Panel & Engineered Lumber International Conference & Expo

APRIL 7-8, 2016

Proven Fire Protection Systems for the Engineered Panel and Lumber Industry

Presented by: Jeffrey C. Nichols

Industrial Fire Prevention, LLC

Jeffrey C. Nichols **Bio**

Jeffrey C. Nichols, Managing Partner, Industrial Fire Prevention, LLC, providing special hazards protection for combustible dust processes since 1979.

NFPA 664 Wood and Cellulosic Materials Processing Technical Committee

Spark Detection Subject Matter Expert. Expertise protecting process equipment, conveying, fume and dust collection systems from fires and explosions in many diverse industries.

Instrumental in helping test and refine some of the first spark detection systems and related equipment for North America. Over the last three decades has also accrued education and expertise in applying a hierarchy of other hazard monitoring, fire and explosion protection systems

Training and education in Combustible Dust, Process Safety, Combustible Dust Fire and Explosion Protection.

Related Education & Training

- **GreCon University** – Process Safety, Fire Prevention, Spark Detection Systems
- **StuvEx** – Process Safety, Explosion Protection
- **ATEX** – Explosion Protection
- **Fike** – Explosion Protection Fundamentals
- **AF&PA American Forest & Paper Association** – Understanding and Practical Application of Combustible Dust Hazards in the Wood Products and Paper Industries

Related Education & Training

- **The NFPA Fire Protection Research Foundation-** Dust Explosion Hazard Recognition and Control
- **Georgia Tech Research Institute** – Process Safety Management
- **Georgia Tech Research Institute** – Combustible Dust Safety Training
- **Georgia Tech Research Institute** – Preventing and Mitigating Combustible Dust Fires and Explosions

Articles

TechnicalExclusive

Spark Detection: First Line of Defense for Preventing Combustible Dust Fires and Explosions

By Jeffrey C. Nichols

According to the National Fire Protection Association (NFPA) Standard 654, the Standard for the Prevention of Fire and Dust Explosions (2013 edition), combustible dust is defined as "a finely divided combustible

console, and countermeasure devices like extinguishment or high-speed abort gates. When a spark or ember enters the field of view of a detector, the detector sends a signal to the control console. The control

radiate energy proportional to their absolute temperature. As the temperature of a black body increases, it emits electromagnetic radiation at higher intensities and shorter wavelengths.

Detectors that sense only

Whitepaper

Available online at www.sciencedirect.com
ScienceDirect
http://www.elsevier.com/locate/biombioe
ELSEVIER
BIOMASS & BIOENERGY

Inherent hazards, poor reporting and limited learning in the solid biomass energy sector: A case study of a wheel loader igniting wood dust, leading to fatal explosion at wood pellet manufacturer

Frank Huess Hedlund [a,b,*], *John Astad* [c], *Jeffrey Nichols* [d]

[a] *Technical University of Denmark, (DTU), Kongens Lyngby DK-2800, Denmark*
[b] *COWI, Parallelvej 2, DK-2800 Kongens Lyngby, Denmark*
[c] *Combustible Dust Policy Institute, P.O. Box 867, Santa Fe, TX 77510, USA*
[d] *Industrial Fire Prevention LLC, P.O. Box 2046, Milledgeville, GA 31059, USA*

ARTICLE INFO

ABSTRACT

Key Points to Take Away:

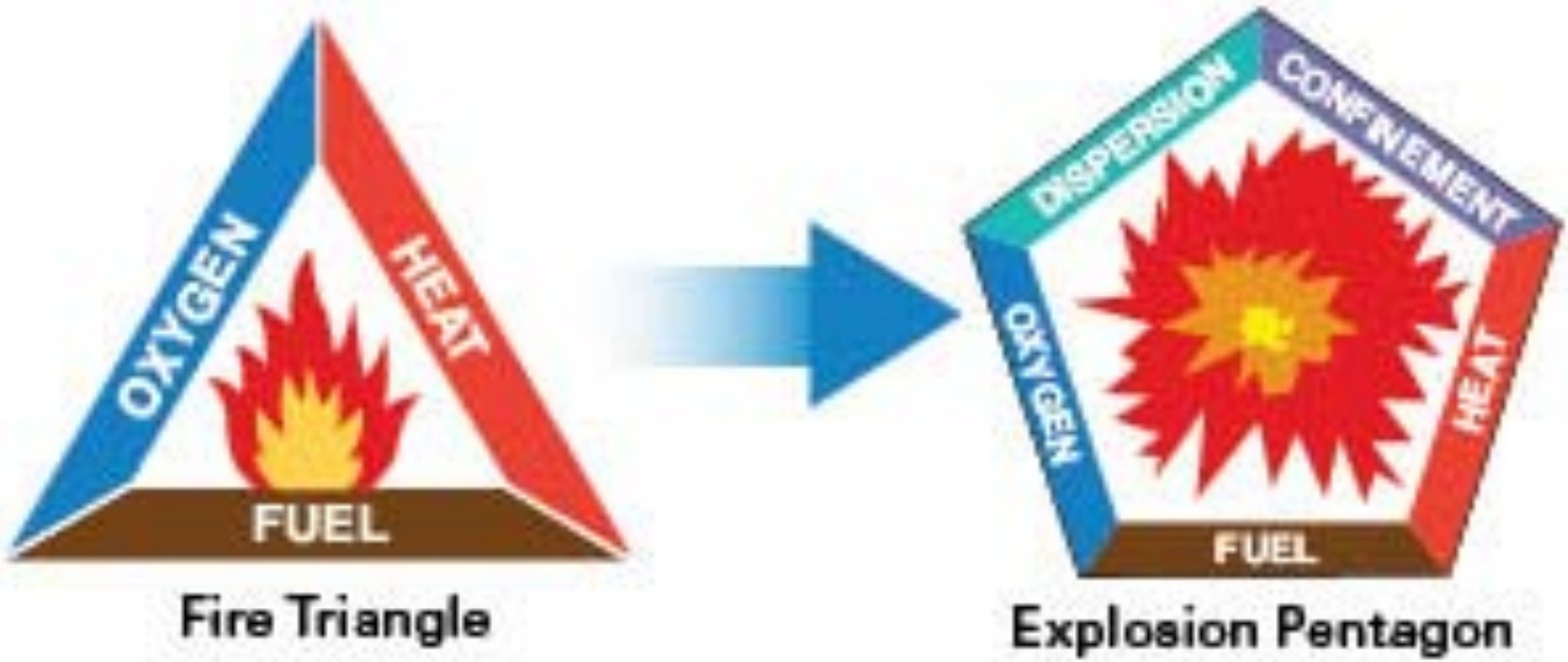
1. 1st Things First – ComDust, Standards, Hazards, DHA
2. Layered Fire and Explosion Protection Systems
3. 1st Line of Defense

Media Reports

- **Fire at Factory Sparks OSHA Citations, Fines**
- **Plant agrees to correct explosion and fire hazards**
- **Units fight another blaze at NC plant**
- **Biomass Industry Plays With Fire, Gets Burned**
- **Explosion damages plant; no injuries reported**
- **Fire at facility not expected to result in major downtime**
- **Combustible-Dust Explosions Prompt Calls for More Oversight**

This is Why

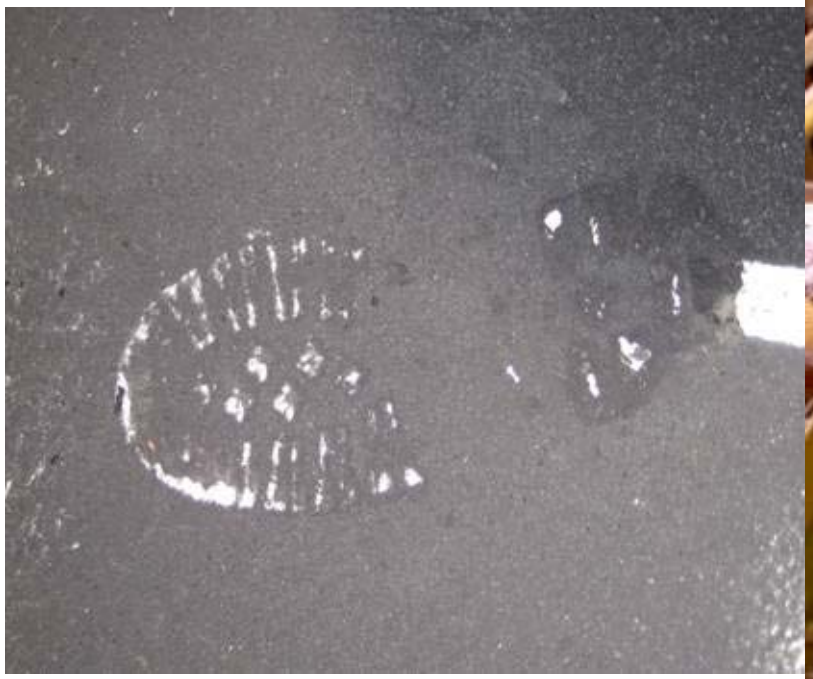
The Fire Triangle and Explosion Pentagon: Control Fuel & Ignition



Dust Explosion Definition

- According to **Dust Explosions in the Process Industries** Third Edition by Rolf K. Eckhoff, a dust explosion can be defined as **“Any solid material that can burn in air will do so with a violence and speed that increases with increasing degree of subdivision of the material “**

"If you can see your footprint, it's going to explode." - Bill Kauffman



Combustible Dust Hazard?

Combustible Dust vs. Gas Explosion

Carolyn Merritt

Former Chairman and CEO of U.S. CSB

- “Dust has the same potential power of gasoline if a dust explosion occurs”
- “Recognize dust as a critical catastrophic potential hazard”

- June 2005 CBS News Interview 60 Minutes

CSB - Common Risk Factors

- Combustible dust hazards not recognized
- Dangerous dust accumulations
- Engineering controls inadequate
- Change management inadequate
- Inadequate dust collection system design and maintenance
- Inadequate fire and explosion prevention

CSB Chemical Safety Board

Combustible Dust Explosion 7-76
FM Global Property Loss Prevention Data Sheets

Table 4. Losses by Cause (Ignition Source)

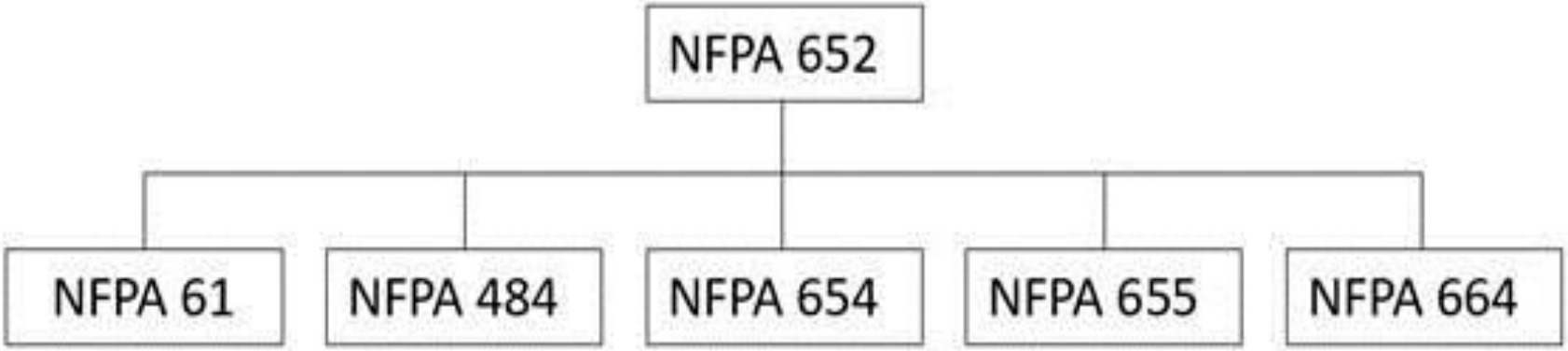
Cause Type	*No. Losses*
•Friction	50
•Spark	38
•Chemical Action	16
•Hot Work	13
•Burner Flame	10
•Electricity	6
•Static Electricity	6
•Overheating	4
•Hot Surface	2
•Unknown/No Data	21
	Total 166

Combustible Dust Hazard Recognition
An Insurer's View

FM Global Engineering Standards Department

Table 2 Losses by Equipment Type		
Equipment Type	**Number**	**Gross Loss - %**
Dust Collector	67	12
Impact Equipment	22	11
Boiler	11	18
Storage Silo	8	4
Processing Equipment	7	2
Conveyor	5	3
Dryer	8	40
Elevator	4	2
Spray Dryer	4	1
Various	30	7
Total	166	100

NFPA Hierarchy of Combustible Dust Standards



Courtesy Brian Edwards, Conversion Technology

NFPA 652: Standard on the Fundamentals of Combustible Dust

NFPA 664: Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities

Key #1 Process Safety Management

- Recognize Combustible Dust as a Potential Catastrophic Hazard
- Hazard Analysis:
- Identify Combustible Dust Hazards
- Identify Ignition Hazards
- Evaluate process equipment having a potential for combustible dust incidents
- Implement control measures to mitigate combustible dust fires and explosions

Manage **Risk**

- Hazard Analysis
- Reduce Probability – *Prevention*
  Inherently Safer Design: facility, process, equipment
  - Engineering Controls are ACTIVE, and include:
    Dust Control and Ignition Control
  - Administrative Controls: Housekeeping, MOC, PPE
- Reduce Severity – *Protection*

  Protection Systems are Re-Active

  - Fire Protection + Explosion Protection

Process Safety Design Principles

Inherently Safer Design:

- **Segregate** – interposing of fire and explosion resistant barriers and diverters *between combustible processes*.
- **Separate** – create distance between combustible processes.
- **Detach** – **Isolate** - locate combustible processes in specially constructed areas, separate building, or outside.

Key #2 - Best Practices in Process Safety Methodology

Layered Safety Systems, Engineering Controls:

- **Prevention:** Spark, Ember, Flame, Temperature, Smoke, and CO Detection Systems, and various types of Suppression Systems.
- **Fire Protection:** Various types of suppression systems: Sprinkler and Deluge systems, water mist, Dry chemical, CO2, and gas Inerting systems
- **Explosion Protection:** Explosion Venting, Suppression and Isolation Systems
- **Interlocks & Controls:** Diverters, Fire Dumps, Alarms, Deluge, E-stop, Sequential Process Shutdown

NFPA 664 Standard for the Prevention of Fires and Explosions in Woodworking Facilities

Prescriptive Requirements

- **8.2.2.2.2* Ducts with a Fire Hazard.** Ducts conveying dry material released by equipment having a high frequency of generated sparks shall be designed and constructed in accordance with one of the following:
- (1) Equipped with a **listed spark detection and extinguishing system** installed downstream from the last material entry point and upstream of any collection equipment.
- (2)* Equipped with be a listed spark detection system actuating a high-speed abort gate, provided the abort gate can operate fast enough to intercept and divert burning embers to atmosphere before they can enter any collection or storage equipment.
- (3) Ducts conveying material to locations representing minimal exposure to personnel and the public at large shall be permitted without spark detection and extinguishing systems subject to a risk analysis acceptable to the Authority Having Jurisdiction.

1st Line of Defense: Spark Detection and Extinguishing Systems

GreCon

Innovation is our Tradition

Company – GreCon, Inc. USA

GreCon

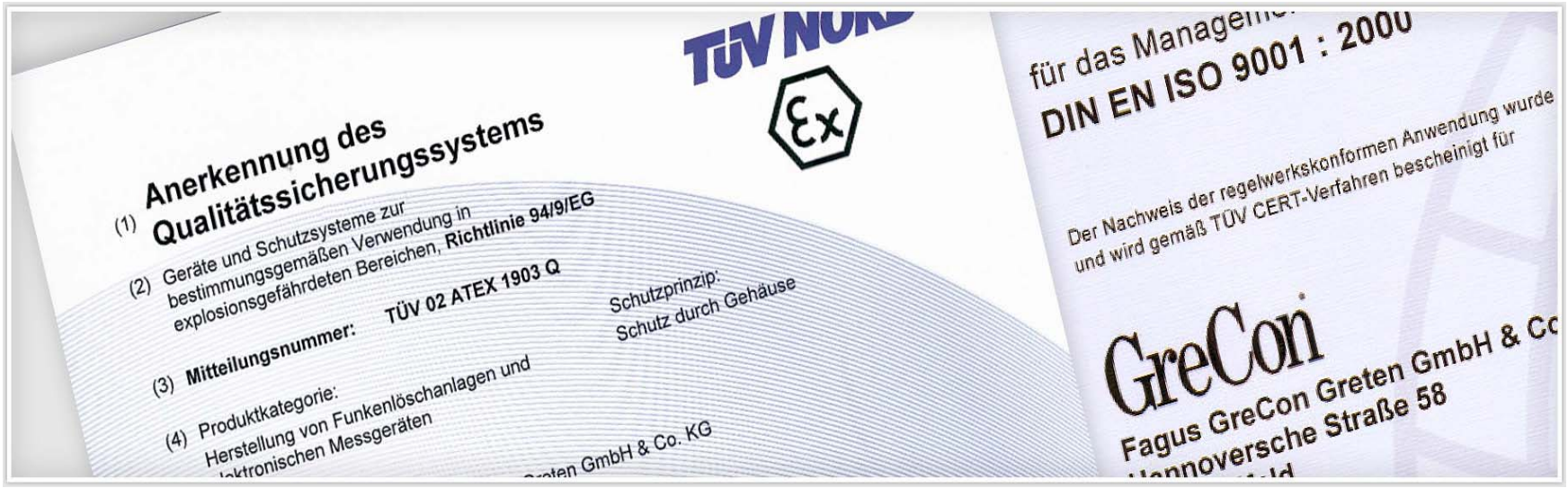
GreCon, Inc.

Located in Tigard, Oregon, is the North American Headquarters and wholly owned subsidiary of Fagus-GreCon Greten GmbH & C KG, of Alfeld/Hanover, Germany.

North America Staff: 25 member

- 1 Research & Development staff
- 6 Service & Support staff
- 8 Regional Sales Managers (Independent Reps)
- In-house internships
- Operational systems for improvement
- Customer focused teams

Certifications & Approvals

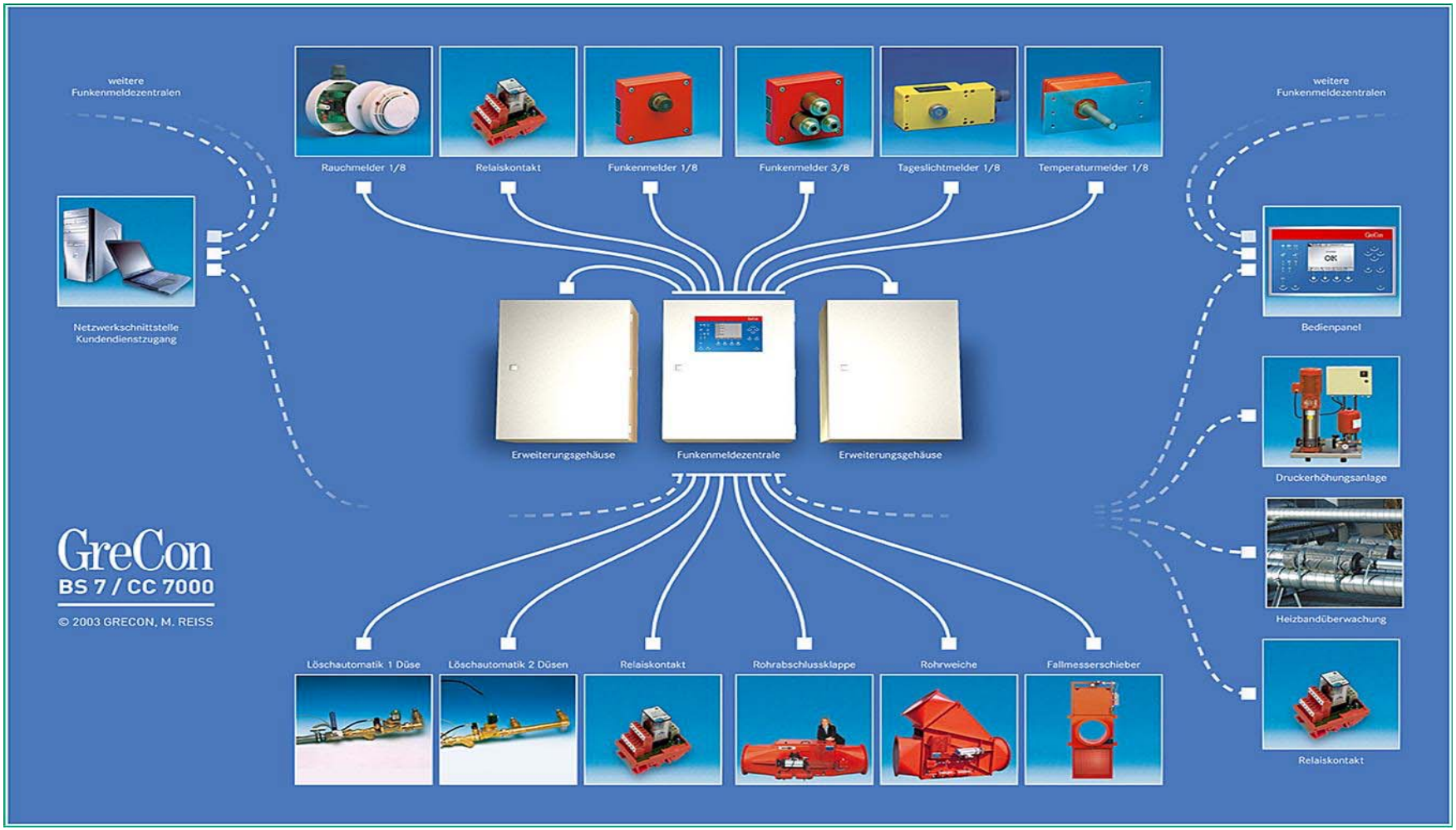


- **Certified according to ISO standards 9001**
- **TÜV-Atex approval**
- **VdS, EX, CE & FM Approvals, CSA, UL**
- **SIL** (failure analysis) **Certification to a Safety Integrity Level 2**
- Customer support for enquiries by trade boards, insurance companies, experts and approval authorities

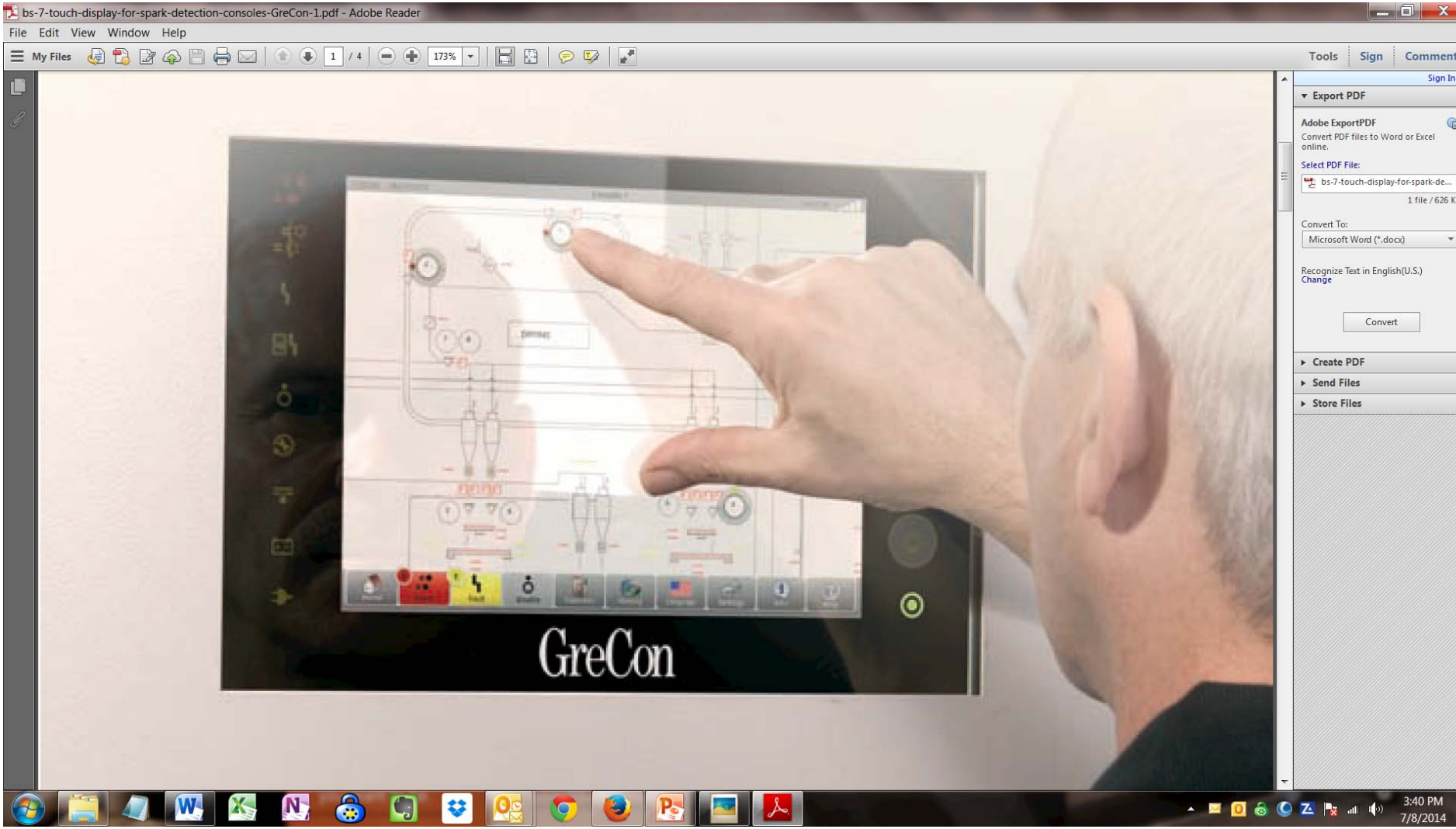
It Only Takes One Spark...

GreCon

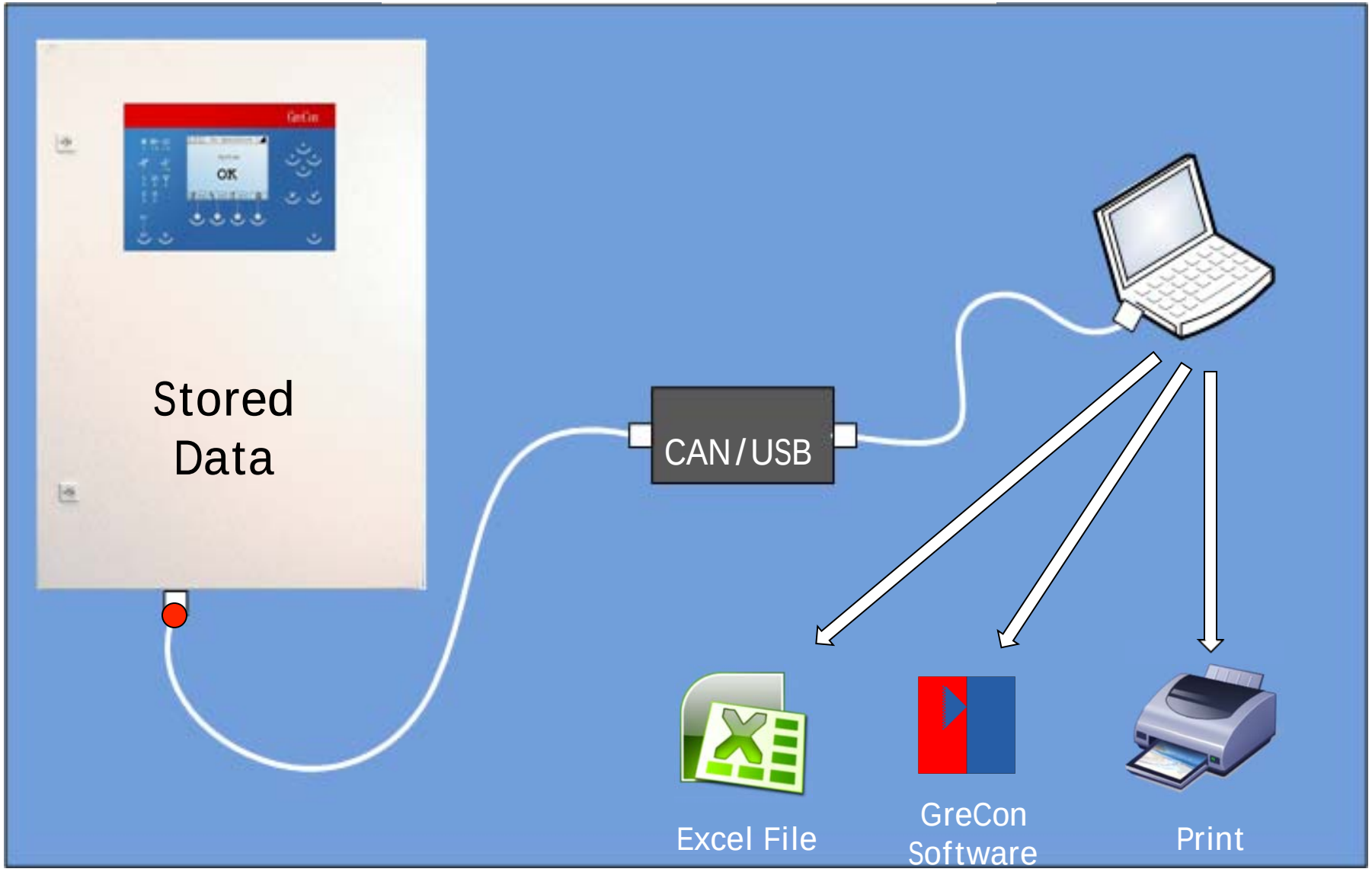
Spark Detection and Extinguishment Systems



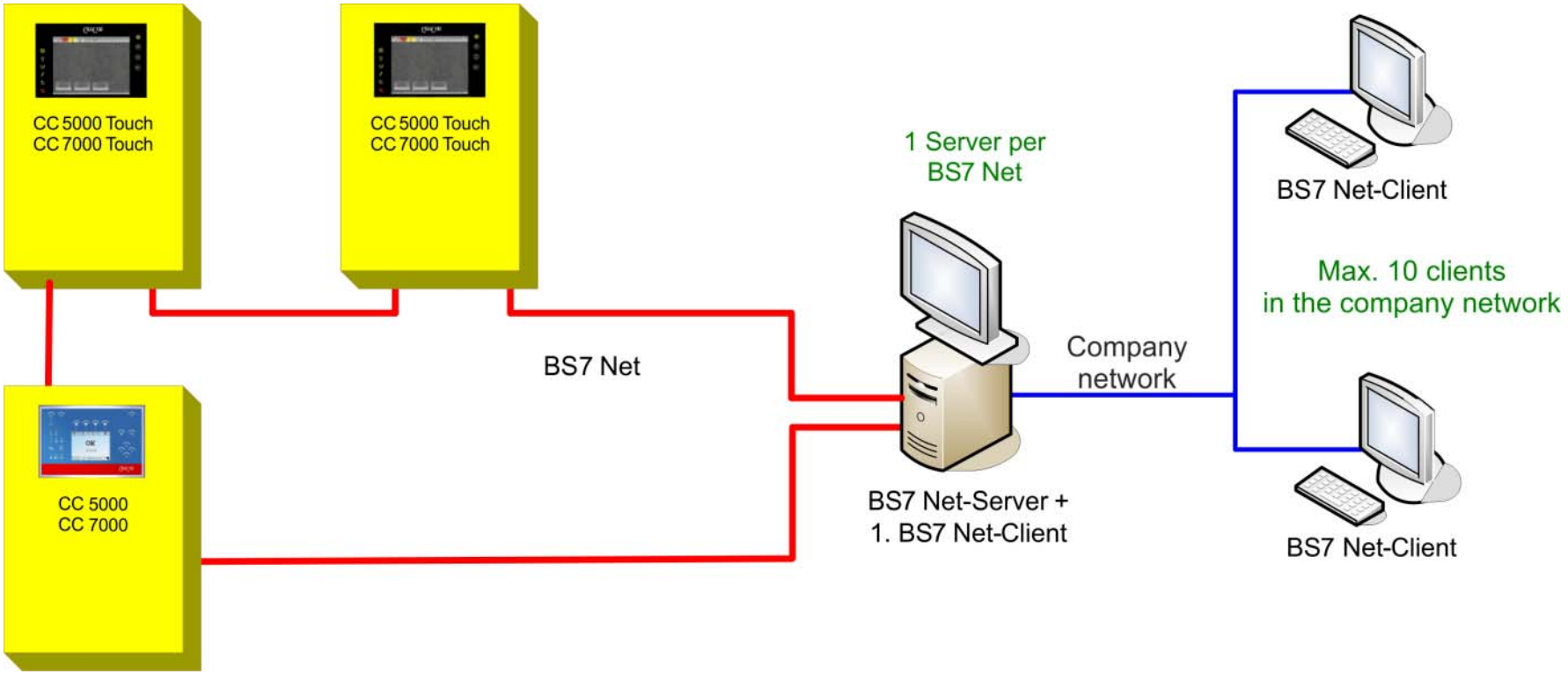
CC7000 Touch Screen



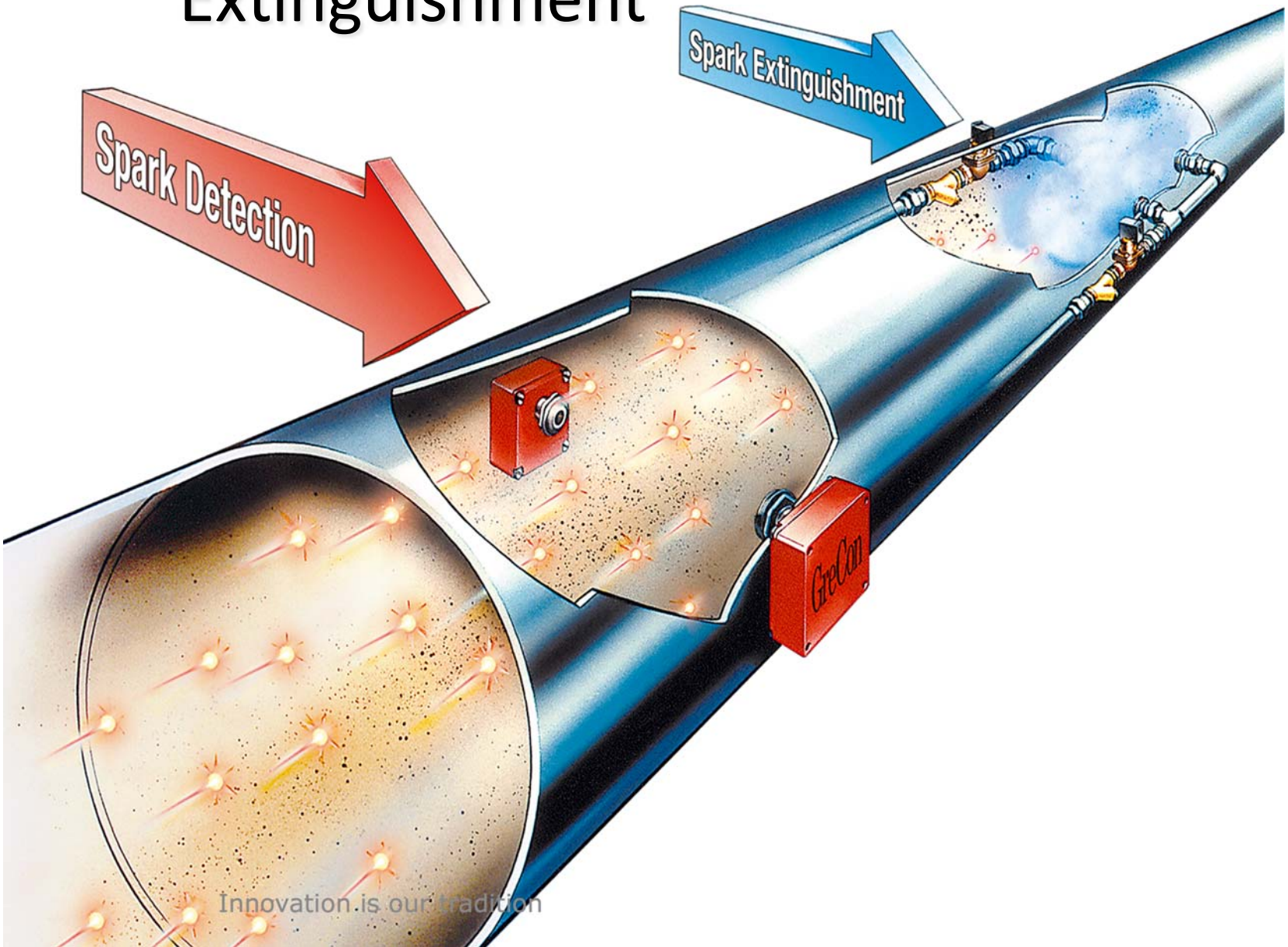
Data Download



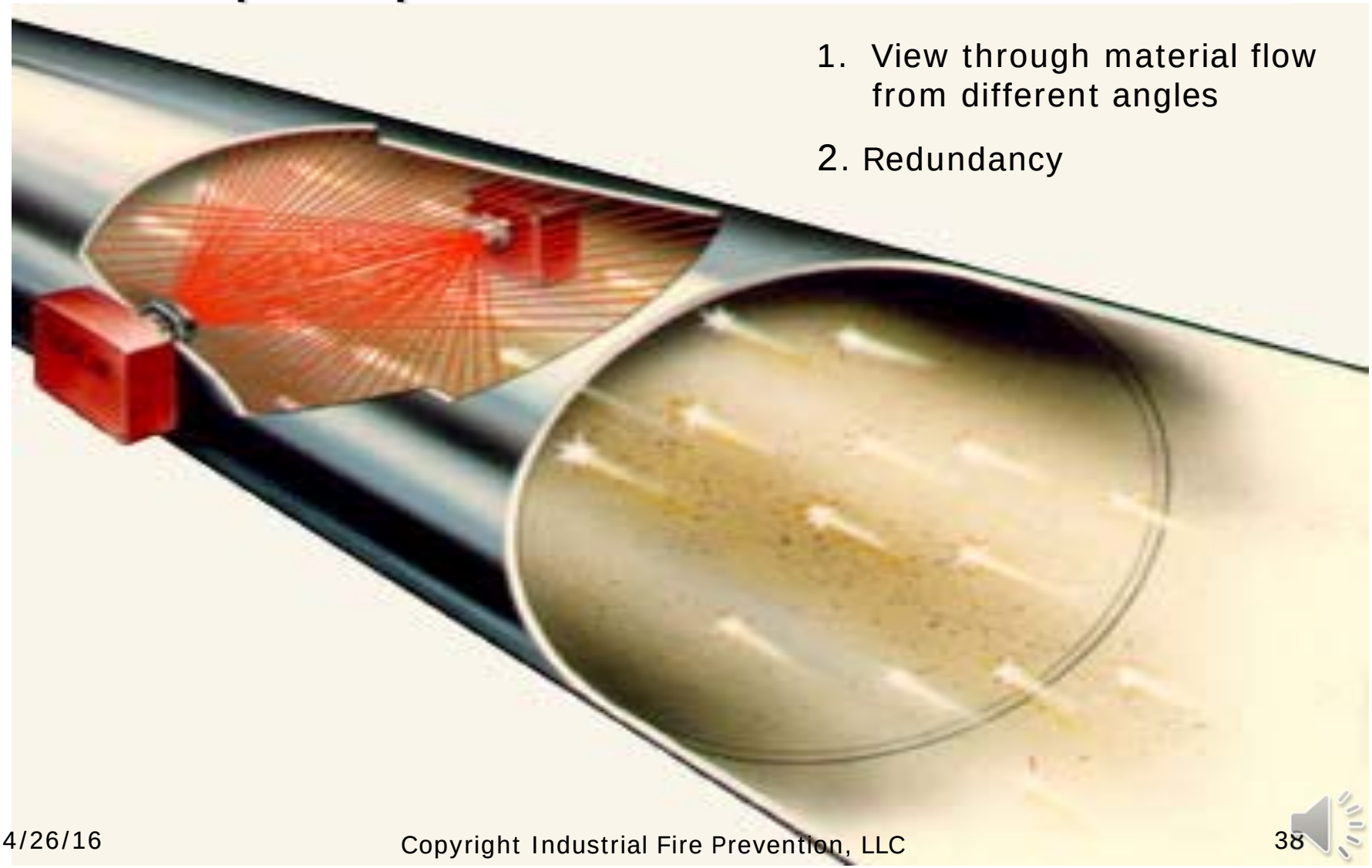
Example of a BS7 Net-network



Principles of Spark Detection & Extinguishment



Key Spark Detection Principle:
- Multiple Spark Sensors at Detect Point



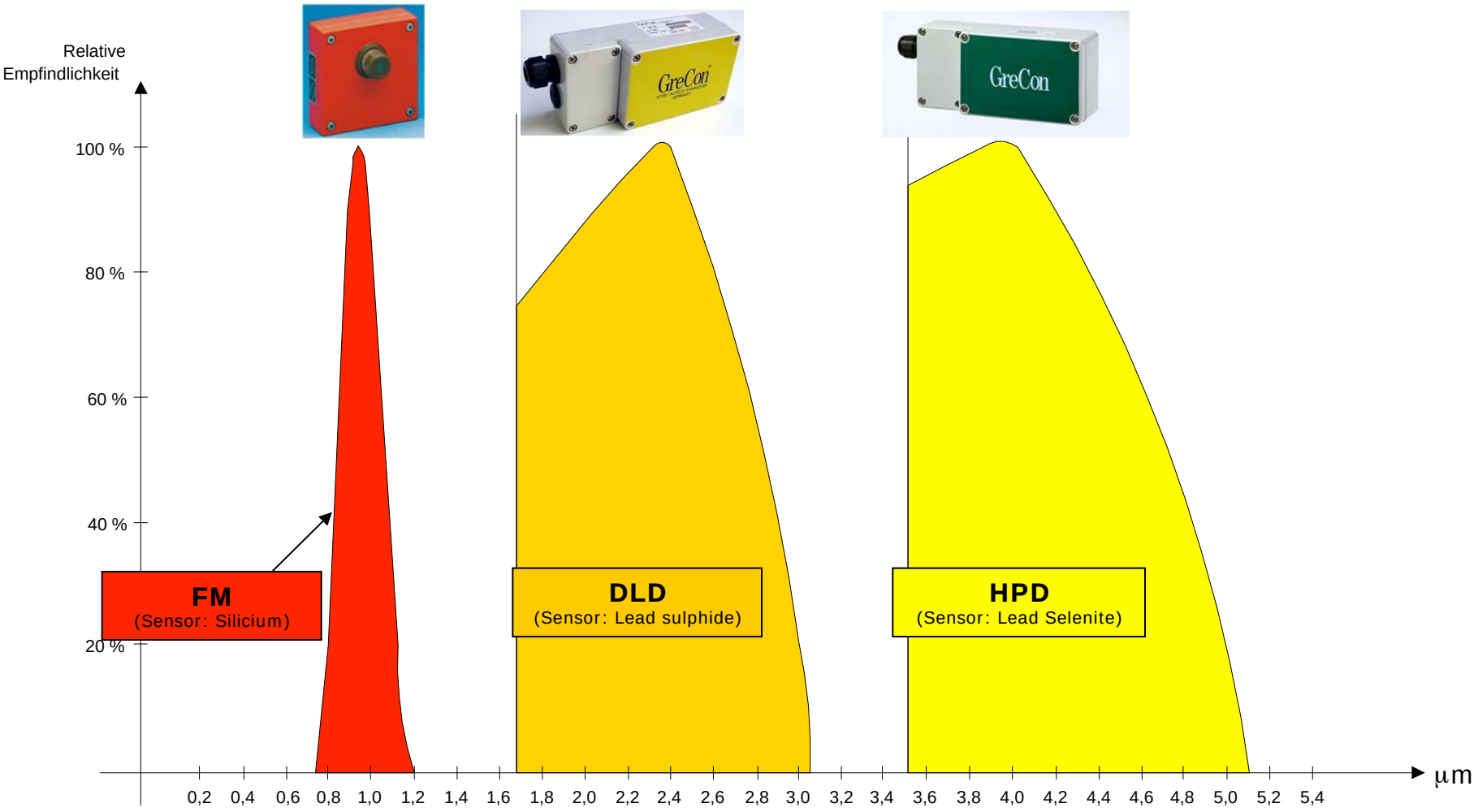
1. View through material flow from different angles
2. Redundancy

GreCon Spark Sensors

SENSOR TYPES

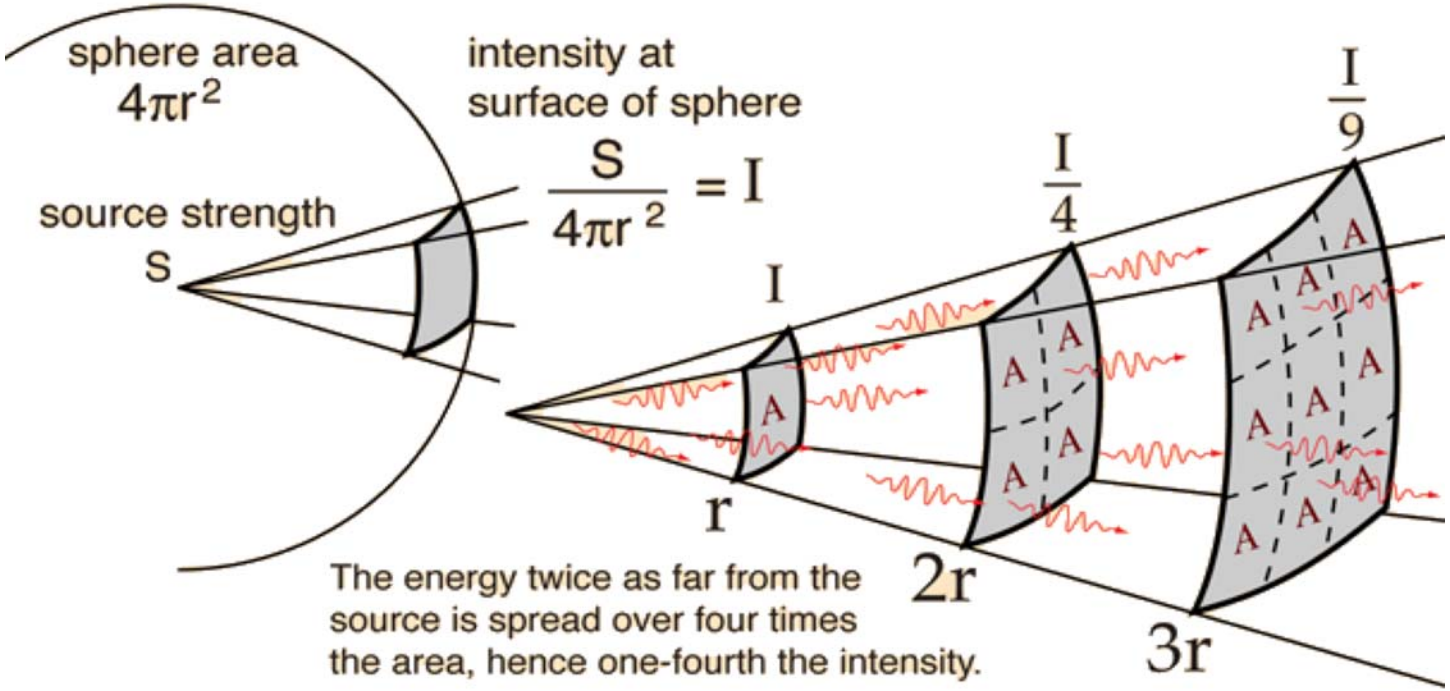
Types of Detectors IR Spectral Response

Spark and Hot Particle



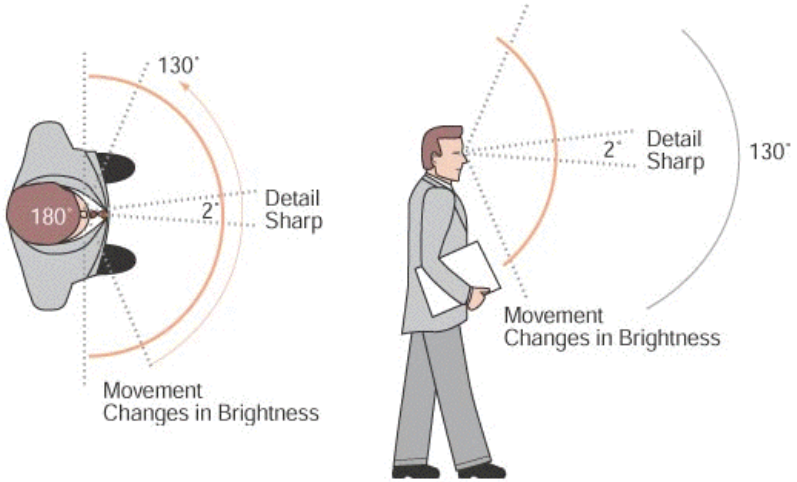
Inverse Square Law

Intensity is inversely proportional to the **square** of the distance from the source.



Optical Spark Detection

FM 1/8



Hot Ember/Radiant Heat Detection

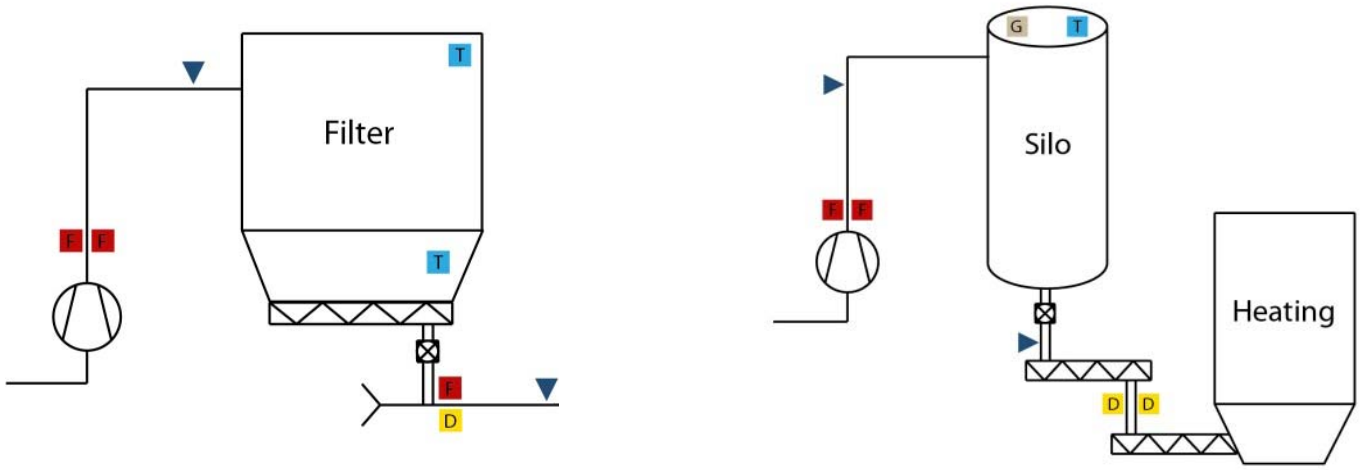
DLD
(Sensor: Lead sulphide

Inverse Square Law

Intensity is inversely proportional to the **square** of the distance from the source

Detect All Sparks and Embers!

Wood Dust Ignition Temperature: Cloud °C **470 /** Layer °C **260**



***Detect ALL sparks as per NFPA 664!**

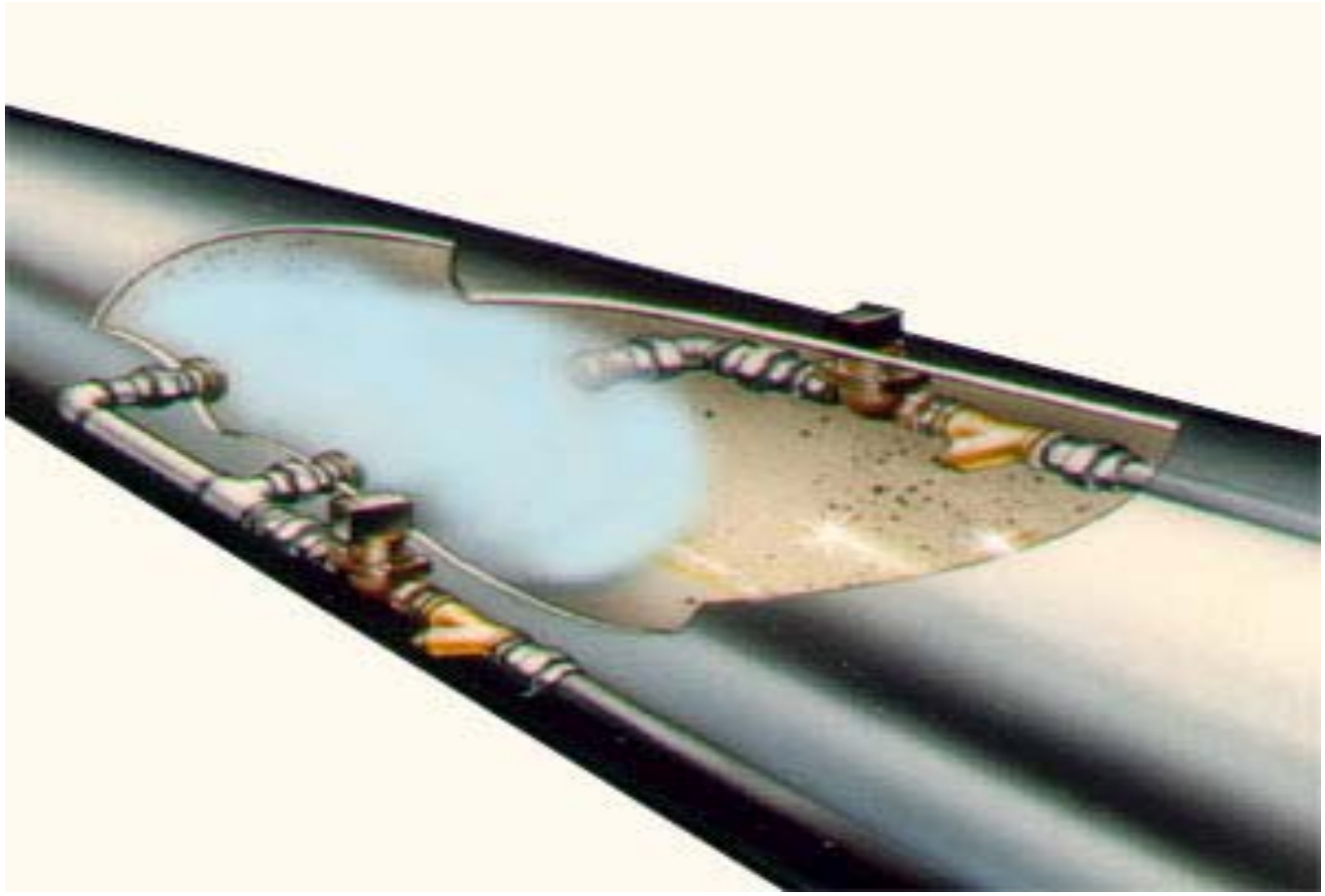
Detect Every Spark

NFPA specifies in its Standard 664 paragraph A.8.6.2.2, ***"The spark extinguishing system should activate every time a single spark is detected."***

Industry expert, Dr. Vahid Ebadat of Chilworth Technology, Inc., a firm that investigates explosions, concurs saying

"…the 'bottom-line' response to this question would be a suggestion to consider the above-quoted guidance from NFPA 664, and detect and extinguish every single spark" (see http://pbs.canon-experts.com/2011/08/).

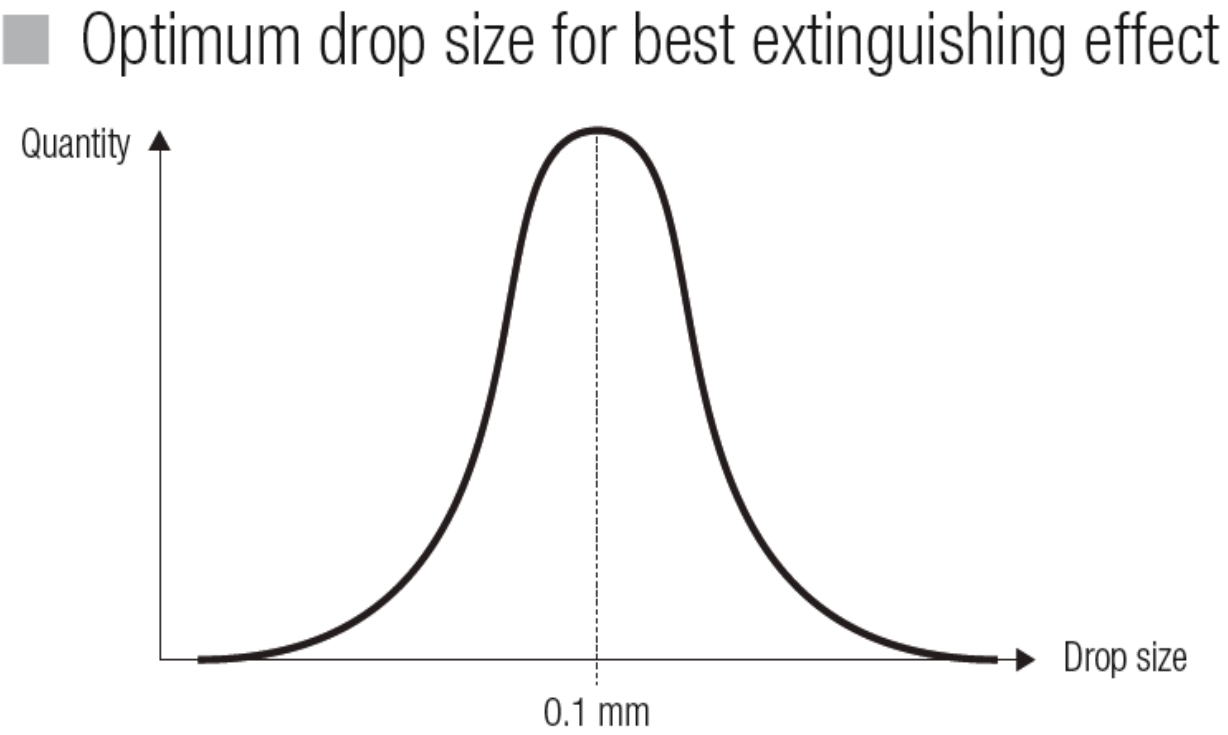
Automatic Extinguishment Principle:
- Atomized Water Suppression
- “Plug Free” Nozzles



Extinguishing Concept:

Atomization of water droplet for maximum cooling effect with minimum water

- The finer the water droplet, the larger the surface area
- The finer the droplet size, the more cooling effect
- The finer the water atomization, the less water gathers in the ductwork
- Minimal use of water by optimum adaptation of cooling effect and throw distance



Reduction of reaction distance

By Ultrahigh-Speed Extinguishment

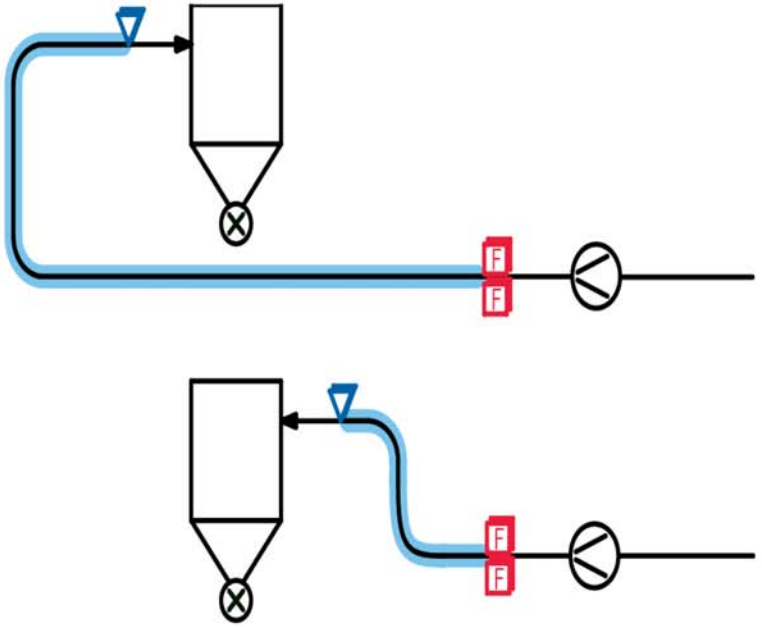
Normal extinguishment

4 to 7 m

Ultrahigh speed extinguishment (UHS)

< 2 m*

* Ø 400 mm at 25 m/s



OSHA.gov Resources

OSHA.gov

- Directives CPL 03-00-008 - Combustible Dust National Emphasis Program (Reissued)

http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=DIRECTIVES&p_id=3830

- Safety and Health Information Bulletin SHIB 07-31-2005

https://www.osha.gov/dts/shib/shib073105.html

- Combustible Dust in Industry: Preventing and Mitigating the Effects of Fire and Explosions

http://www.osha.gov/dts/shib/shib073105.html

NFPA Standards NFPA.org

http://www.nfpa.org/aboutthecodes/list_of_codes_and_standards.asp

- **NFPA 68**: Standard on Explosion Protection by Deflagration Venting
- **NFPA 69:** Standard on Explosion Prevention Systems
- **NFPA 664**: Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities
- **NFPA 652:** Standard on Combustible Dusts

FM Global Resources

FM Global Loss Prevention Data Sheets

http://www.fmglobal.com/FMGlobalRegistration/Downloads.aspx

- 7-73 DUST COLLECTORS AND COLLECTION SYSTEMS
- 7-76 PREVENTION AND MITIGATION OF COMBUSTIBLE DUST EXPLOSION AND FIRE
- 7-78 INDUSTRIAL EXHAUST SYSTEMS

For More Information

Spark Detection or Fire and Explosion Protection for Combustible Dust processes:

www.IndustrialFirePrevention.com

Combustible Dust News and Information:

www.IndustrialFirePrevention.Blogspot.com

For a Copy of My New Book:

"Guide to Keeping Your Plant From Burning Down and Blowing Up"

Contact us at:

Industrial Fire Prevention, LLC

1-800-367-0063

www.info@IndustrialFirePrevention.com

THANKS!

Industrial Fire Prevention, LLC

1-800-367-0063

www.IndustrialFirePrevention.com

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