

PREVENTING FIRE IN RECORDS STORAGE ENVIRONMENTS

When there was a fault in one of the power factor correction units at Sydney Adventist Hospital, it was fortunate an oxygen-reduction fire prevention system had been installed just a few months before.

By Janelle Mattila



story
snapshot

Can you risk a fire in your records and information centre?

An oxygen-reduction fire prevention system prevents fire proactively instead of suppressing a fire after it has started and damage and business interruption has occurred.

An oxygen-reduction system creates an environment of breathable, controlled oxygen-reduced air that prevents fire ignition.

The system is safe for people and the environment.

Australia's first oxygen-reduction fire prevention installation took place in June 2013 at the Sydney Adventist Hospital (SAH). The SAH is NSW's largest single campus private hospital, with approximately 2,300 staff, 500 volunteers and 750 accredited medical practitioners.

A few months after the installation of the oxygen-reduction system, there was a fault in one of the hospital's power factor correction units.

The oxygen-reduction system – **which creates an environment of breathable, controlled oxygen-reduced air that prevents fire ignition** – protects several rooms at the SAH, including the power factor correction room and the





Above: Bernard Jakovac, Director of Engineering Services, Sydney Adventist Hospital; Right: FirePASS® FP-500 Oxygen reduction fire prevention system, Sydney Adventist Hospital



hospital's main switch room that feeds the operating theatres; a volume of approximately 500m³. The very early smoke detection apparatus (VESDA) system detected the fault and the oxygen-reduction system prevented a fire starting.

Bernard Jakovac, Director of Engineering Services at SAH, said: "The hospital is very pleased with the oxygen-reduction system and we think it is a great solution for the environment it is protecting. Our insurers are also very keen on the system and we are considering this for other high-risk areas across the large campus. We believe the oxygen-reduction fire prevention system is a wonderful product and a great innovation in fire prevention".

Benefits of oxygen-reduction fire prevention

- ◆ Certainty of avoiding the outbreak and spread of fire
- ◆ Continuous fire prevention without any interruption; no refilling or replacement required
- ◆ Straightforward installation process compared with a sprinkler system or a traditional fire suppression system
- ◆ Very small footprint and little building space required
- ◆ Environmentally friendly – no chemicals used
- ◆ Simple to install and maintain
- ◆ Easily installed into existing premises as well as newly built spaces.
- ◆ Retaining access to protected areas at any time
- ◆ Scalable to fit any sized area, large or small
- ◆ Slows oxidation and reduces deterioration of documents, materials, equipment and artefacts.

HOW DOES OXYGEN-REDUCTION FIRE PREVENTION WORK?

Oxygen-reduction fire prevention uses a technology that produces oxygen-reduced (hypoxic) air by partly filtering out oxygen from ambient atmospheric air. Normal atmosphere contains 21% oxygen. The hypoxic air injected into a protected space is 15% oxygen and 84% nitrogen (1% is made up of argon, carbon dioxide and other gases). A fire cannot start in this environment. Common flammable solid materials and liquids cannot be ignited with an oxygen level below 16%.

Fire must have three elements to ignite and spread: heat, oxygen and fuel. Removing any one of these three will prevent fire. The basic principle of oxygen-reduction fire prevention is that a fire will not start without sufficient oxygen.

This system works by taking oxygen out of the air as opposed to other systems that inject pure nitrogen into the area to be protected.

HOW DOES OXYGEN-REDUCTION TECHNOLOGY DIFFER FROM CONVENTIONAL FIRE PROTECTION?

Oxygen-reduction technology provides a continuous level of prevention rather than discharging an extinguishing agent once a fire starts, as is the case with traditional fire suppression systems. Oxygen-reduction fire prevention systems also have a smaller footprint compared to conventional gaseous fire suppression systems.

SAFE FOR PEOPLE AND SAFE FOR THE ENVIRONMENT

Oxygen-reduction fire prevention uses ambient air to produce breathable air for fire prevention. It is safe for people and safe for the environment. No chemicals or gases are involved. The oxygen-reduction fire prevention agent is simply oxygen-reduced (hypoxic) air.

Hypoxic environments created for the purpose of fire prevention are precisely controlled and monitored reduced-oxygen environments. They should not be confused with other environments where hypoxic conditions can occur in an uncontrolled, unwanted or unexpected way. Oxygen-reduction fire prevention systems are clean-air systems.

There has been extensive medical research in the UK, Europe and Australia to support the safety of working in a hypoxic environment of oxygen at 16% and below.



At sea level 15% oxygen content is equivalent, in terms of human physiology, to normal atmospheric air at an elevation of around 2,700 metres (9,000 feet) above sea level or being on a commercial flight. Millions of people around the world live at altitudes equivalent to exposure at or below 15% oxygen concentration at sea level.

Hypoxic air environments are currently used for physical training and rehabilitation of athletes, as well as in medical research.

WHAT ARE SUITABLE ENVIRONMENTS FOR AN OXYGEN-REDUCTION FIRE PREVENTION SYSTEM?

Oxygen-reduction fire prevention is best suited to any situation that requires the highest levels of fire prevention, and where uninterrupted operation is essential including high-value areas such as records storage and archive environments, data centres, and electrical rooms.

Oxygen-reduction fire prevention systems can be implemented as an alternative, but also as a complementary or supplementary option that enhances the conventional fire-safety means without interfering with their performance.

Oxygen-reduction not only prevents the outbreak of fire, avoiding any collateral damage by extinguishing agents, it also slows oxidation due to the reduced oxygen content of the

hypoxic air produced. The hypoxic air reduces deterioration of irreplaceable items such as archived documents, museum exhibits, artworks and rare artefacts.

HOW DOES THE SYSTEM MONITOR OXYGEN LEVELS?

The system is designed to enable the oxygen concentration levels to be monitored on a continual basis by a minimum of two independent oxygen sensors, in different locations, in each protected space. The monitoring units are typically placed at eye level, at an appropriate distance from the door of the room. This is to provide for monitoring of oxygen conditions and alert if doors are wedged open or not closed properly, whilst minimising the amount of false, high oxygen alarms. The oxygen sensors transmit to monitoring and control points (eg, the fire alarm panel and the building management system), as required.

Performance indicators show, as a minimum, for each protected space:

- ◆ Oxygen concentration level as indicated by every oxygen sensor
- ◆ High and low oxygen alarm conditions
- ◆ An output indicating the operation of any other system alarms ➡

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HEALTH AND SAFETY

The design aim of any oxygen-reduction fire prevention system is to create and maintain an atmosphere in an enclosure that is capable of preventing ignition of combustibles found within the protected area whilst simultaneously remaining safe for the occupants.

A risk assessment, in accordance with AS/NZS ISO 31000-2009, *Risk management – Principles and guidelines*, shall be carried out prior to any installation of an oxygen-reduction fire prevention system to ensure safety of both people within the protected area and those outside the protected area that may be exposed to output air from the oxygen-reduction fire prevention system. Such an assessment shall detail as follows:

1 The safeguards employed for persons having access to the protected space and oxygen-reduction fire prevention system equipment

2 Limitations to the number of people allowed in the protected enclosure and the level and duration of physical activity permitted to be undertaken

INSTALLING AN OXYGEN REDUCTION FIRE PREVENTION SYSTEM

Oxygen-reduction fire prevention systems come readily mounted and tested. Once on site, the system is connected to the room sensors and to the power supply. The system is then connected to the rooms via the installed tubing. The by-product oxygen-enriched air is vented outside.

Oxygen-reduction fire prevention systems do not require rigid piping within the protected spaces. The only requirement is simple, minimal pressure piping to each protected area and to the ambient air, along with wiring of the oxygen monitoring units in the protected areas.

It is recommended that protected areas be equipped with highly sensitive smoke detectors such as VESDA or equivalent. This is to ensure that any smouldering combustion from cable faults, for example, is reported in its incipient stages.

A comfortable, breathable atmosphere is created inside the protected space by the ongoing ventilation with fresh, hypoxic air.

SEALING THE ROOMS

It is essential the protected area is well sealed in order to minimise the permanent leakage of air in and out of the room.

Applications

- ◆ Archive rooms
- ◆ Data centres
- ◆ Server rooms
- ◆ Electrical switch rooms
- ◆ Power factor correction rooms
- ◆ Control rooms in power plants
- ◆ Telecommunication rooms
- ◆ Laboratories
- ◆ Libraries
- ◆ Museums
- ◆ Warehouses
- ◆ Hazardous materials storage
- ◆ Food storage areas / deep freeze / cold storage rooms

The key factor relating to running costs (energy consumption and maintenance) of an oxygen-reduction fire prevention installation is the leakage. This is the sum of permanent leakage of the protected area and the temporary leakage created by door openings. Investing in improving the sealing of the protected areas will have a direct impact on running costs, as they are directly proportional to the leakage rate achieved. Typically, the payback for such improvements is less than one year.

All spaces in the protected area must have split-type air cooling or closed, dedicated air recirculation systems.

To evaluate the current leakage of the area to be protected, it is recommended to perform an integrity fan test (accurately predicts the room's pressurisation and identifies any leaks in the room), prior to any works being commenced.

VENTING / COOLING

The area where the compressors and filtration units are housed is required to be well-vented in order to allow a permanent supply of fresh, ambient air

to the compressors. Alternatively, the room can be cooled with chillers; this will also require a supply of fresh air. There is a requirement for a small drain in the machine room for the wastewater of the condensate cleaner.

MAINTENANCE

The highly reliable hypoxic air generators require very little upkeep and can operate for decades with proper maintenance. A maintenance cycle of six months is typical. Regular monthly inspections are recommended to ensure a fire preventative atmosphere is maintained. This cycle applies if the supplied fresh air is compliant with the required quality. If the air quality is lower (in the event of dust, humidity, temperature etc) the cycle of filter changes needs to be reduced.

LIMITATIONS ON INSTALLATION

Oxygen-reduction fire prevention systems will not be installed for use in areas where sufficient infiltration control cannot be achieved; an alternative source of oxygen is present; oxidizing agents exist that have the potential to reduce oxygen concentration by chemical reaction (eg, chlorine); substances or processes exist that evolve gases capable of modifying the atmosphere such that the oxygen concentration is reduced (eg, toxic displacement). ❖

ABOUT THE AUTHOR

Janelle Mattila is Group Marketing Manager for the ARA Group, an Australian company that delivers facility and infrastructure solutions for commercial, industrial and government sectors. Janelle liaises with operational and technical teams in ARA's five divisions (fire, electrical, mechanical, security and manufacturing) in the development and delivery of communication, marketing and customer relationship strategies.

Janelle has worked with ARA for nine years and specialises in researching and writing about ARA's innovative technologies, services and products sourced from the latest findings around the world. Janelle has written articles that have appeared in Australian and international publications.

✉ For more information on oxygen-reduction fire prevention systems, Janelle can be contacted at janelle@aragroup.com.au or visit www.arafirepass.com.au

