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FIRE PROTECTION ASSOCIATION OF SOUTHERN AFRICA

Fire Protection Engineers

Impact of Extreme Water Scarcity on Fire-Fighting and Fire Protection Systems

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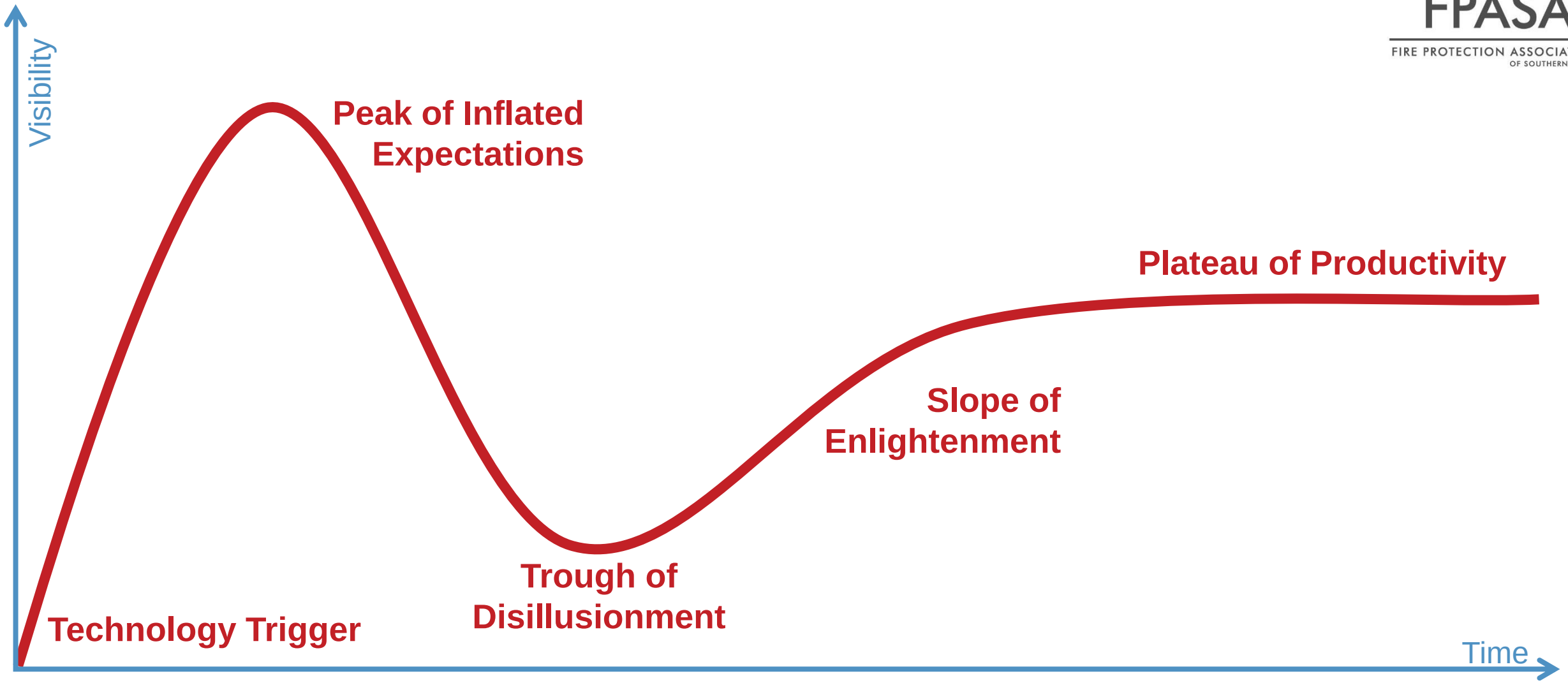

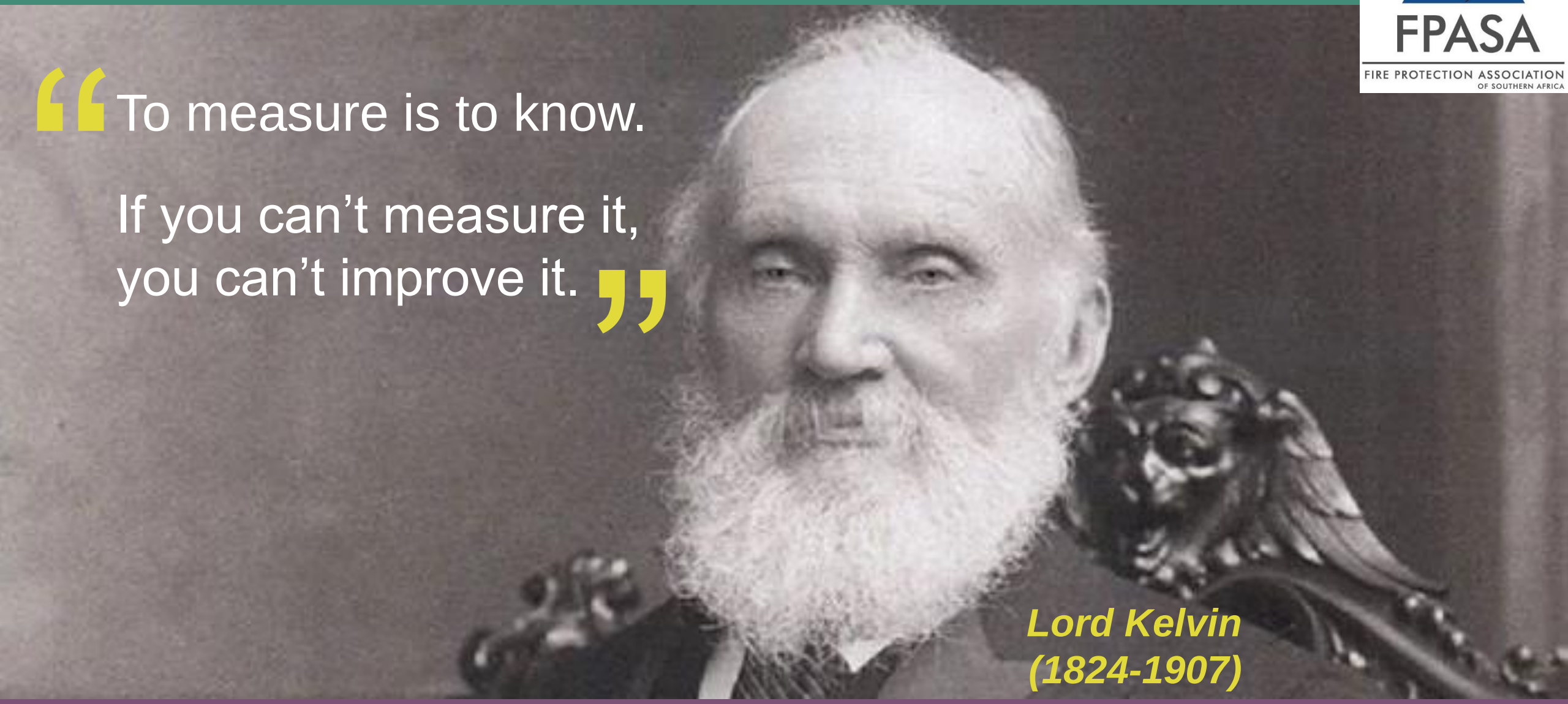

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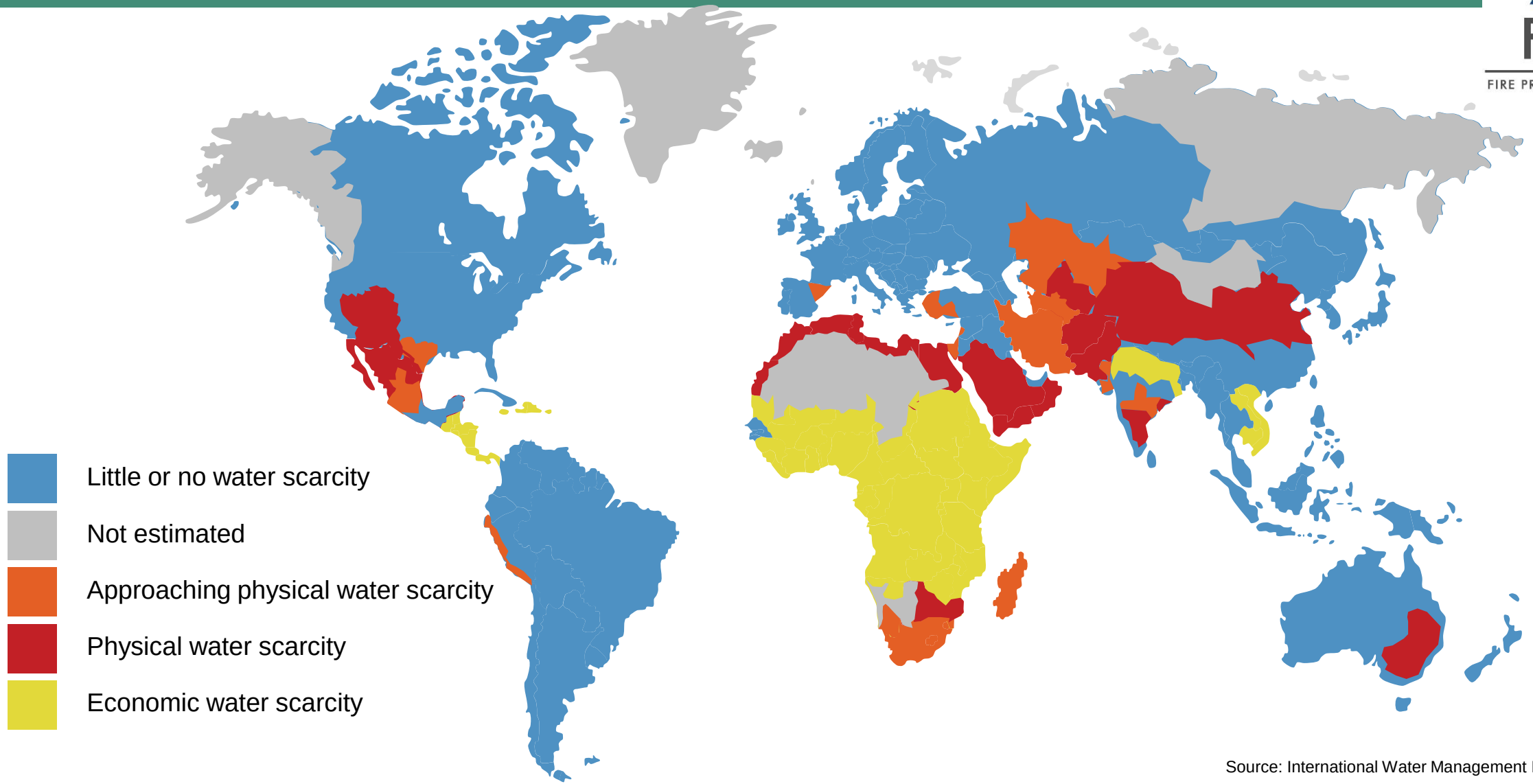
Water Scarcity



Source: International Water Management Institute

Typical Fire Suppression Options

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1. Automatic sprinkler systems
2. Gaseous suppression systems
3. Hypoxic air technology
4. Water mist
5. Local application

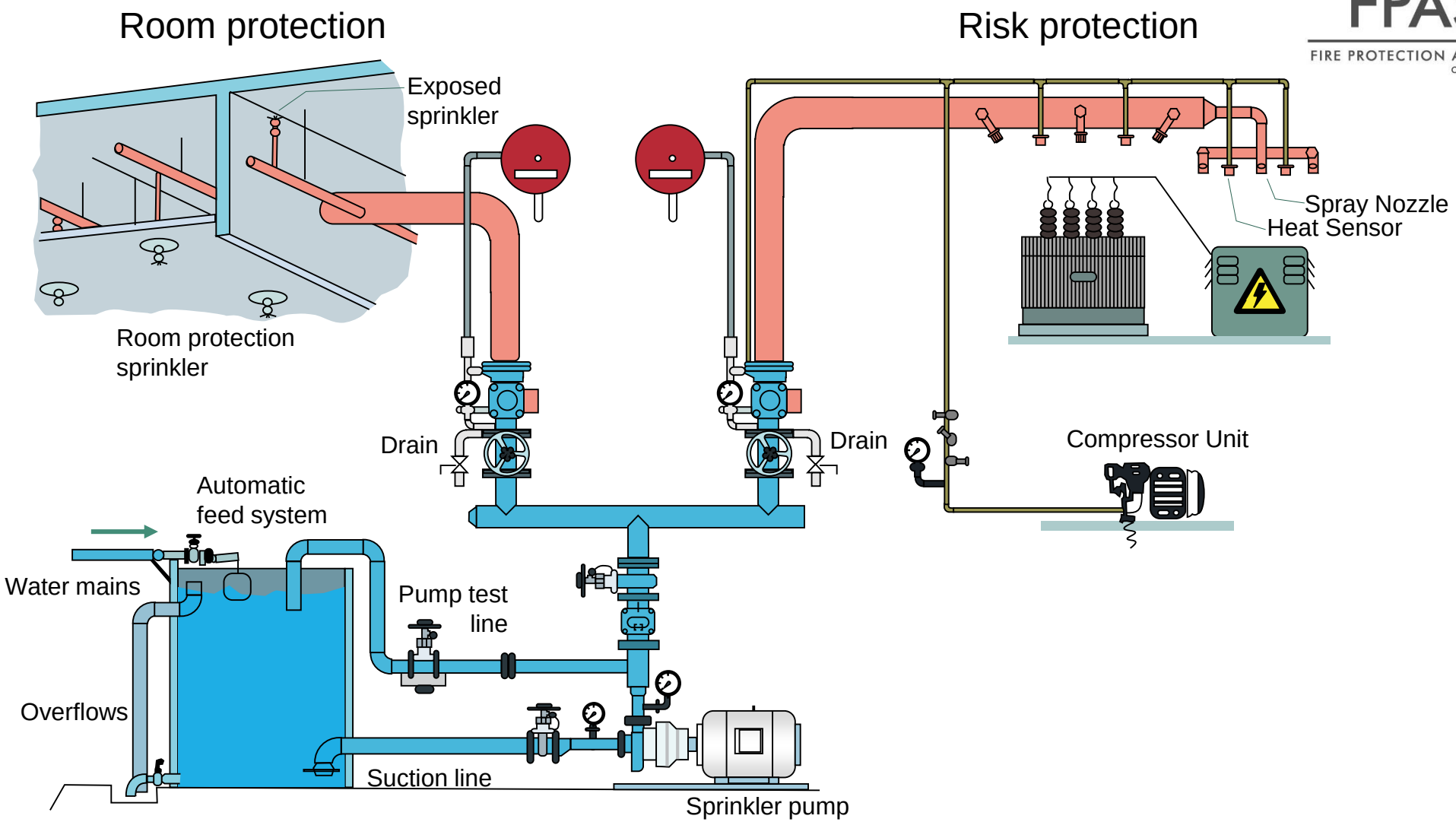
Automatic Sprinkler Systems

1

- Well documented design based on numerous tests
- Proven over decades
- Excellent track record
- Closed system incorporating tanks and pumps, except alarm gongs and drain

Automatic Sprinkler Systems

1



Gaseous Suppression Systems

2

Well documented design based on either:

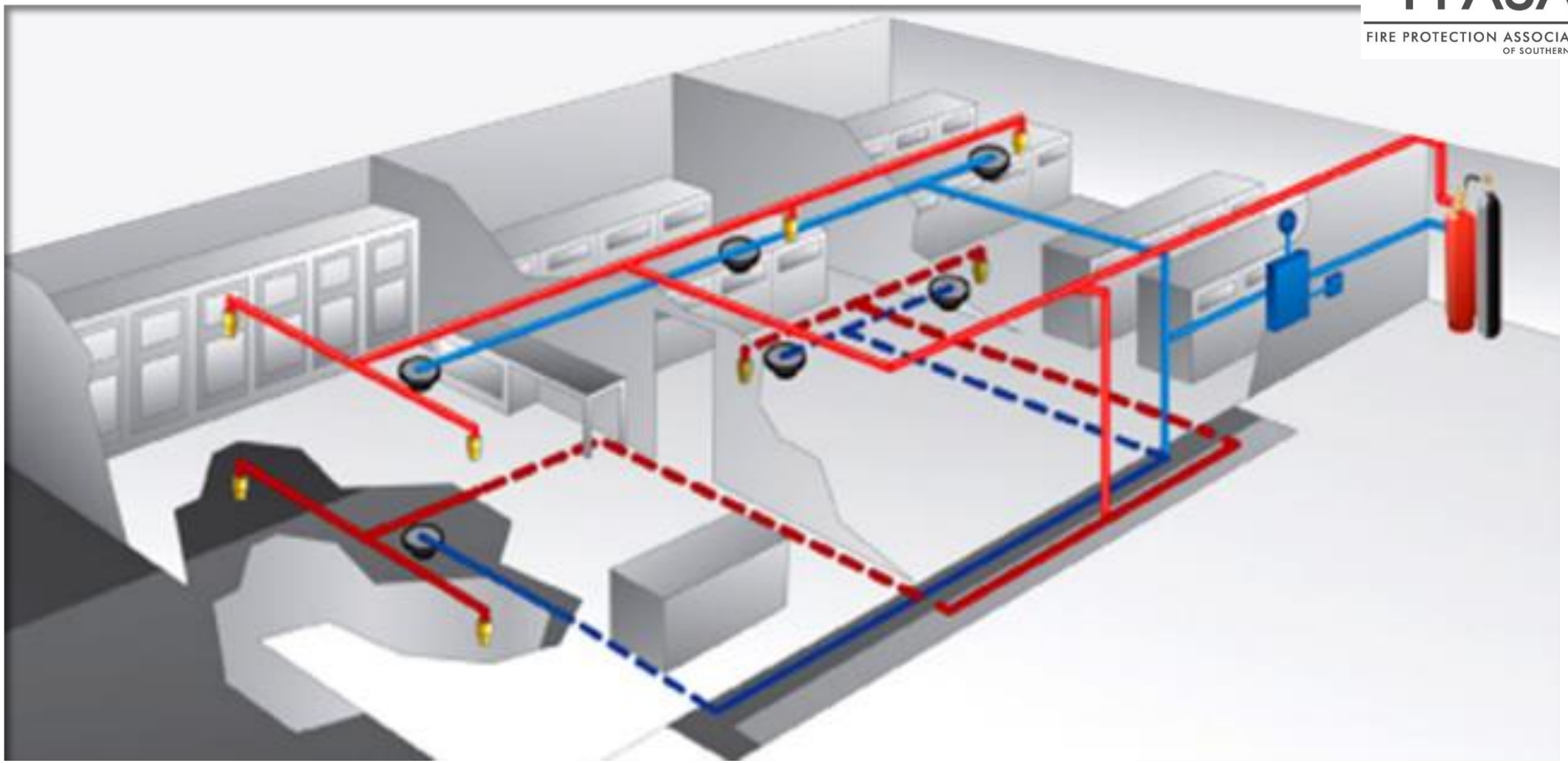
- Chemical reaction on the combustion process; or
- Reduction in oxygen levels to below that supporting combustion.

Proven over a number of years in specific applications

No water usage

Gas Suppression

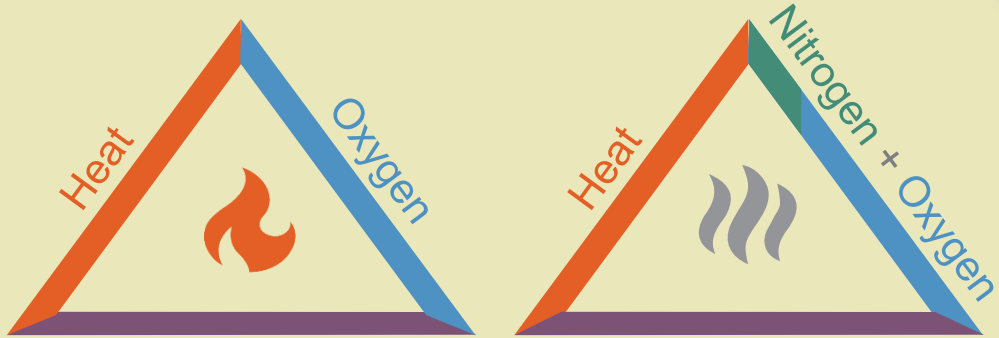
2



Hypoxic Air Technology

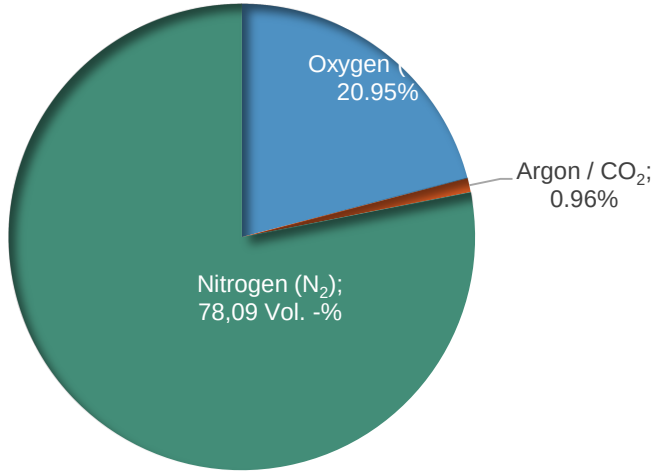
3

- Relatively new technology for specific air-tight applications
- Reduction in oxygen levels to below that supporting combustion
- Working principles of oxygen reduction fire prevention

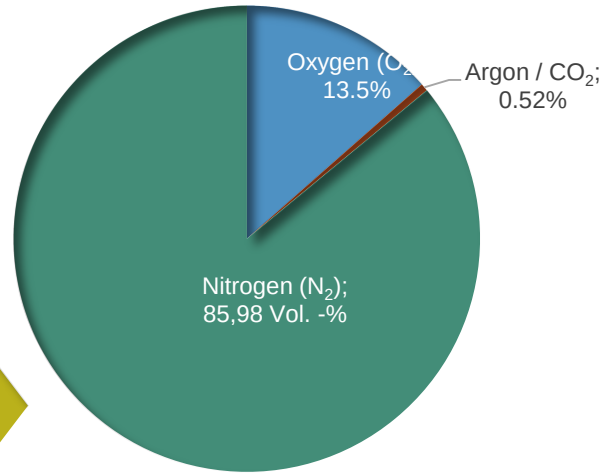


- No water used

Natural atmosphere



Oxygen-reduced atmosphere



Water Mist

4

- NFPA 750: 2015 – Standard on Water Mist Fire Protection Systems
- BS 8458: 2015 – Domestic
- BS 8489-1: 2016 – Industrial and Commercial
- Both single fluid and twin fluid water mist systems deliver a mist of small droplets which control, suppress or extinguish fire by:
  - absorbing heat from the fire and its surroundings
  - smothering the flames by evaporation to steam
  - blocking radiant heat transfer to adjacent combustible materials
- With the high surface area of the droplets produced (< 1 000 microns), water mist is able to absorb relatively large amounts of heat and thus provide efficient cooling

4

Minimum Design Criteria

The following application parameters need to be determined as a minimum (BS 8489-1):

- Is the fuel similar to the test protocol (liquid or solid fuel, flash point, combustibility, quantity, arrangement)?
- Is the compartment volume equal to or less than the volume of the test room?
- Is the compartment height equal to or less than the test protocol?
- Is the compartment ventilation conditions similar (presence of fans, forced ventilation, etc., area of openings, position of openings)?
- Are there more obstructions to the distribution of mist than the test protocol?
- Is the duration of protection provided by the listed system appropriate for the actual level of protection needed?

4

Appropriate Occupancies & Test Protocols BS 8489-1:

Table 1	Occupancies and acceptable fire protocols for an automatic watermist system [A)]		
Occupancy	**Description of occupancy**	**Exceptions**	**Fire test protocol**
Apartments (where BS 8458 cannot be complied with or is not appropriate) Churches Concrete spaces Gymnasiums Hotel bed rooms and their access (only) Local lending libraries Residential or nursing or convalescent homes where BS 8458 cannot be compiled with or is not appropriate Offices Restaurant seating areas Schools and university classrooms Unused attics in low hazard premises containing no combustible contents or stored materials and no electrical or mechanical services other than lighting	Lightly loaded non-storage and non-manufacturing areas with ordinary combustibles Expect fire with relatively low rates of heat release in these occupancies	Mat stores	BS 8489-7 FM 5560:2016, Appendix G

NOTE The listed test protocols are applicable with the following limited parameters

- *BS 8489-7 covers Category 1, 2 and 3 systems for:*
  - *fire loads ≤ 500 MJ/m² (covered in Category 3 only);*
  - *ceiling heights ≤ tested height up to 5m;*
  - *floor area = restricted ad unrestricted*
- *FM 5560:2016, Appendix G covers:*
  - *fire loads ≤ 150 MJ/m²;*
  - *ceiling heights ≤ tested height up to 5m;*
  - *floor area = restricted ad unrestricted*

[A)] Specific areas within buildings can be protected by watermist where relevant fire test protocols exist.

4

Occupancy and Test Protocol for Deluge Applications BS 8489-1:

Table 2	Occupancy and acceptable fire test protocol of Class B and Class F fire hazards operated by a deluge system
Occupancy	**Fire test protocol**
Machinery spaces ≤ 80m³	BS 8489-5 or FM 5560:2016, Appendix A
Machinery spaces ≤ 260m³	FM 5560:2016, Appendix C
Machinery spaces ≤ 260m³	FM 5560:2016, Appendix E
Combustion turbines ≤ 80m³	BS 8489-5 or FM 5560:2016, Appendix B
Combustion turbines ≤ 260m³	FM 5560:2016, Appendix D
Combustion turbines ≤ 260m³	FM 5560:2016, Appendix F
Industrial oil cookers	BS 8489-6 or FM 5560:2016, Appendix J
Pool and spray fires – local application	BS 8489-4 or FM 5560:2016, Appendix I

4

Occupancy and Test Protocol for Deluge Applications **BS 8489-1:**

Table 3	Occupancy, operating volume and discharge duration for Class B and Class F fire hazards operated by a deluge system	
Occupancy	**Operating volume**	**Minimum discharge duration (min.)**
Machinery spaces	<80m³	10
Machinery spaces	<260m³	10
Machinery spaces	>260m³	60 A)
Combustion turbines	<80m³	10
Combustion turbines	<260m³	10
Combustion turbines	>260m³	60 A)
Industrial oil cookers	As per test protocol	10
Pool and spray fires – local application	As per test protocol	10

4

Design Considerations

BS 8489-1:

- Wherever possible, the ventilation system should be shut down automatically before the system operates. In those cases where this is not possible or desirable, the air velocity and/or total leakage area should be within the limits specified by the manufacturer on the basis of tests
- Components should be in accordance with BRE publication LPS 1283 [N1] or FM 5560:2016 or other appropriate standard that can be shown to give equivalent performance (e.g. a listed component in the LPCB Red Book)
- Components should be suitable for the expected operating temperatures and pressures
- The nozzles should be permanently marked to identify the manufacturer, unique model number, year of manufacture and K factor

4

Pipework

BS 8489-1:

- Pipework materials should be one of the following:
  - stainless steel, grade 316 or at least equivalent quality in respect to both corrosion and fire resistance;
  - copper pipe conforming to BS EN 1057 with capillary or cold pressed fittings;
  - galvanized steel piping conforming to BS EN 10255. A strainer, and downstream test valve, should be fitted at the termination of the galvanized piping upstream of the piping feeding the nozzles.

NOTE: *CPVC pipe is not suitable for use in pre-action systems or for high pressure water mist systems.*

Water Mist

4

Water

BS 8489-1:

- The water supply should be capable of supplying the maximum demand of both the hydraulically most unfavourable and the hydraulically most favourable AMAO
- The water used in water mist systems should be demineralized water, deionized water, wholesome or sweet industrial water
- Additives can be used in water mist systems for various reasons including the following:
  - preventing freezing in containers and system piping (wet systems);
  - preventing water/container deterioration;
  - preventing corrosion;
  - fire suppression capabilities.

Water Mist

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Maintenance

i

- The system must self-run twice every 28 days (BS8458 States this must happen)

ii

- A service is to be performed annually to extend the systems warranty period

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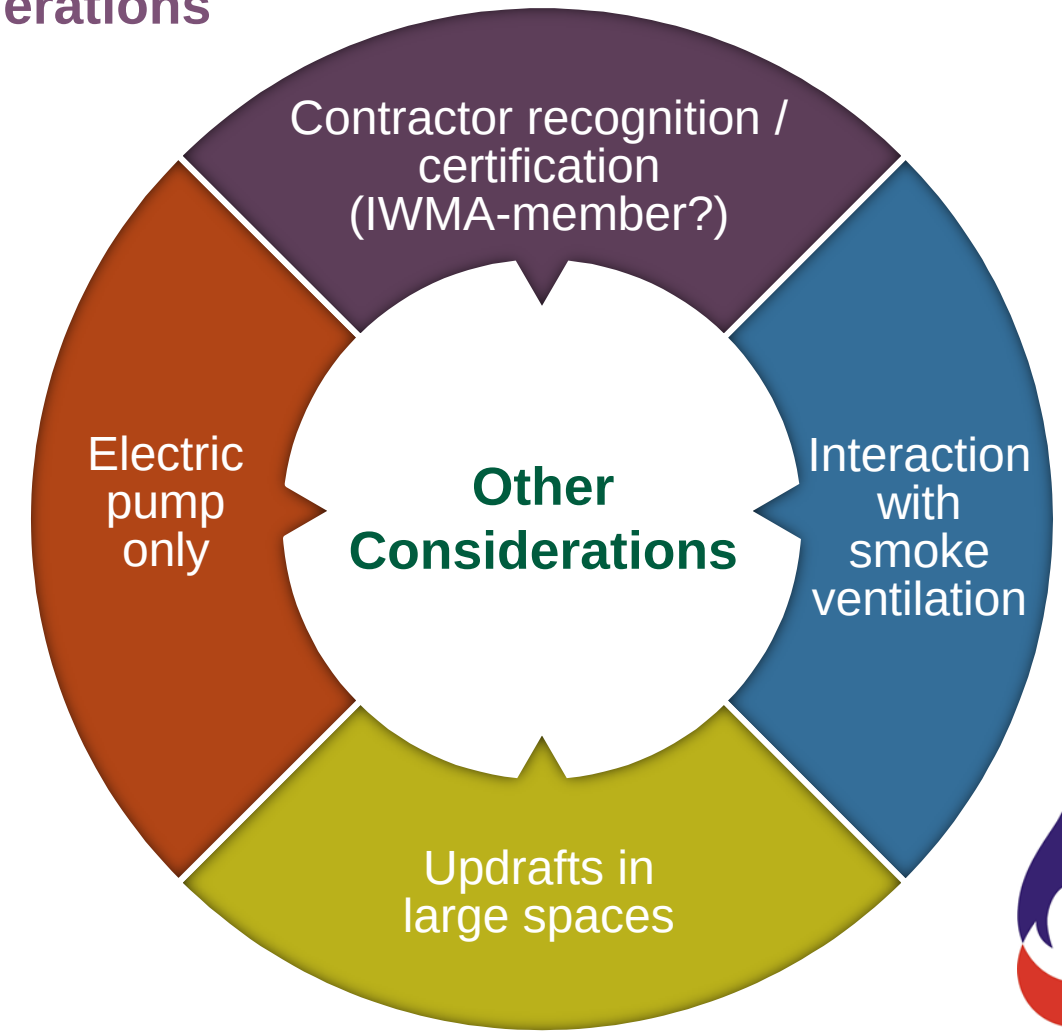
Other Considerations



Local Application

5

- Newer technology
- Tested and certified for specific applications
- Generally product / manufacturer specific
- Limited / no water

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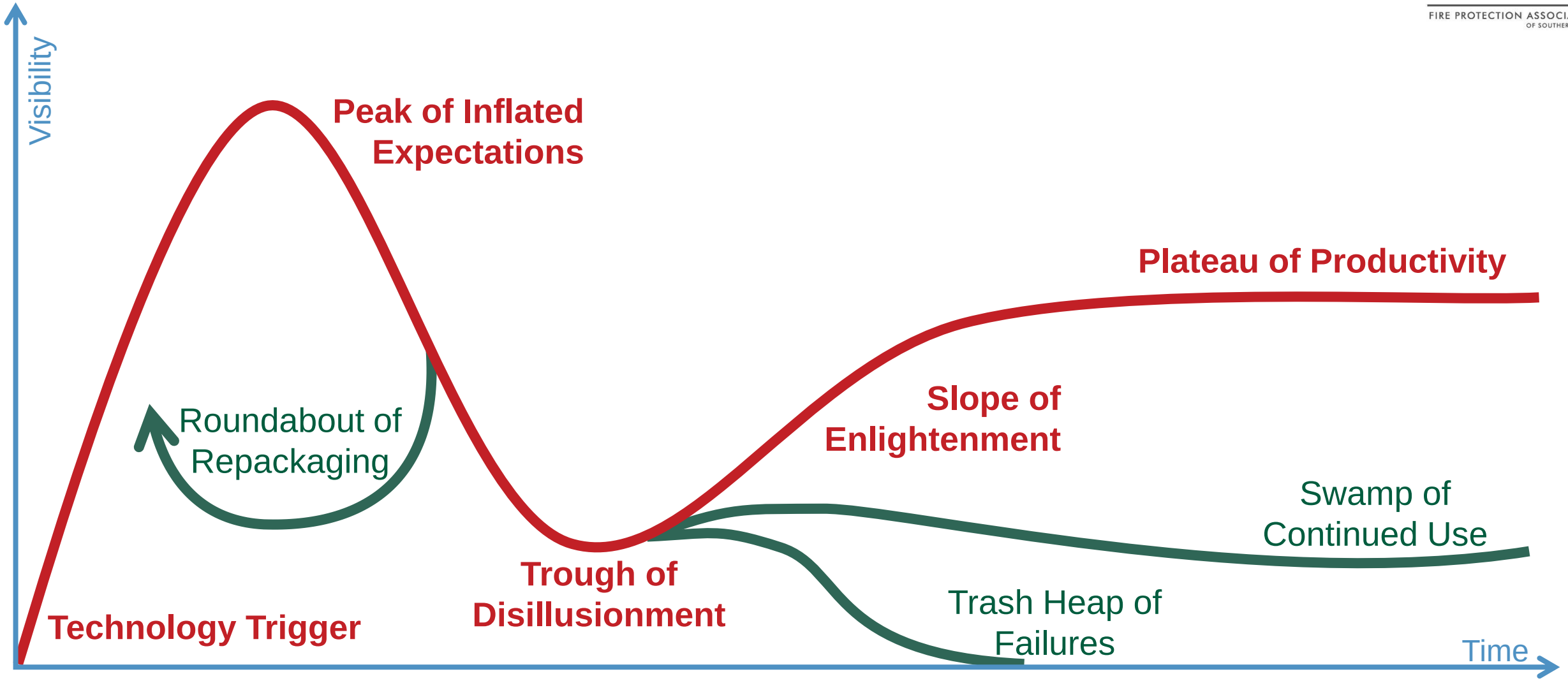

Conclusion

Which Solution to Use?