Low-Oxygen Systems in Cold Storage Warehouses

November 30, 2021 – 6:00 PM EST

WAGNER®
BETTER SOLUTIONS IN FIRE PROTECTION

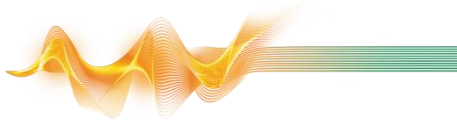
SFPE
Central Savannah River Area

Today’s Presenter

Florian Buchner, Wagner Fire Safety Inc.

He has over 12 years of experience in international sales and industrial engineering. As a sales engineer, he participated in fire protection projects worldwide, and currently promotes a revolutionary approach with low-oxygen systems for the cold store business in the US.

Agenda



- Introduction Wagner and OxyReduct
- Principle behind fire prevention
- Focus on case study NewCold Tacoma
- Low-oxygen building standards and OSHA regulations
- Investment costs of low-oxygen solution
- Benefits of low-oxygen systems compared to sprinkler solutions
- Drawbacks of low-oxygen systems compared to sprinkler solutions
- Key takeaways

Wagner – Manufacturer of …

Oxygen reduction systems with OxyReduct®

Aspirating Smoke Detection Systems with TITANUS®

Some Words about Wagner

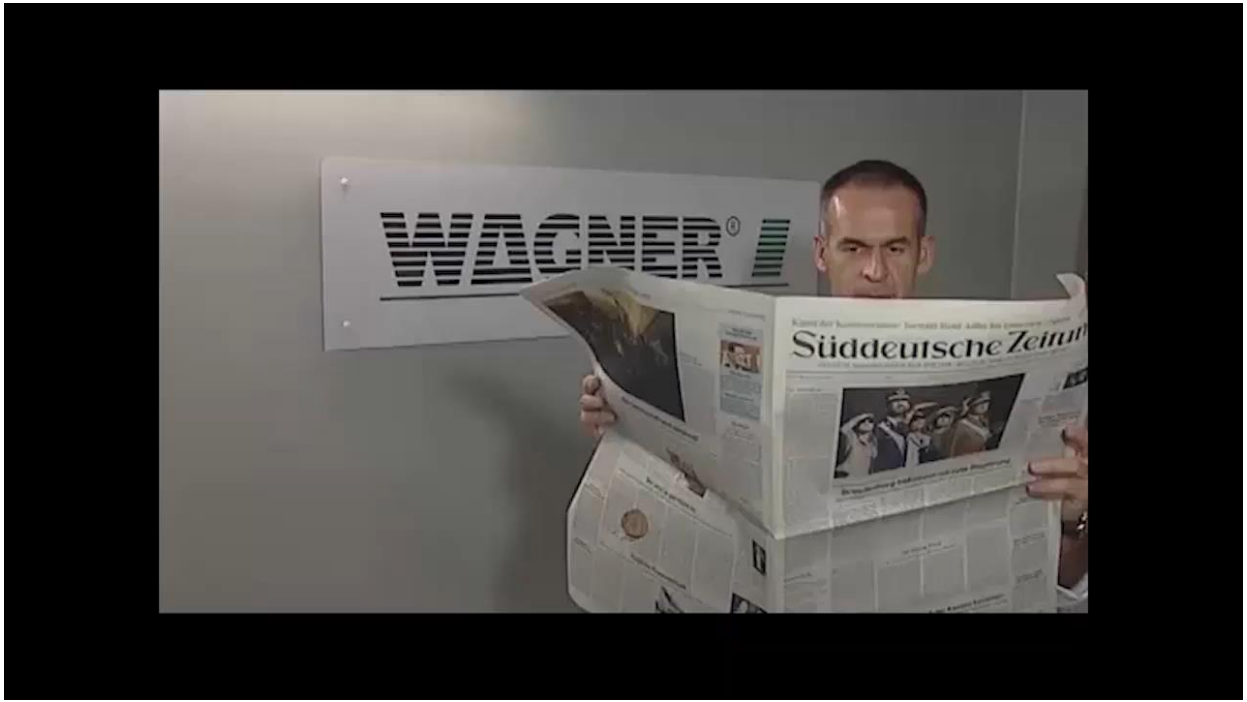
WAGNER Group:

- Founded in 1976
- Family-owned business to 100 %
- Headquarters in Langenhagen (near Hannover – DE)
- Worldwide business activities

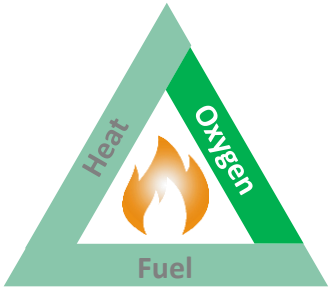
Werner Wagner
General director and founder

Torsten Wagner
General director

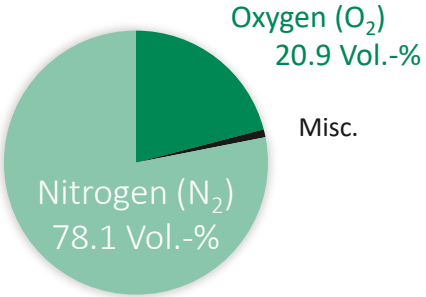
Fire Prevention with OxyReduct®



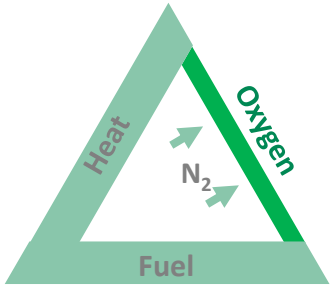
The Principle behind Fire Prevention



Ambient atmosphere
(0 % rel. humidity)

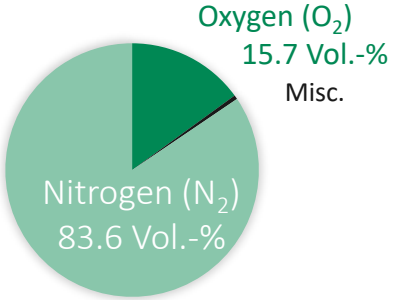


By introducing nitrogen, the mixture ratio of the atmosphere changes



Oxygen-reduced atmosphere
(example)

N_2



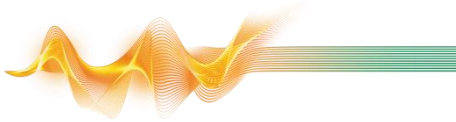
The oxygen concentration is reduced and therefore the flammability of the fuel as well

Fire Prevention with OxyReduct®

Real fire test with ambient temperature conditions

Ignition threshold of polypropylene: **16.0 Vol.-% O_2** at 68…77°F ambient temperature

Our References in North America



Case Study – NewCold Tacoma, WA





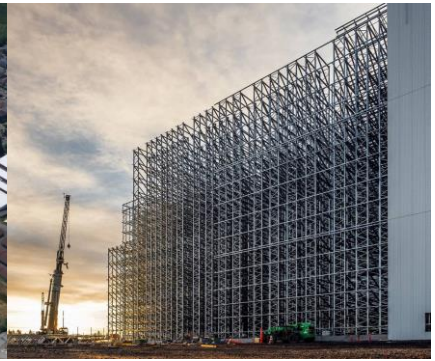


NEWCOLD
ADVANCED COLD LOGISTICS

WAGNER®

Case Study – NewCold Tacoma, WA



General Information:

- Tacoma is NewCold's first cold storage facility in the United States
- Second low-oxygen high-bay freezer in the country
- Phase I volume with 25 million cubic feet of storage capacity (103,000 pallets), completed in 2018
- Phase II volume will double the volume and storage of Phase I
- Fully automated with Automatic Storage and Retrieval Systems (AS/RS)
- Using high bay model reduced the warehouse footprint by about 75%, from ±600,000 sf to 157,000 sf

Low-Oxygen System by Wagner Fire Safety



Active Fire Prevention with:

- OxyReduct® from Wagner Fire Safety Inc.
- 3 x VPSA (Vacuum Pressure Swing Adsorption) lines
- Full automated
- Operation concentration at 16.35 Vol.-% O2
- Aspirating smoke detection systems recommended and installed in pick floor, shipping and truck dock areas

Project Timeline for NC Tacoma



Milestones:

- Design and amount of Oxygen sensors according to prEN16750
- Oxygen operation concentration of critical materials is based on fire tests performed for similar facilities in Europe in March 2013
- Local AHJ approved AMM based on Wagner design in 2016
- Construction started in 2017 and completed in 2018

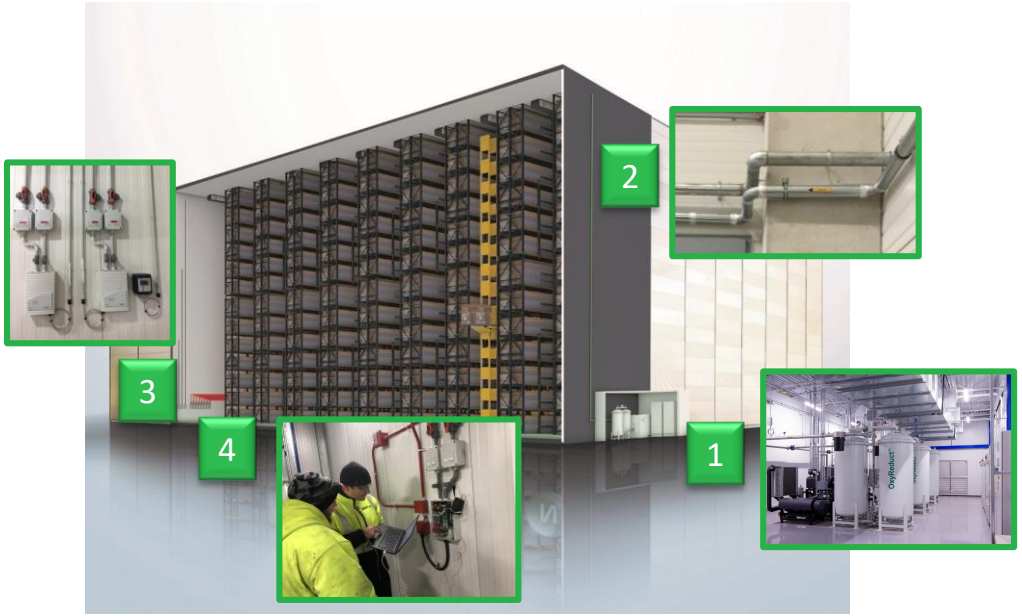
AHJ = Authorities Having Jurisdiction

AMM = Alternative Means and Methods

Low-Oxygen Components at NC Tacoma

Overview:

- Equipment room (1) with
  - Nitrogen production modules VPSA
  - PLC OxyControl
  - Electrical cabinets
- Nitrogen pipe (2)
- Oxygen sensors (3)
- Aspirating Smoke Detection Systems for adjacent areas (4)



Low-Oxygen Component Overview

Equipment room for low-oxygen machinery

- VPSA vessels
- VPSA compressor / vacuum pumps
- VPSA control cabinets
- Control air compressor
- Nitrogen piping incl. filter
- PLC OxyControl

Low-Oxygen Component Overview

Nitrogen pipe

- Inside equipment room
- Inside cold storage

Low-Oxygen Component Overview

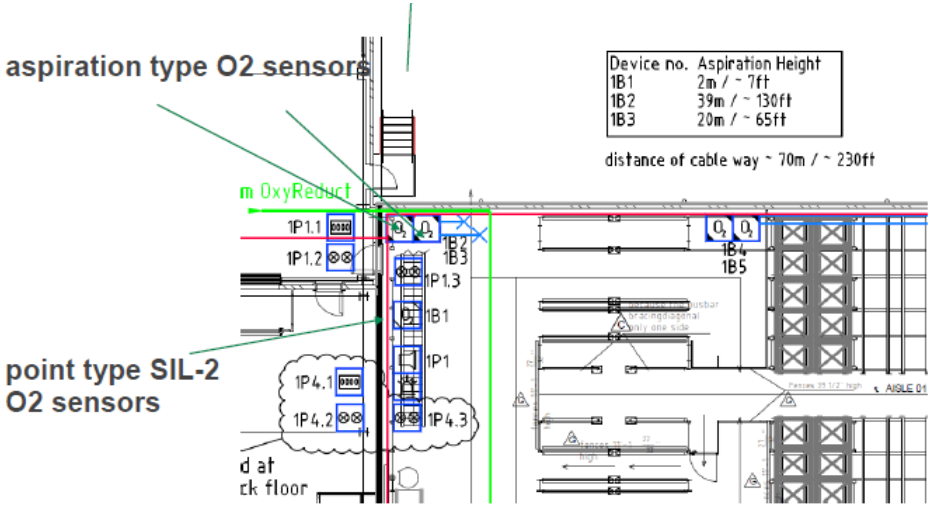
Control devices

- Oxygen sensors (aspiration and SIL-2)
- O2 display and alarm displays
- Design according EN16750

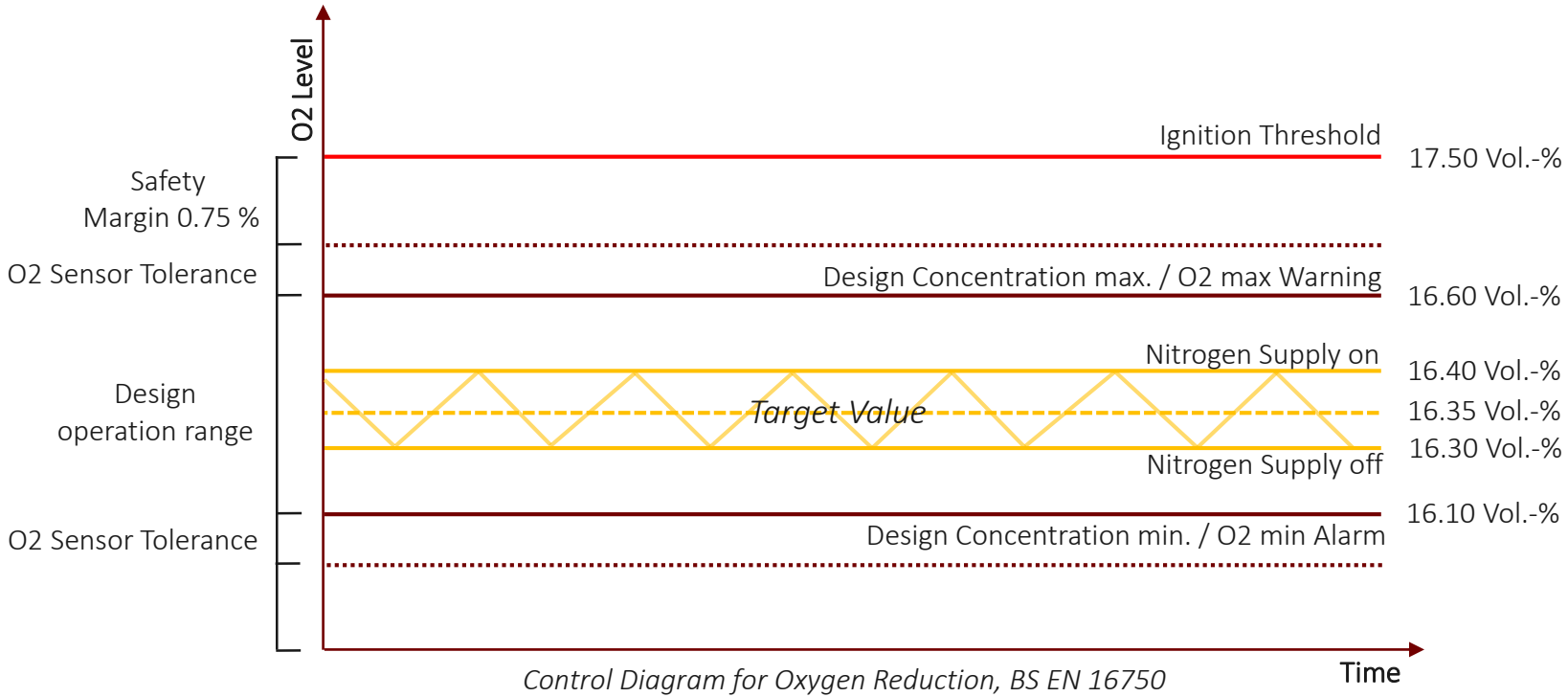
Low-Oxygen Component Overview

Oxygen sensors according to EN16750:

- 17 oxygen sensors in cold storage installed (aspirating)
- 1 SIL-2 sensor classified
- Devices mounted at the front and end zones of cold storage
- Sensors are monitored for damaged wiring, short circuit, value tolerance, and air flow



Design Thresholds for NewCold Tacoma

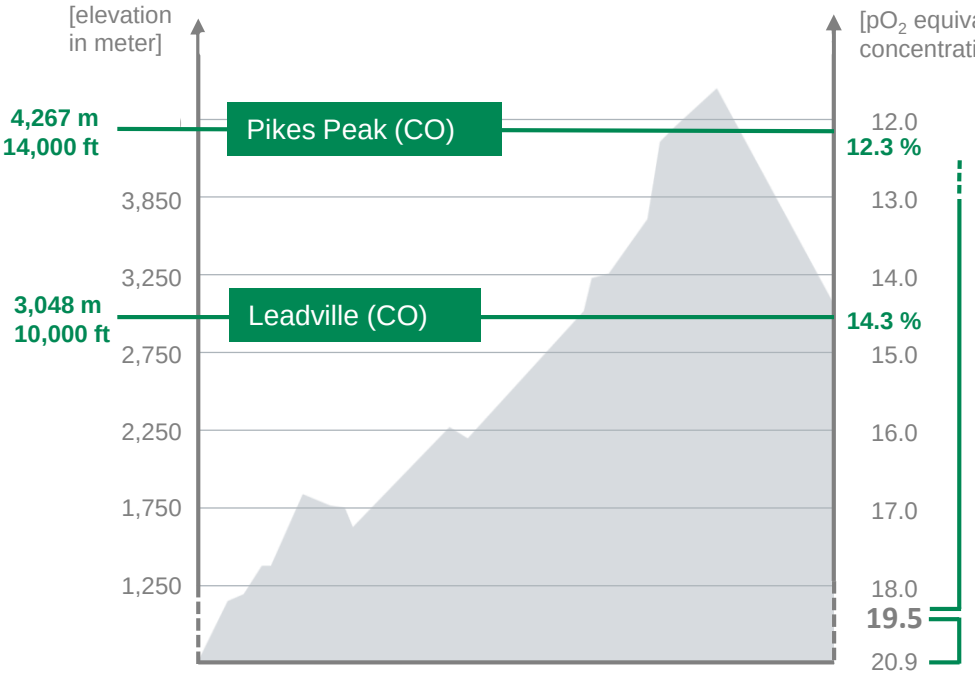


Control Diagram for Oxygen Reduction, BS EN 16750

Low-Oxygen Standards

Country	Organization	Reference	Issued in year
Germany	VdS	VdS 3527 (01) VdS 3527 (02)	2007 2015
Austria	Fire brigades ASI – Austrian Standards Institute	TRVB S 155 08 OENORM F 3073	2008 2010
Switzerland	SNV	SN 123456	2009
The Netherlands	KIWA	BRL-K21017	2009
UK	BSI - British Standards Institute	PAS 95	2011
Europe	CEN - European Committee for Standardization	EN 16750	2017
USA	UL Underwriter Laboratories	UL 67377 #1 UL 67377 #2 Outline of Investigation for Oxygen Reduction …	2016 2016
USA	FM Global	Examination Standard for Oxygen Reduction Systems #5800 Property Loss Prevention Sheets	Aug 2021 Oct 2021

Low-Oxygen and OSHA Regulations in the US



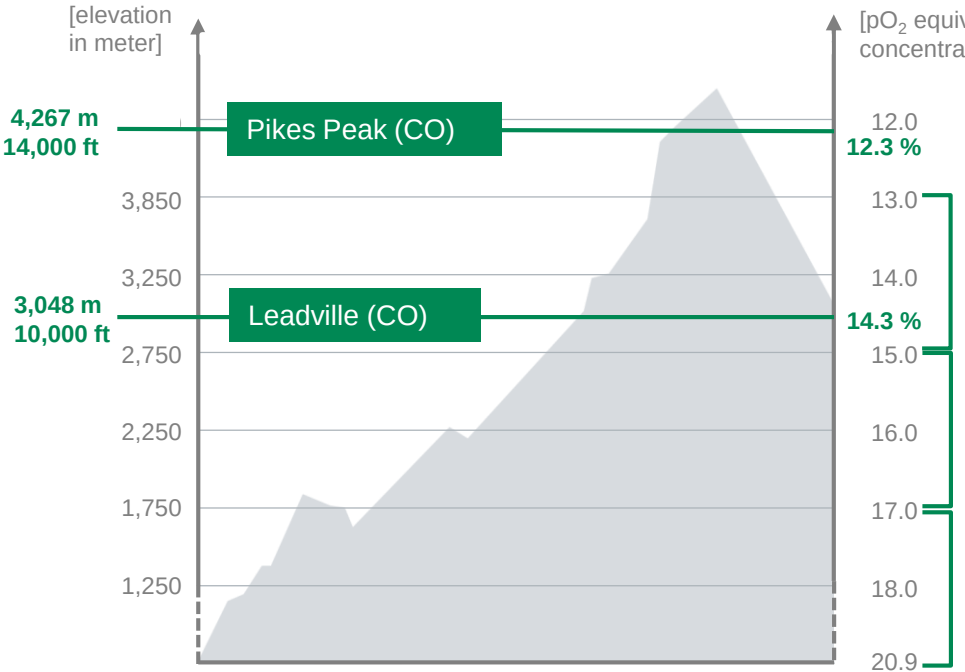
OSHA-regulation in the US:

Less than 19.5%:
Accessible with self-contained breathing apparatus (SCBA)

Accessible with no time limit and additional equipment

Source: Küpper, T. et al. (2015); Recommendation of the UIAA Medical Commission. Vol. 15. Work in Hypoxic Conditions. p 6ff.

Low-Oxygen and OSHA Regulations in Germany



Regulation in Germany (BGI/GUV-I 5162, 2013): no equipment needed for:

Accessible for up to 2 hours

Accessible for up to 4 hours

Accessible with no time limit

Source: Küpper, T. et al. (2015); Recommendation of the UIAA Medical Commission. Vol. 15. Work in Hypoxic Conditions. p 6ff.

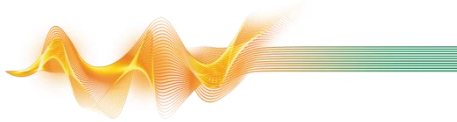
Investment Costs of Low-Oxygen Solution

Depending on various variables (extract)…

- Elevation, average wind speed, shielding of building
- Operation temperature, ignition threshold of stored material and goods, O_2 operation level, air flow rate (n_{50} value = airtightness of the building)
- Dimensions and type of openings (roller doors, vestibules, air locks), maximum and average number of openings per hour/day

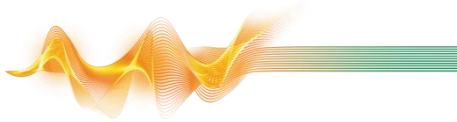
… in order to calculate **demand of N_2** to maintain defined 0_2 operation level and compensate N_2 loss through building leakage and freezer operations.

Benefits of Low-Oxygen Systems compared to Sprinkler Solutions



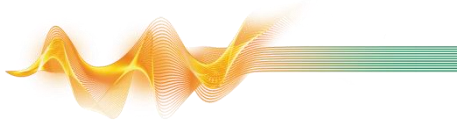
- Due to reduced oxygen level in protected area, no fire is able to propagate with tested material – fire prevention
- No smoke contamination of sensitive materials and goods (i.g. frozen food, meat,…)
- No installation of sprinklers in rack systems needed during construction
- No water damages due to sprinkler malfunctions or fire incidents
- Horizontal and vertical racking runs uninterrupted throughout the length and width of the coldstore – maximizes storage density
- In combination with ASRS, low-oxygen systems enable higher-density and lower footprint configuration, which reduces energy costs of the building and land use

Drawbacks of Low-Oxygen Systems compared to Sprinkler Solutions



- OSHA regulations in the US: additional equipment for technical personnel is needed (self-contained breathing apparatus)
- Convincing local authorities about low-oxygen solutions (trips to existing facilities, time for decision making)
- Insurance industry: New technology
- Higher investment costs for smaller facilities and ambient warehouses
- Energy costs for operation of low-oxygen system
- Preventive maintenance costs of low-oxygen system

Key Takeaways



- Fire protection in automated frozen warehouses is challenging
- Active fire prevention with low-oxygen systems is an innovative alternative in the US, and already in use in Europe for 20 years
- Design of low-oxygen system is case-by-case, depending on project variables
- Technology (Automation and/or Fire Protection) requires close collaboration between involved parties to make it happen

… and to achieve the best results!

End of Presentation

Any Questions?

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