be made for automatic venting 15 minutes after actuation into the building's smoke evacuation systems, or into the general office space after a warning buzzer.

Comments re: Remote data sites/telecom huts

- 1) Water is often not an option and or may be subject to freezing. Gas system recharge may be very difficult or expensive. In foreign countries the availability of skilled labor for proper installation of piping may not be available.
- 2) Stat-X is an inexpensive, ultra-low maintenance alternative that can greatly reduce damage and downtime and risks to surrounding property. It may be used on a limited basis where there are known hazards such as inside a rectifier and its batteries, or as a total flood for the shelter.
- 3) Where possible, unless leakage is near the limits acceptable to the design program so the Stat-X with vent, a small interlocked exhaust fan should triggered 15 minutes after actuation.

A note on the Stat-X particulate and equipment:

- 1) The total amount of particulate discharged is extremely low. The UL application density 67 grams/m^3 (35 ft^3) is based on gross weight, ie, a 1000 gram unit would cover a volume of 15 m^3 (530 ft^3). The actual amount of particulate discharge would be $1000\text{g} \times 80\%$ actually discharged from the generator $\times 70\%$ particulate (vs. 30% gas) or 560 grams, a bit over 1 gram per cubic foot. For comparison there are 4 grams in a teaspoon of sugar.



- 2) The particulate is extremely fine. Almost all of it is between 1 and 2 microns. For comparison human hair is 40-60 microns across. It will initially pass through most CRAC unit filters. It will not pass through HEPA filters which are designed to filter down to the .3 micron level. Stat-X should not be used in clean rooms.
- 3) Due to its small size, Stat-X will continue to stay suspended in air for up to 10 hours. This greatly increases its effectiveness against slow fires and in preventing re-ignition. Because of this hang time, it may, over hours, begin to collect on fans and filters if not vented. This issue is more pronounced in humid environments.
- 4) It is recommended that 15 minutes after a discharge a smoke exhaust system should be activated to exhaust the area. Smoke detectors and filters should be cleaned and checked and equipment should be given a blow down with compressed air if possible. In general, standard procedures for smoke clean-up as outlined in NFPA 75 Appendices are more than sufficient.
- 5) Third party tests have not shown any damage to circuit boards or computer equipment from Stat-X when properly installed and evacuated after discharge.
- 6) Nevertheless, Stat-X is not recommended for tape storage silo arrays.
- 7) The Stat-X particulate and gases can cause temporary eye and lung irritation and should be avoided in high concentration, as should FM-200 gasses. When you can see through the particulate cloud, it is generally completely safe. When a departmental type office data center is opened after a discharge, the resultant cloud which may emerge into an adjacent office space is not harmful and will disappear into the normal HVAC system, but personnel may want to temporarily relocate to another floor for a few minutes.

Summary:

Stat-X is a very cost effective and space effective alternative to gas or water mist systems in many data center settings. The savings are in both initial purchase and in ongoing maintenance. Stat-X flexibility is particularly beneficial in non-raised floor areas of the data center. On the data floor itself careful attention to discharge path and timed venting, and size of generators installed will prevent most issues. In large data centers careful consideration must be given to the normally unoccupied requirement.

About the Author:

The author has 15 years of data center design and operating experience. Prior to founding Fireaway Inc. he was the founder and CEO of Switch and Data Facilities Company. As such was responsible for the design and buildout of 36 data centers worldwide. He also was the general manager of Newport Financial Center, a 10 MW Critical and Essential load vertical data center and office complex with 50 data center clients including the world's largest financial institutions.

