Hypoxic Air Ventilation
Fire Prevention Systems
Prevenex
Hypoxic Air Ventilation (HAV)

Using ordinary air to save lives and property

- Prevenex uses ordinary air with a reduced oxygen content
- SAFE. No nitrogen or other toxic gases present anywhere in the system.
- Oxygen available for respiration is the same as exists at 2,500m or in a commercial airliner

An oxygen environment that tens of thousands spend their working lives in, and millions spend their entire life in.
How does it prevent fires?

Normal air at sea level contains 21% oxygen, 78% nitrogen and 1% other gases – mainly argon. Let’s call it $21\% \text{ O}_2$, $79\% \text{ N}_2$.

Air at altitude has the same proportions, but the reduced pressure means that there is simply less of everything in any given volume. Since the air is the same as sea level air – except ‘thinner’ - fire is unaffected.

Prevenex air is at normal pressure, but some of the oxygen is replaced with nitrogen. The number of oxygen molecules in any volume is the same as occurs in a similar volume of air at 2,500m, so to humans, it is just like being at altitude.

**BUT**

The extra nitrogen molecules in the Prevenex environment absorb heat from the combustion process. Without heat, combustion cannot occur. In effect, the extra nitrogen molecules act like a fire blanket around each oxygen molecule.
The effects of Prevenex HAV

In the Prevenex Environment

All common materials cannot ignite, whilst the effect on humans is to lower the oxygen level in the blood by just 3%... similar to what happens naturally when taking a brisk walk. Not un-natural – and for most of us, very healthy.
A compact, automated solution

- On site generators automatically create and maintain oxygen levels that are safe for people but which prevent any fire from starting. 60% of compressor energy used can be utilised for heating.

- No need to rely on a code or standard for assurance. No need to trust it will work IF required. It’s always ON, always working. All the time.

- Protects in even the most inaccessible locations – inside cabinets, in ducts, even inside packaging – anywhere that there is air.

- Integrates with the Building Management System
LPG PREVENEX®
Ideal locations

- Where contents are of very high value – or irreplaceable
- Where uninterrupted 24/7 operation is required.
- Where damage from extinguishing agents is not acceptable
- Where there is a known high risk of fire or explosion
- Where conventional suppression systems will not work.

Plus, where total Fire Prevention is not justified Prevenex can also be stored in high pressure cylinders for use in Suppression mode, like existing Inert Gas systems, but with the added advantages of:

- No danger to humans – no need to evacuate before release
- On site generator provides top up flow to prevent secondary re-ignition
- Refills itself automatically
Standards

• Existing standards relate to Detecting and Extinguishing not Preventing.

• Hypoxic systems are covered in the new BS5306 Part 0 (final draft with BSI)

• LPG is working with British Standards, COWI AS and Prevenex to create the world’s first Specification for low oxygen fire prevention systems.

• Pending the standard (predicted for early 2010) Performance Based Design Verification is available from COWI AS – the leading global consultancy on HAV.

• Health & Safety endorsement has already been provided by the Fire Prevention Association of Great Britain, and will be strengthened in the new BS Specification.

• Systems are already operating in Europe and the Middle East. It has started.

  “In the presence of an appropriate risk management procedure a 15% (equivalent to 2700m) low oxygen atmosphere environment does not appear to present any significant issues in the context of employee health and safety or performance for non strenuous work.” Fire Protection Association, GB 2006
Traditional Extinguishing Solutions

• INERT GASES (Argon, Nitrogen, etc)
  – Compressed gases at 300 bar
  – Reduce oxygen

• SYNTHETIC GASES (FM-200, NOVEC, etc)
  – Liquefied gases at 25 - 42 bar
  – Chemically inhibit flame reaction

• Water Mist
  – High pressure (100 bar) & Low pressure (4-6 bar)
  – Cools and reduces oxygen
Inert Gases

– Discharge over 60 seconds
– Require pressure relief dampers
– Often configured to protect multiple risks with directional valves
– Often configured with reserve cylinders
– Many components and large runs of pipe
– Require large areas of storage
– Can be located remote from risk
INERT GAS INSTALLATION
Synthetic Gases

- Discharge over 10 seconds
- Require pressure relief dampers
- Rarely have reserve cylinders
- Multiple cylinder systems complex
- Much less storage than inert gases
- High refill cost
- Environmental concerns
- Have to be located adjacent or within risk
- Rarely used with directional valves
SYNTHETIC GAS INSTALLATION
High Pressure Water Mist

- Operating pressure 100 bar
- Use minimal water quantities (0.5 – 1.2 mm/m²)
- Application type specific
- Extinguishing system only for Class B/F fuels
- Ordinary Hazard Risks as per Sprinklers
- 3rd Party verification very important
- Open deluge & sprinkler bulb type
- Cylinder systems (finite run time), pump systems
- Stainless steel pipe work
WATER MIST
LPG PREVENEX®

– Maintains permanent level of reduced oxygen – 24/7
– Does not require pressure relief
– Requires minimal pipe work & installation
– Occupies minimal storage
– Can be used to protect more than one area simultaneously
– No damage on discharge
– No cost of refill
# Reliability

## A Big Difference

System Reliability: What Crucial Elements must be covered by Standard?

<table>
<thead>
<tr>
<th>As conditions approach imminent fire – what preventive/suppressing system elements need to be operational?</th>
<th>Gas Fire Suppression</th>
<th>HAV Fire Prevention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypoxic air in protected volume, sensor</td>
<td>N/A</td>
<td>Yes</td>
</tr>
<tr>
<td>High sensitivity smoke detectors for non-flaming fire</td>
<td>Yes</td>
<td>Yes but no fire risk on failure</td>
</tr>
<tr>
<td>Detectors for system activation</td>
<td>Yes</td>
<td>N/A</td>
</tr>
<tr>
<td>Programming</td>
<td>Yes</td>
<td>N/A</td>
</tr>
<tr>
<td>Wiring</td>
<td>Yes</td>
<td>N/A</td>
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<tr>
<td>Actuators</td>
<td>Yes</td>
<td>N/A</td>
</tr>
<tr>
<td>Fire Alarm Panel</td>
<td>Yes</td>
<td>N/A</td>
</tr>
<tr>
<td>Evacuation Procedure</td>
<td>Yes</td>
<td>N/A</td>
</tr>
<tr>
<td>Smoke dampers open/close</td>
<td>Yes</td>
<td>N/A</td>
</tr>
<tr>
<td>Power Supply</td>
<td>Yes</td>
<td>N/A</td>
</tr>
<tr>
<td>Pressurized Gas Bottles</td>
<td>Yes</td>
<td>N/A</td>
</tr>
<tr>
<td>Piping, nozzles, valves</td>
<td>Yes</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Slide courtesy of COWI AS 2008
Storage Space Comparison

![Graph showing storage space comparison for Novec, Inert, and Prevenex across different volumes of risk in m³.](image-url)
Cost Comparison - Install

Relative Cost vs Volume of Risk m³

- Novec
- Inert
- Prevenex
Cost Comparison
Maintenance 10 year with discharge

Relative Cost

Volume of Risk m³

Novec
Inert
Prevenex

0 10000 20000 30000 40000 50000 60000 70000 80000 90000 100000 110000 120000

1000 1500 3000 5000 7500 10000 17000
Cost Comparison - Discharge

Relative Cost vs. Volume of Risk m³

- Novec
- Inert
- Prevenex
Cost Comparison
Maintenance 10 year without discharge
Benefits

• Install cost benefit, particularly larger volumes
• Minimal install, no long term works
• Permanent Protection
• No discharge costs
• No business interruption
• Reliable - it works 24/7
• Cost benefit long term maintenance
• Easy retrofit to existing installations