HASTINGS®
air energy control, inc.
creating a cleaner workplace

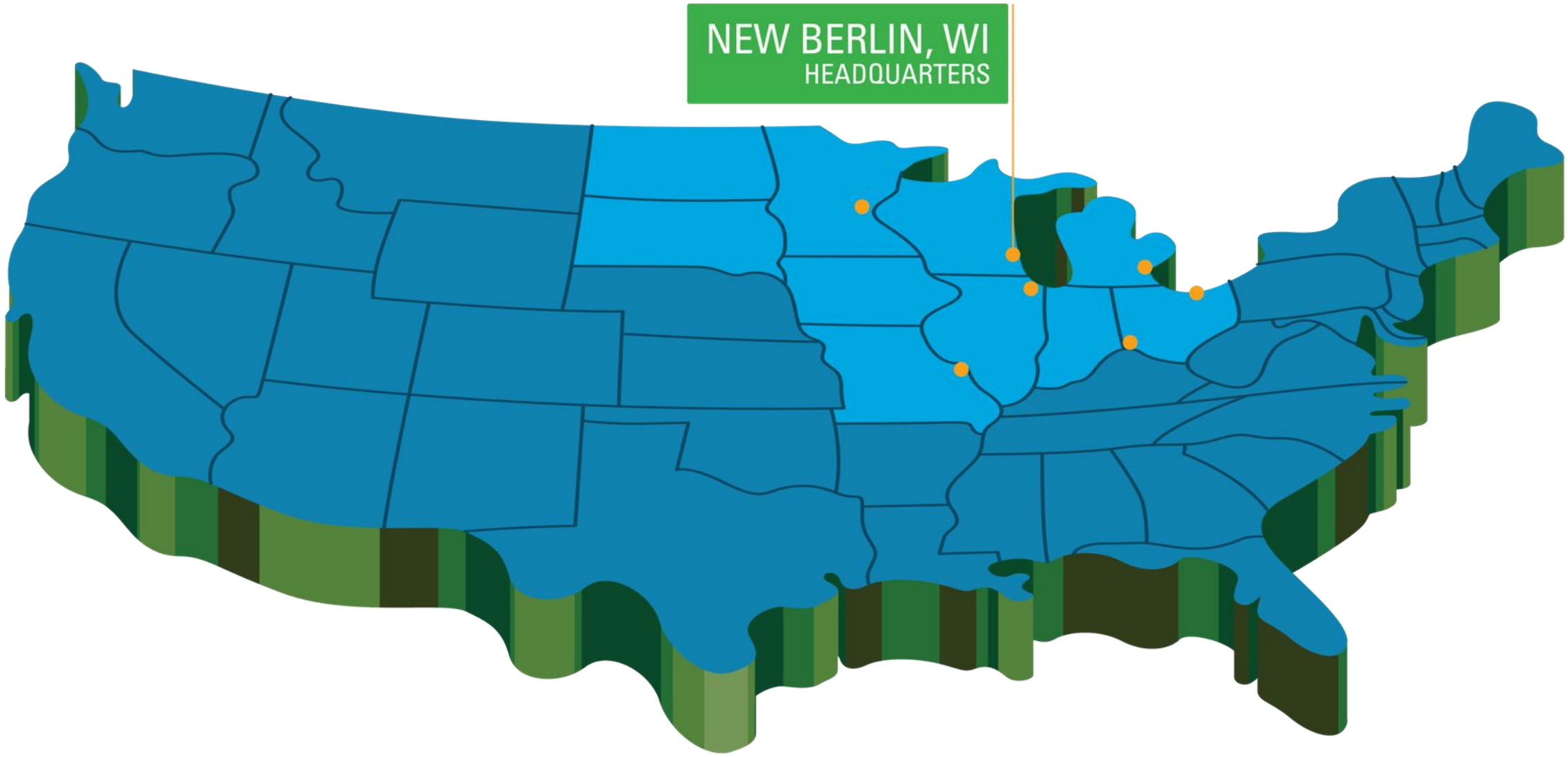
Michigan Safety Conference

Nathan Collins
National Sales Manager

Agenda

- Dust
- Brief history of Combustible Dust
- What is Combustible Dust
- Design of Dust Collection Systems
- Safety/Maintenance Concerns

"Polluting stimulates the economy.
It creates cleanup jobs!"



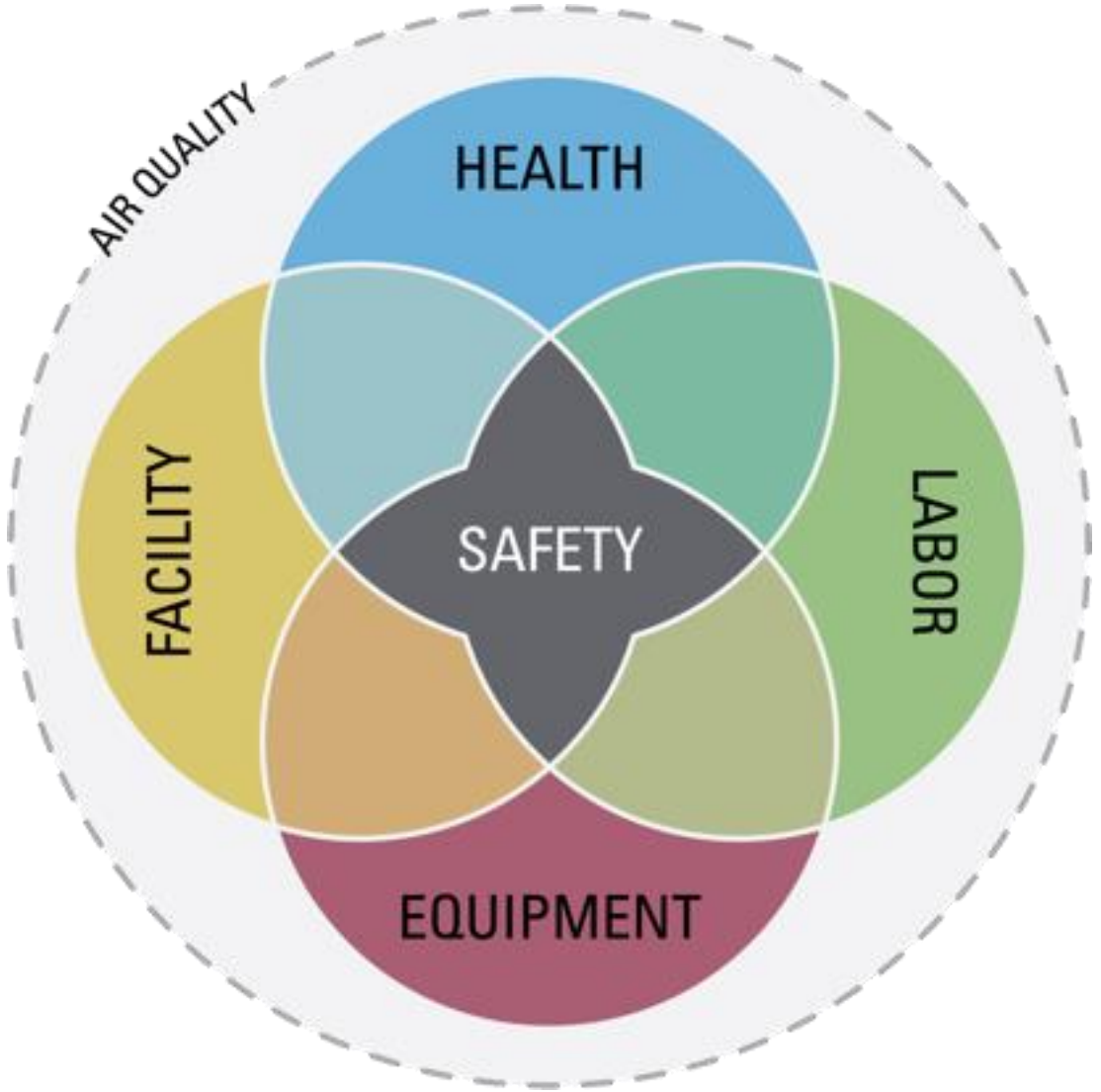
Offices in: **New Berlin, WI** | Chicago, IL | Minneapolis, MN | St. Louis, MO | Cleveland, OH | Cincinnati, OH | Detroit, MI

Primary Objectives

Providing innovative solutions that create healthier lives for workers and energy savings for employers.

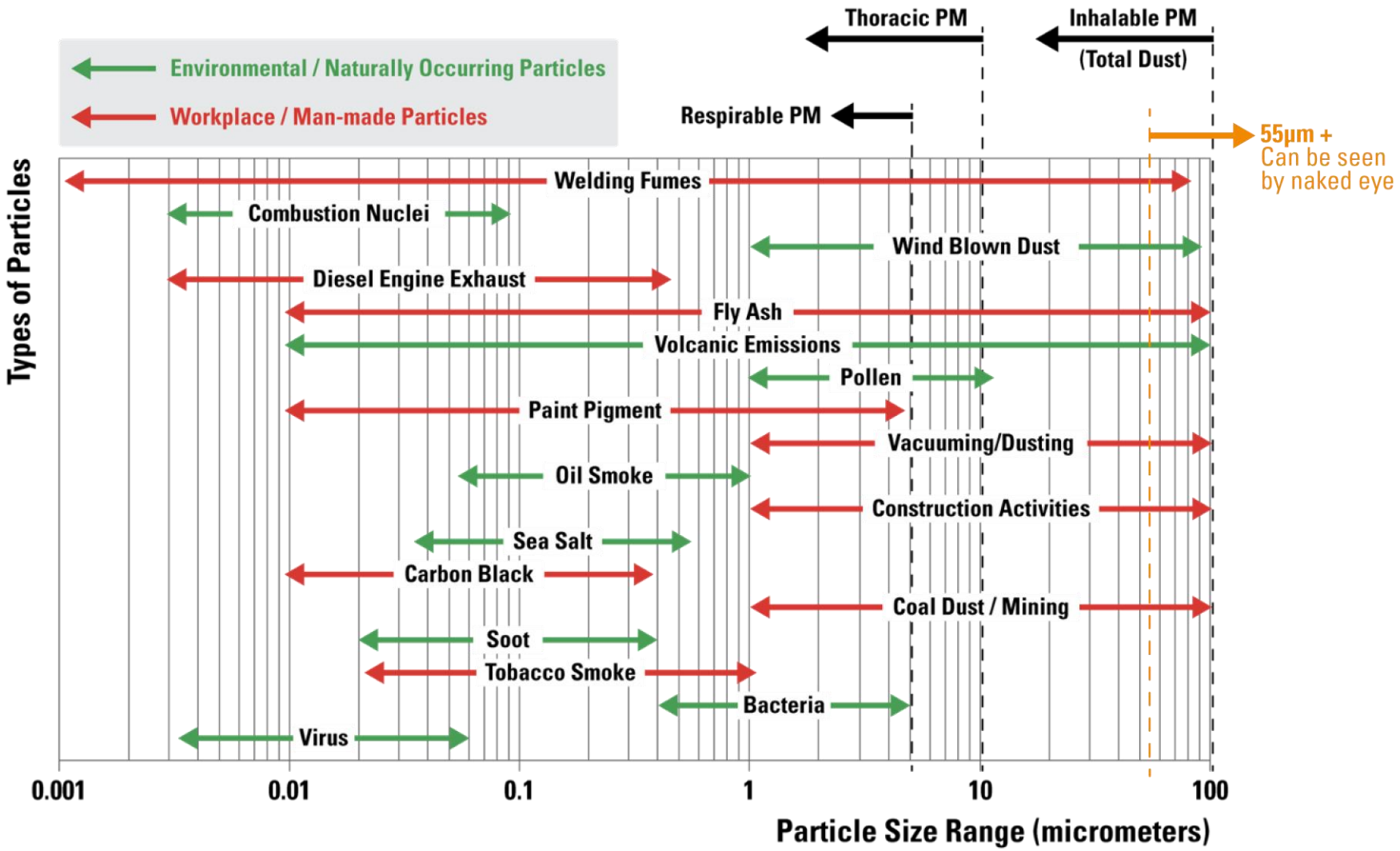
- Reduce worker exposures to air contaminants to below allowable limits
- Erase the perception of poor environmental control by minimizing buildup of contaminated air in the plant and improving in-plant housekeeping
- Improve worker comfort no matter the process or application

Everything is Connected



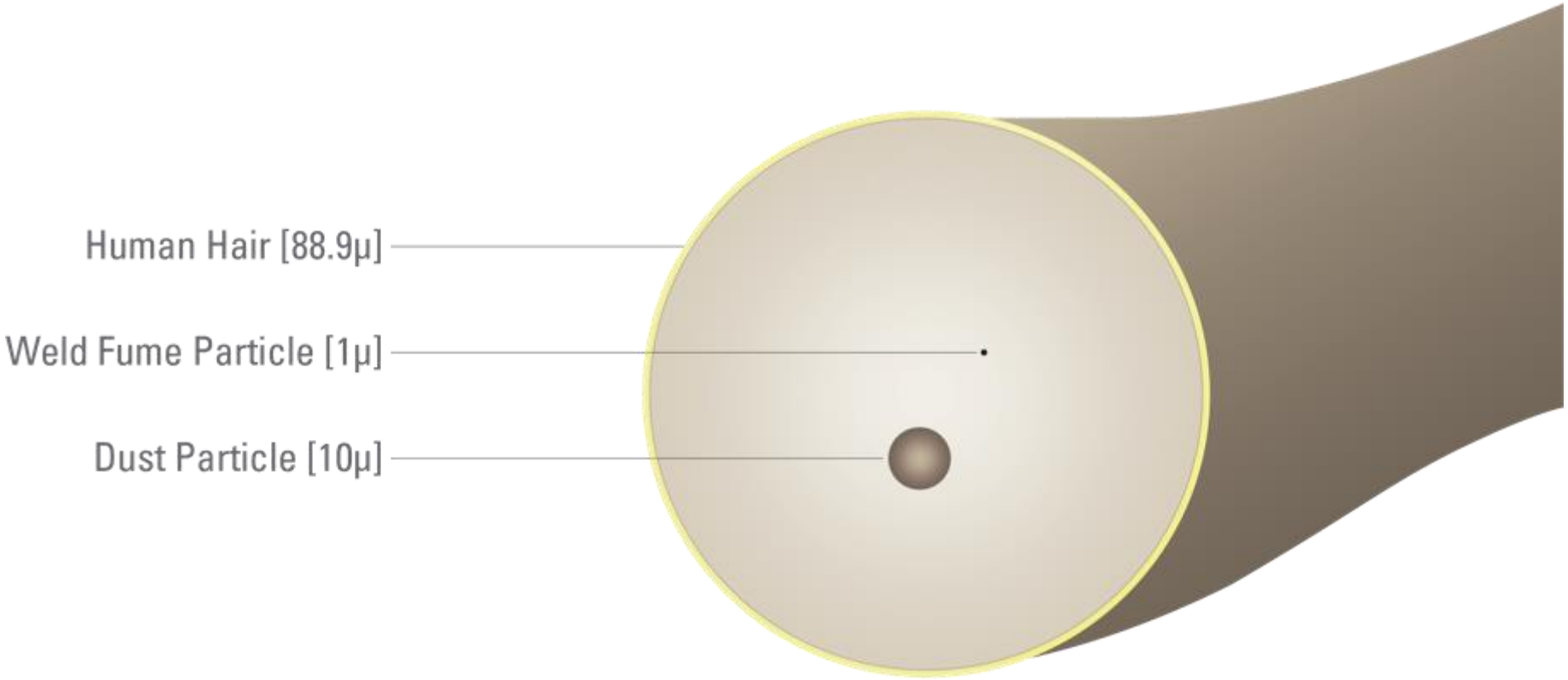
HOW SMALL CAN THE NAKED EYE SEE?

Particle Sizes in the Workplace



Relative Size of Weld Fume Particles

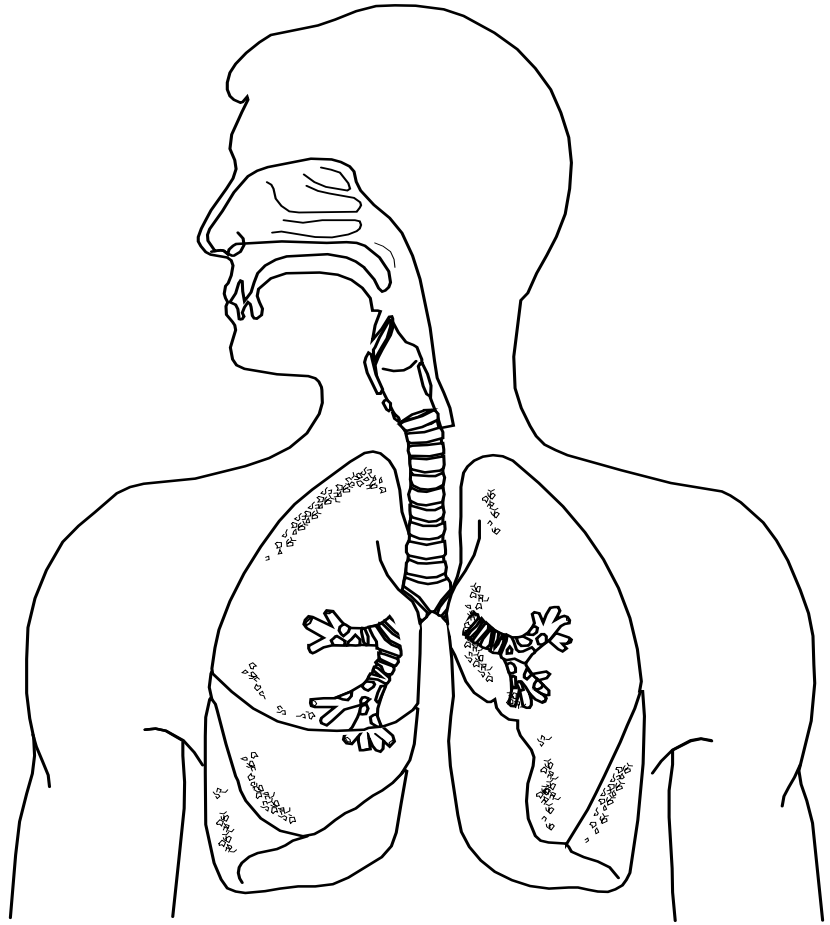
What you need to know!



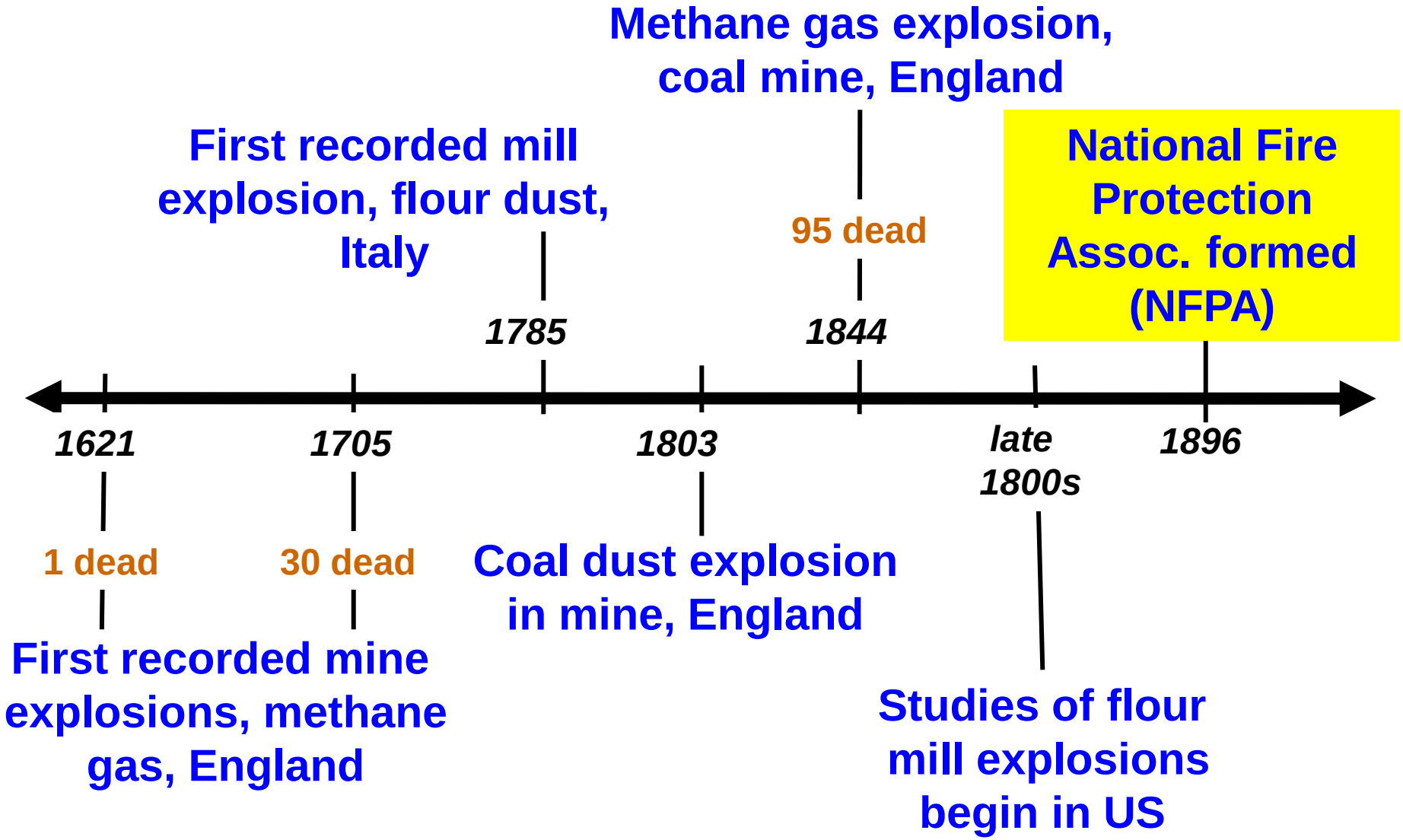
Weld fume particles come from consumable electrodes, molten puddles, shielding gases, base metals, or previously applied paint/surface coatings.

Health Hazards

- Particulates
  - Lung diseases such as cancer
  - Lung irritants
  - Toxic
- Gases
  - Pulmonary effects
  - Non-pulmonary effects



Early Timeline of Events



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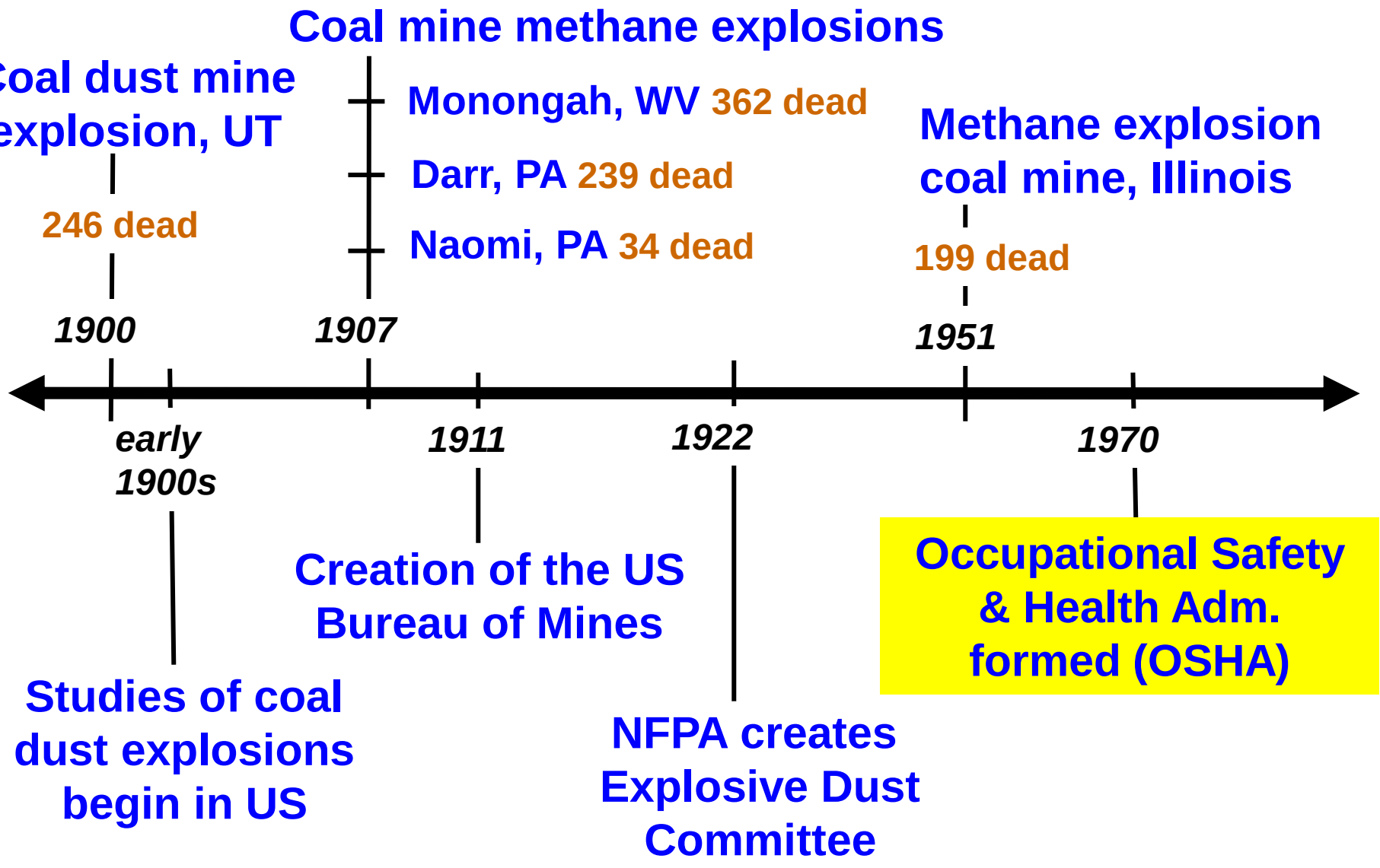
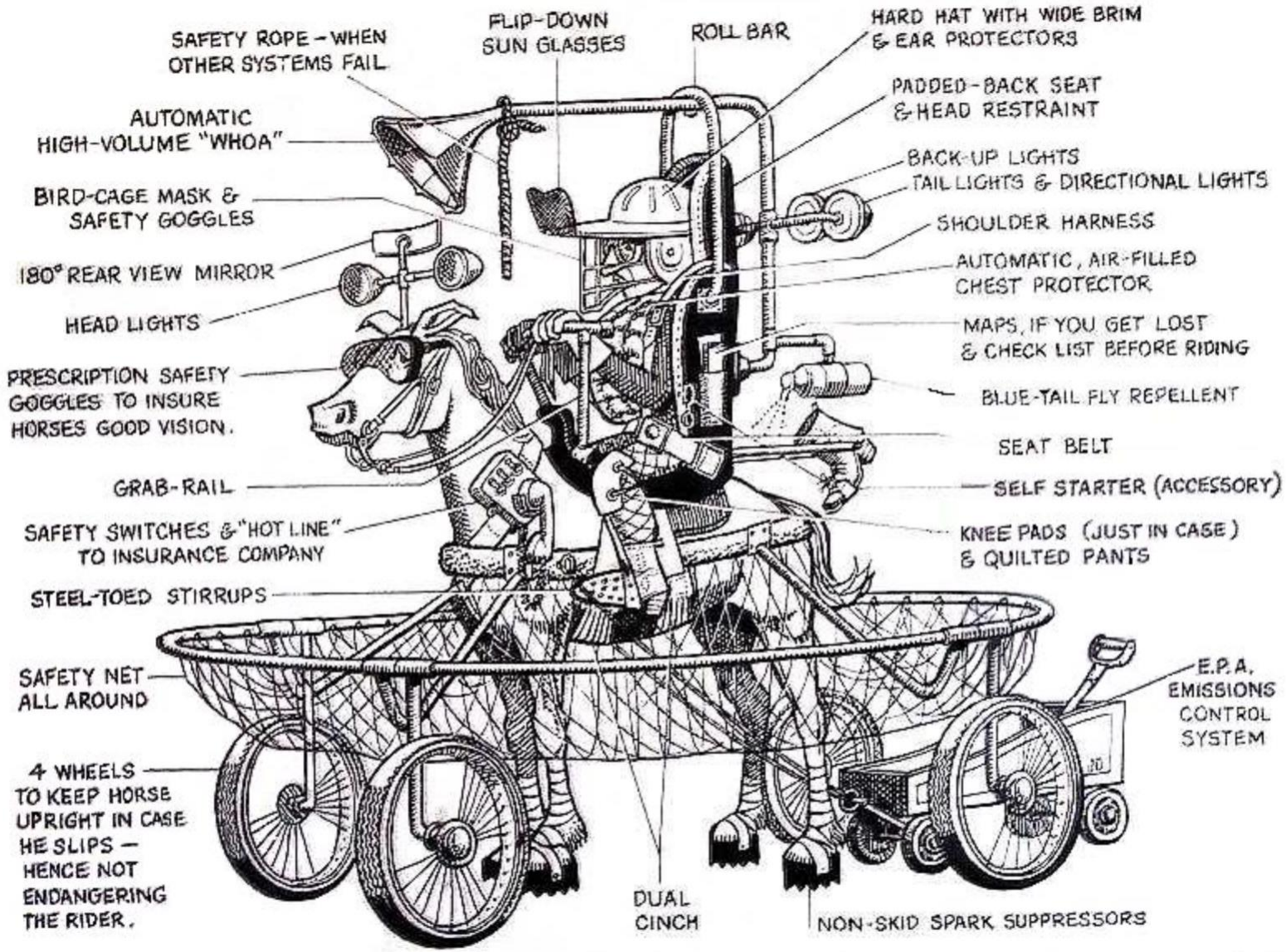




Cowboy after O.S.H.A. Inspection

Recent OSHA investigations

Hayes Lemmertz
Indiana 2003

1 dead
several Injured

<u>Cause:</u>
Aluminum Dust in casting facility
Incorrect Isolation

Recent OSHA investigations

February 20, 2003
CTA Acoustics
Corbin, KY

7 dead

Cause:
Phenolic resin dust accumulated in production area exploded

Recent OSHA investigations

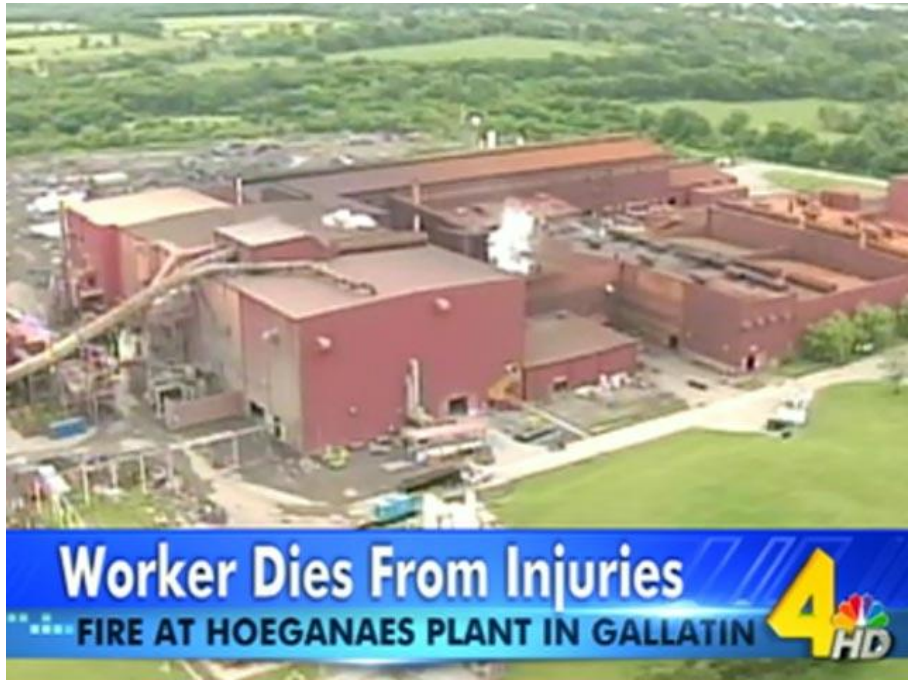
THREE Incidents

Hoeganaes
Gallatin, TN

January 31, 2011
(2 deaths)

March 29, 2011
(1 seriously injured)

May 27, 2011
(3 deaths, 2 injured)



As a result of these incidents, the CSB issued a report urging OSHA to publish a combustible standard in one year.

Cause:
Accumulations of fine iron powder with lack of engineering controls and basic housekeeping

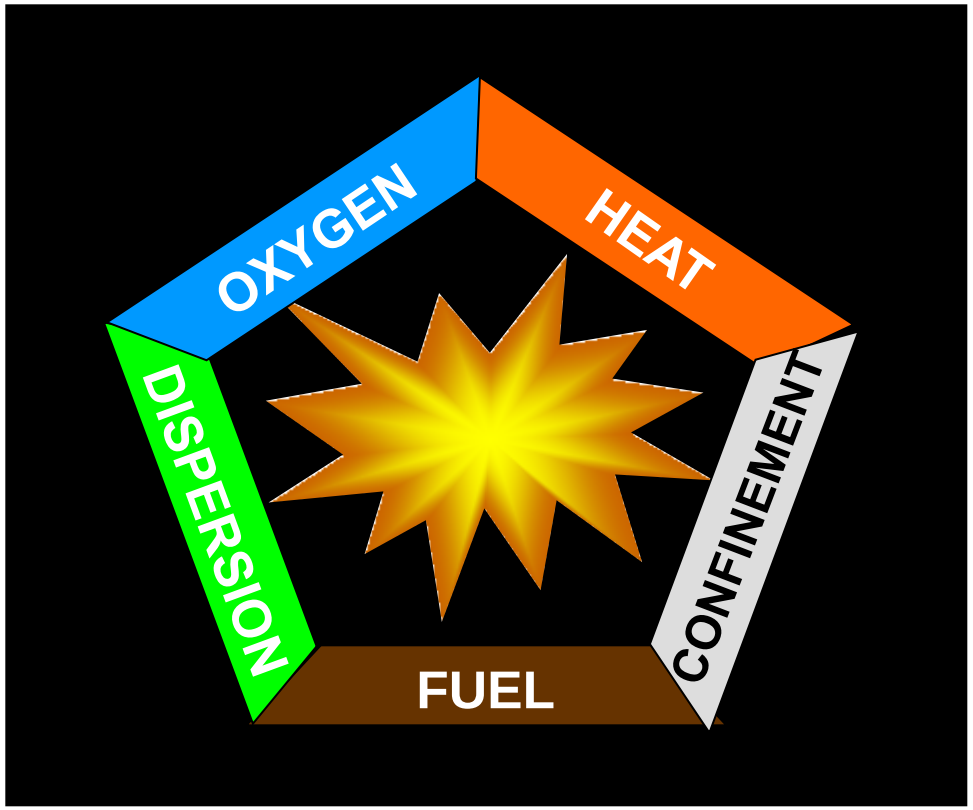
Explosion Types

- **Primary Explosion** – usually in process equipment
- A **Primary Dust Explosion** - occurs when a dust suspension within a container, room or piece of equipment is ignited and explodes
- A **secondary explosion** occurs when dust accumulated on floors or other surfaces is lifted into the air and ignited by the primary explosion

Dust Explosion Pentagon

5 basic elements needed for an explosion:

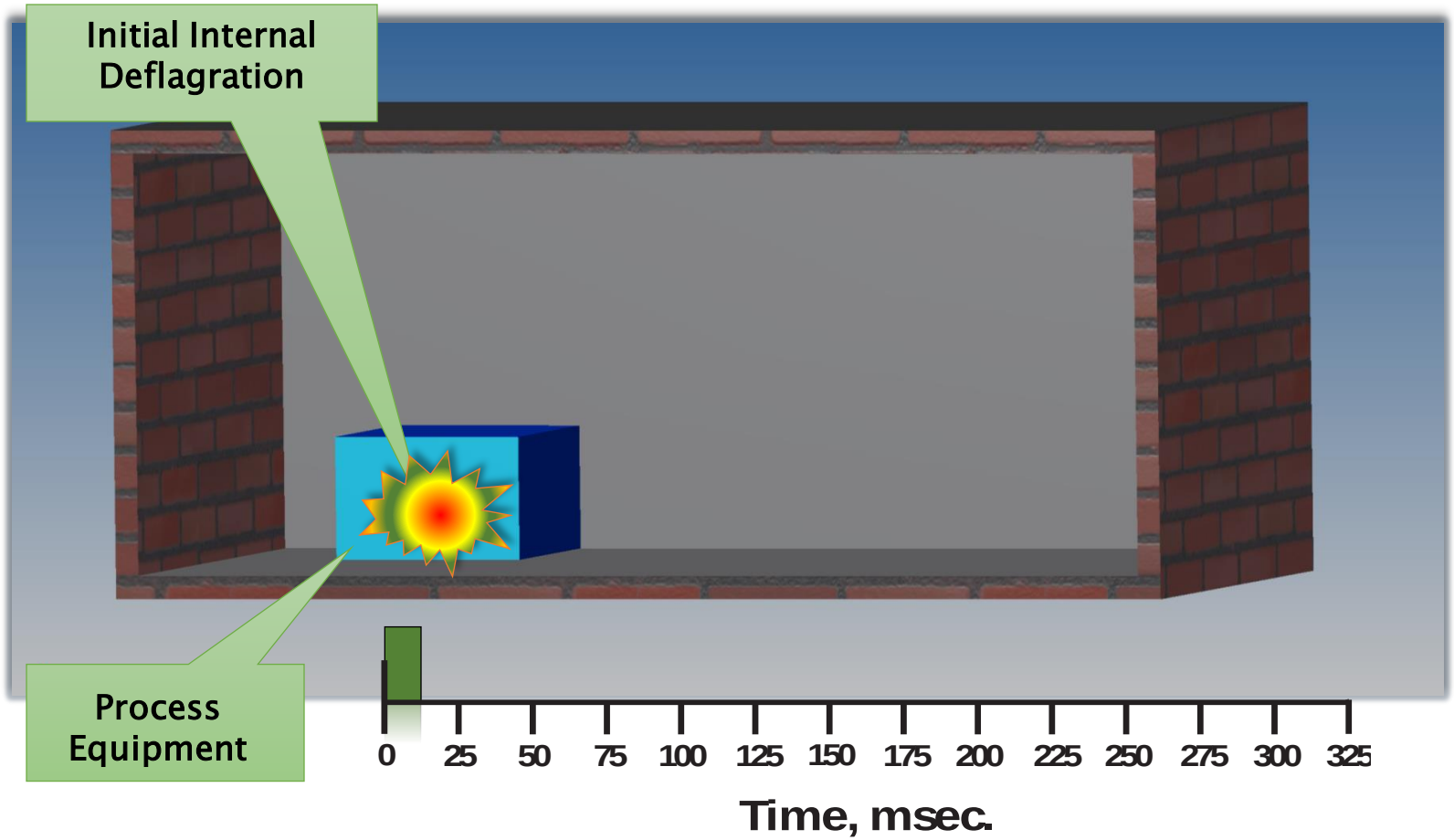
1. A fuel is needed to burn (combustible dust)
2. Oxygen is needed to sustain the fire (air)
3. Heat from an ignition source is needed (spark)
4. A high concentration of dust is dispersed into the air (deflagration)
5. The dust must be confined within an enclosure or structure (explosion)



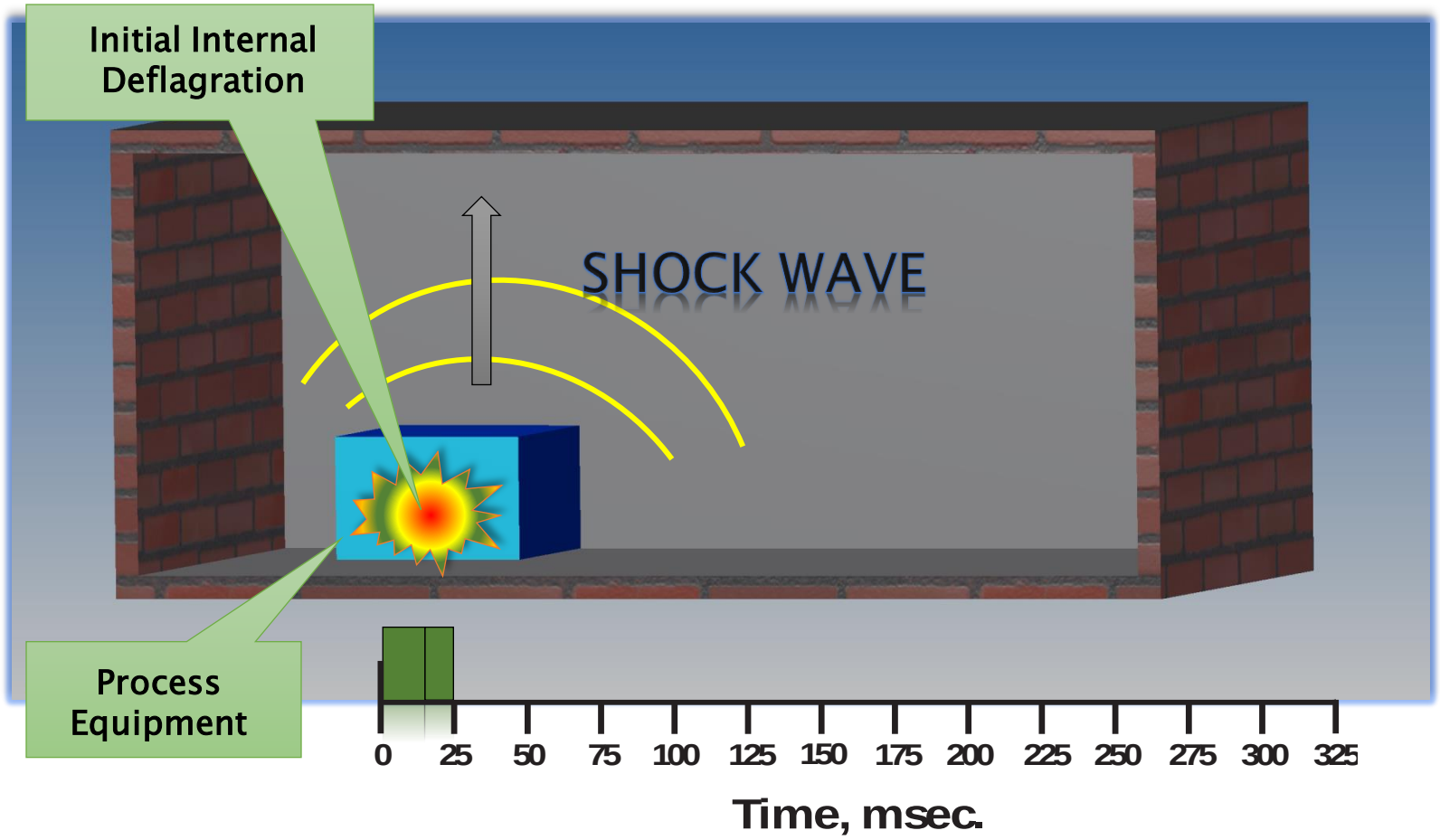
What is Combustible Dust?

- At present there is no universal definition for combustible dust.
- The OSHA NEP defines it as “particulate solid that presents a fire or deflagration hazard when suspended in air or some other oxidizing medium over a range of concentrations, regardless of particle size or shape.”
- The NFPA defines it as “any finely divided solid material that is 420 microns or smaller in diameter that presents a fire or explosion hazard when dispersed and ignited in air.”
- Most solid organic materials, as well as many metals and some nonmetallic inorganic materials, will burn or explode if finely divided and dispersed in sufficient concentrations.

The “Typical” Explosion Event



The “Typical” Explosion Event
(continued)



The “Typical” Explosion Event
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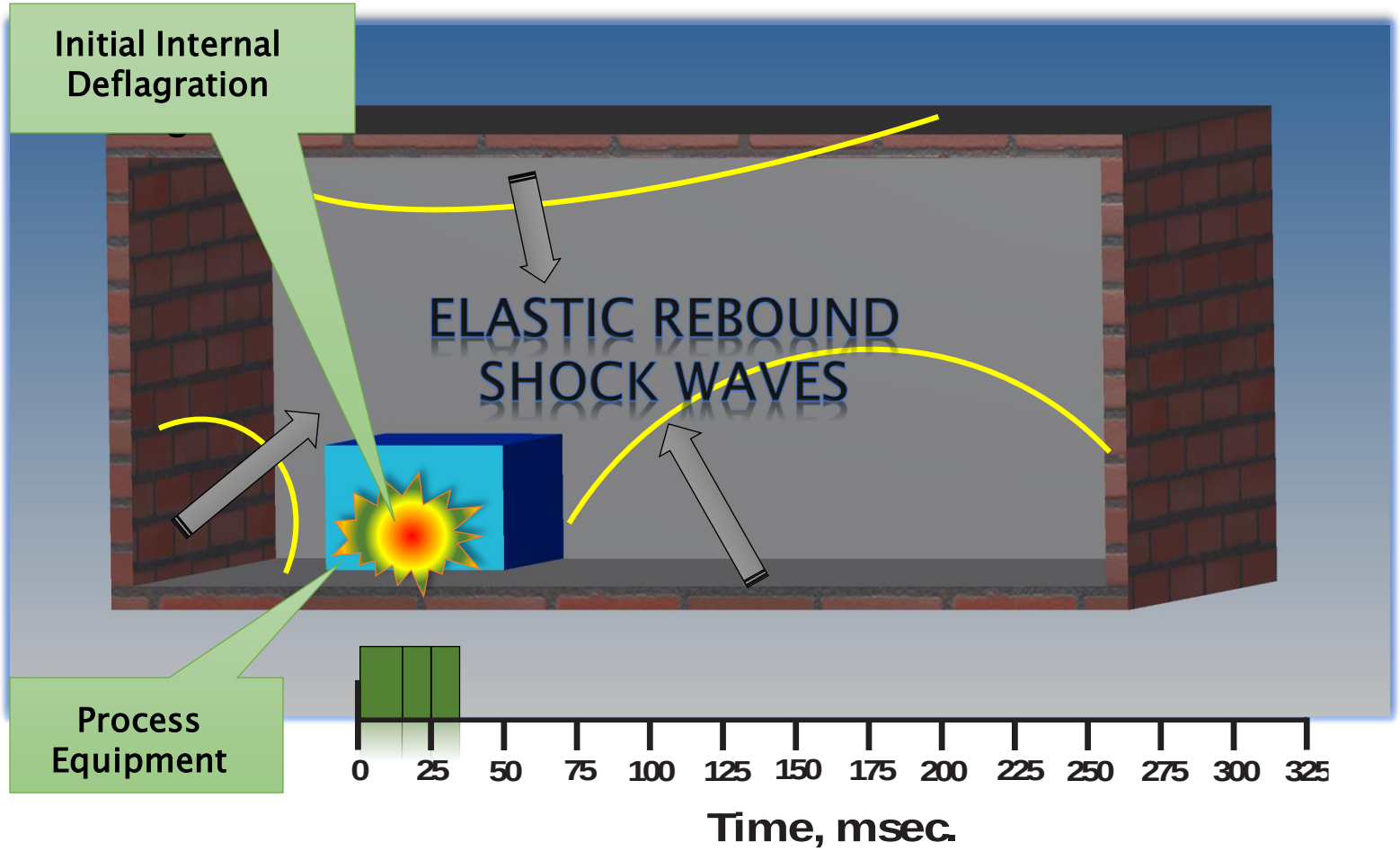

The “Typical” Explosion Event
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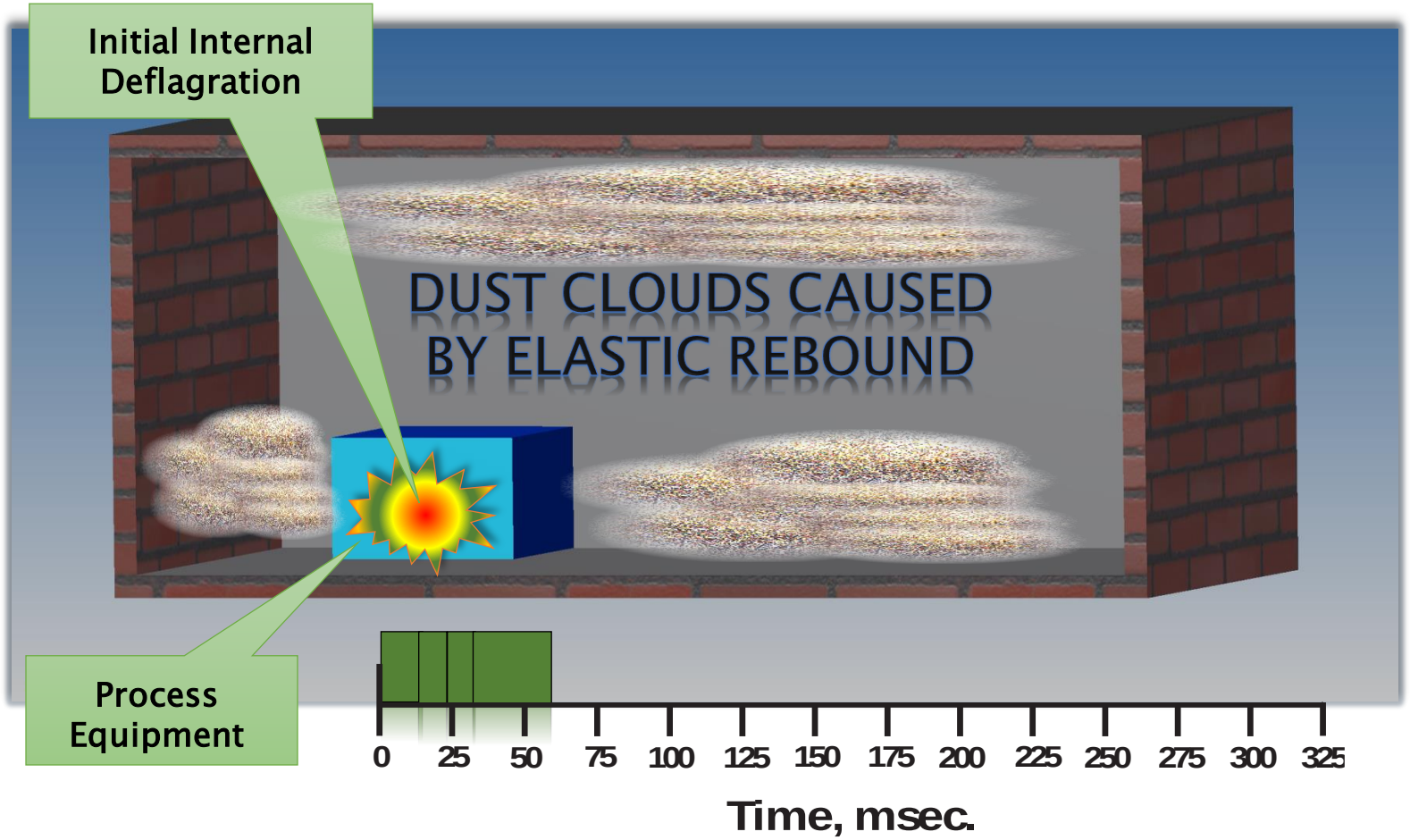

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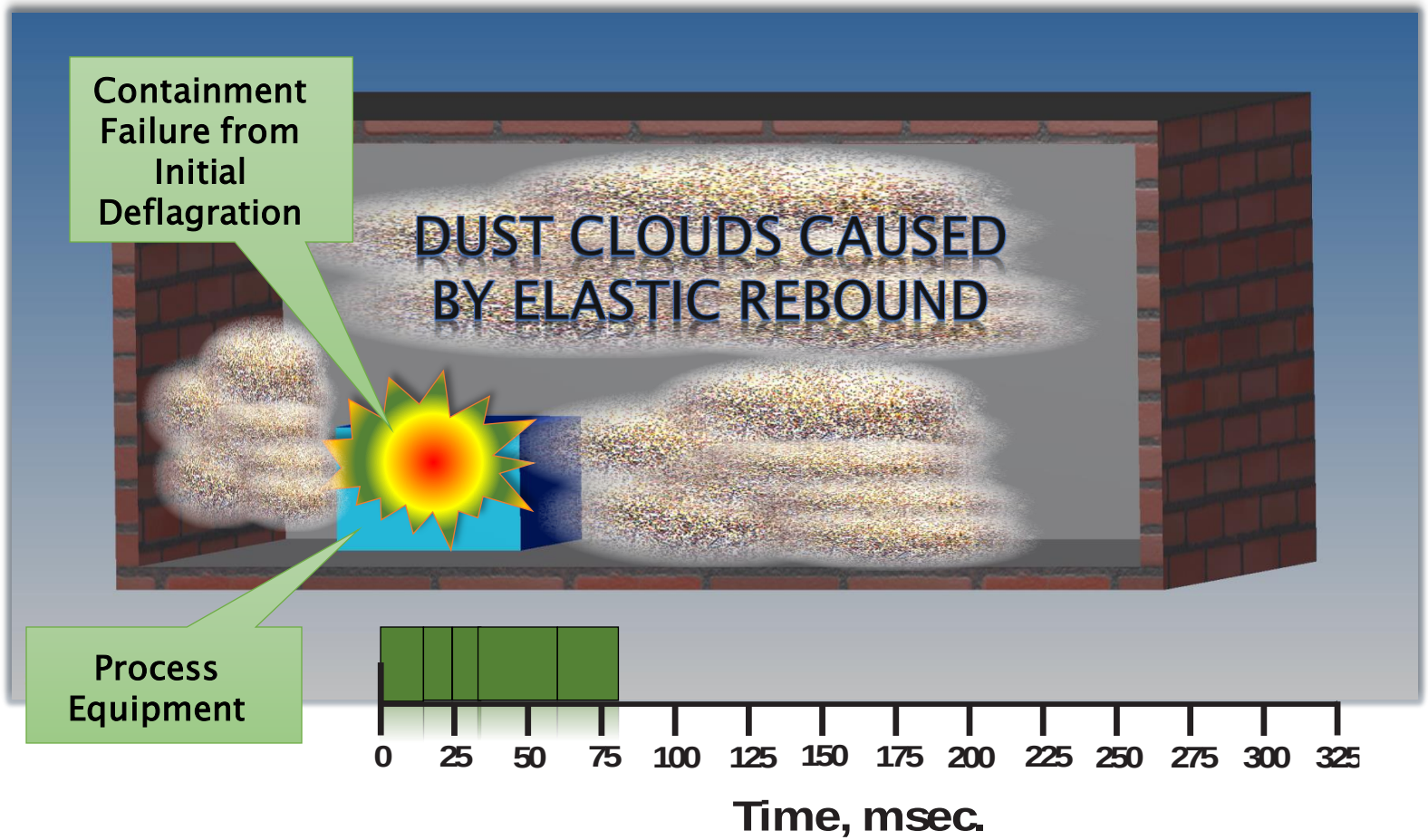

The “Typical” Explosion Event
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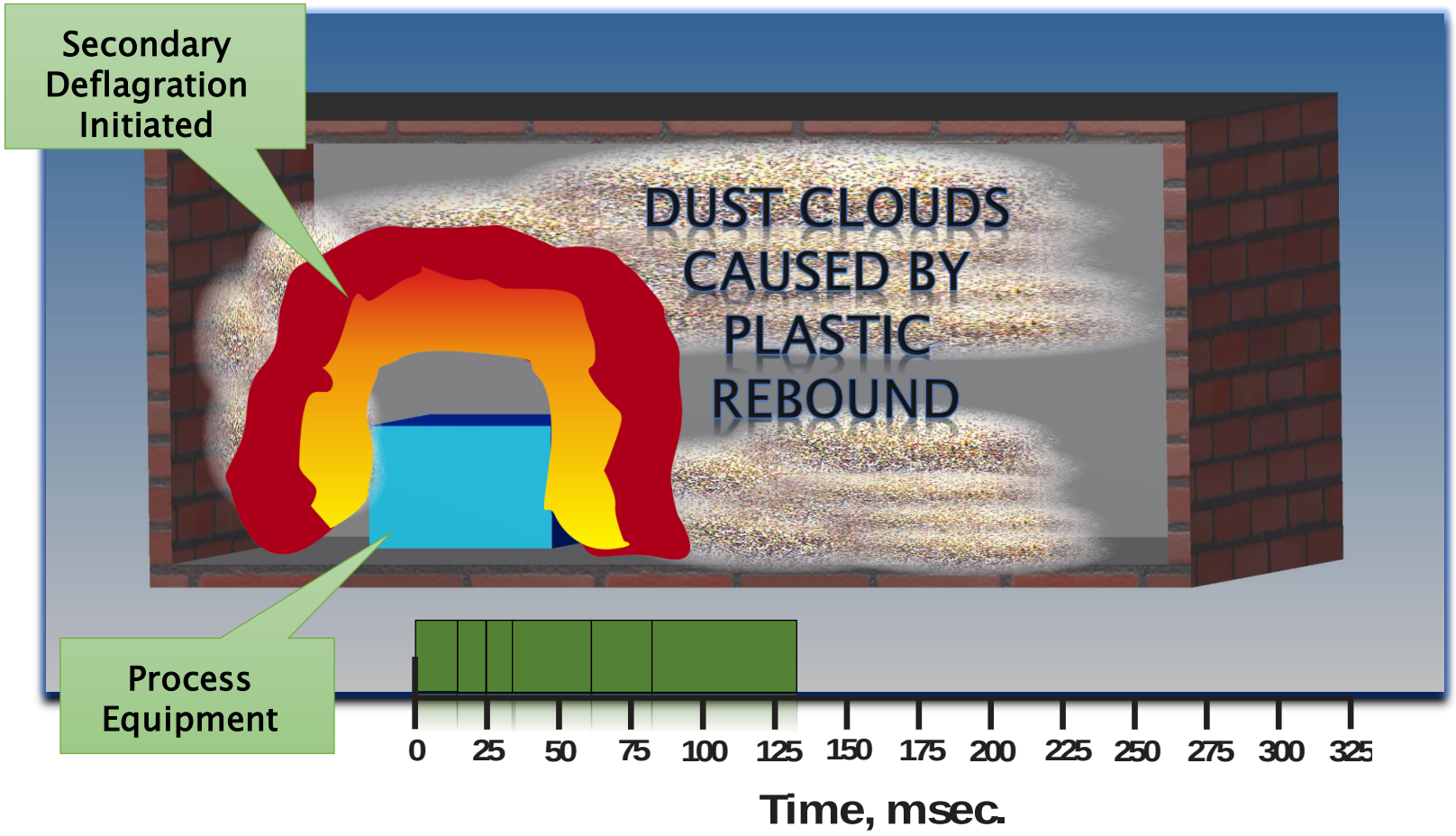

The “Typical” Explosion Event
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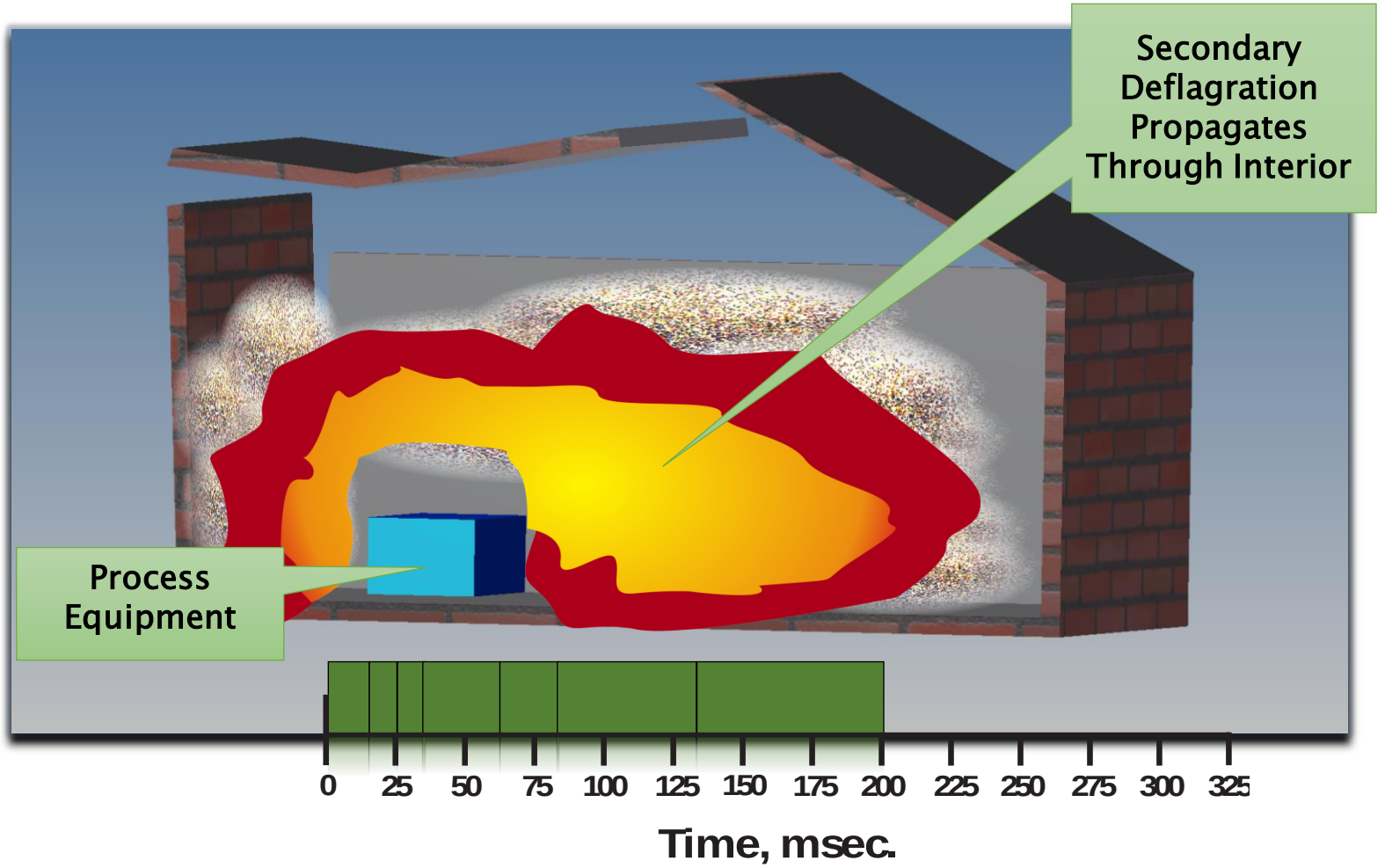
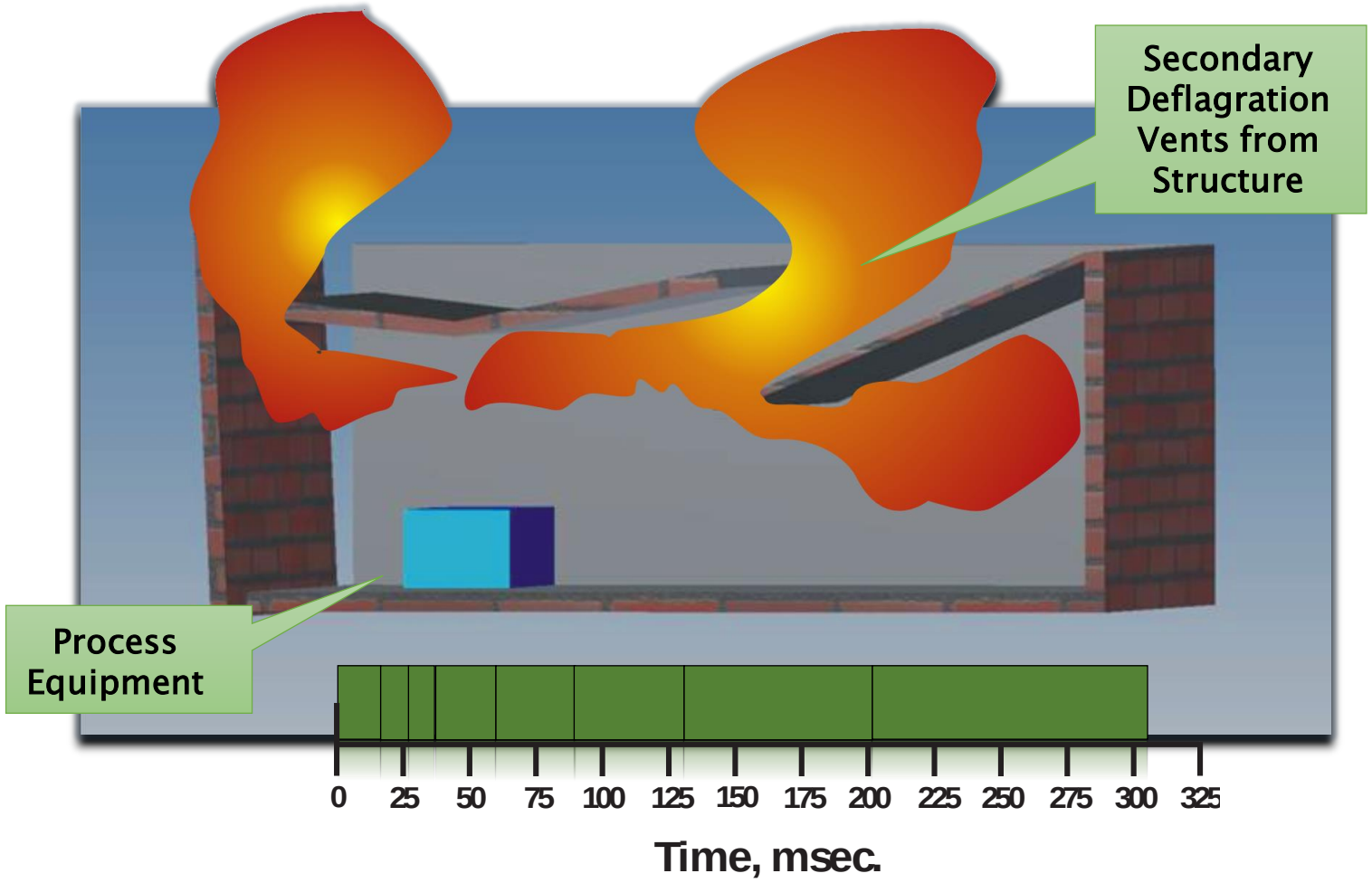


The “Typical” Explosion Event
(continued)



The “Typical” Explosion Event
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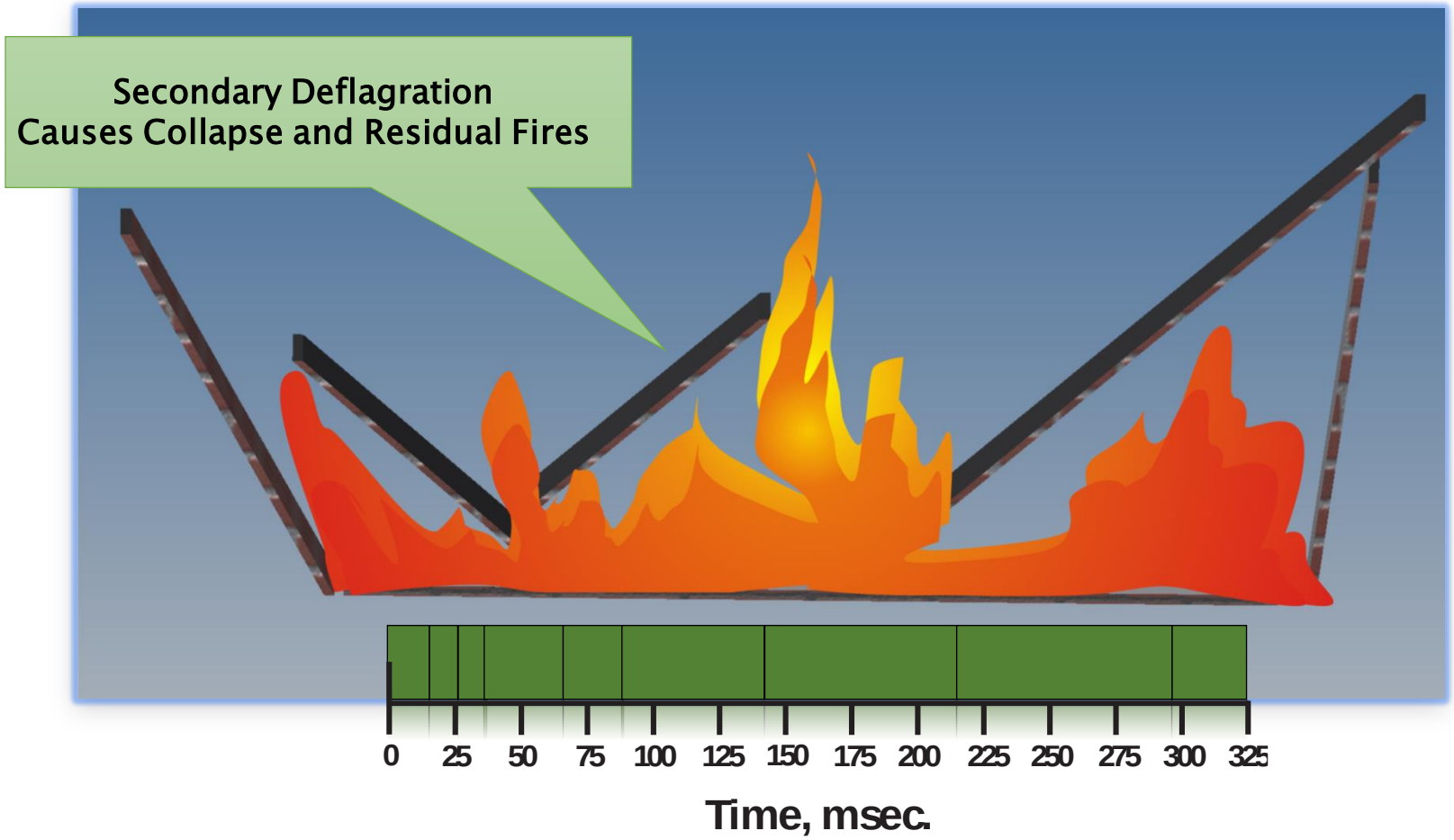
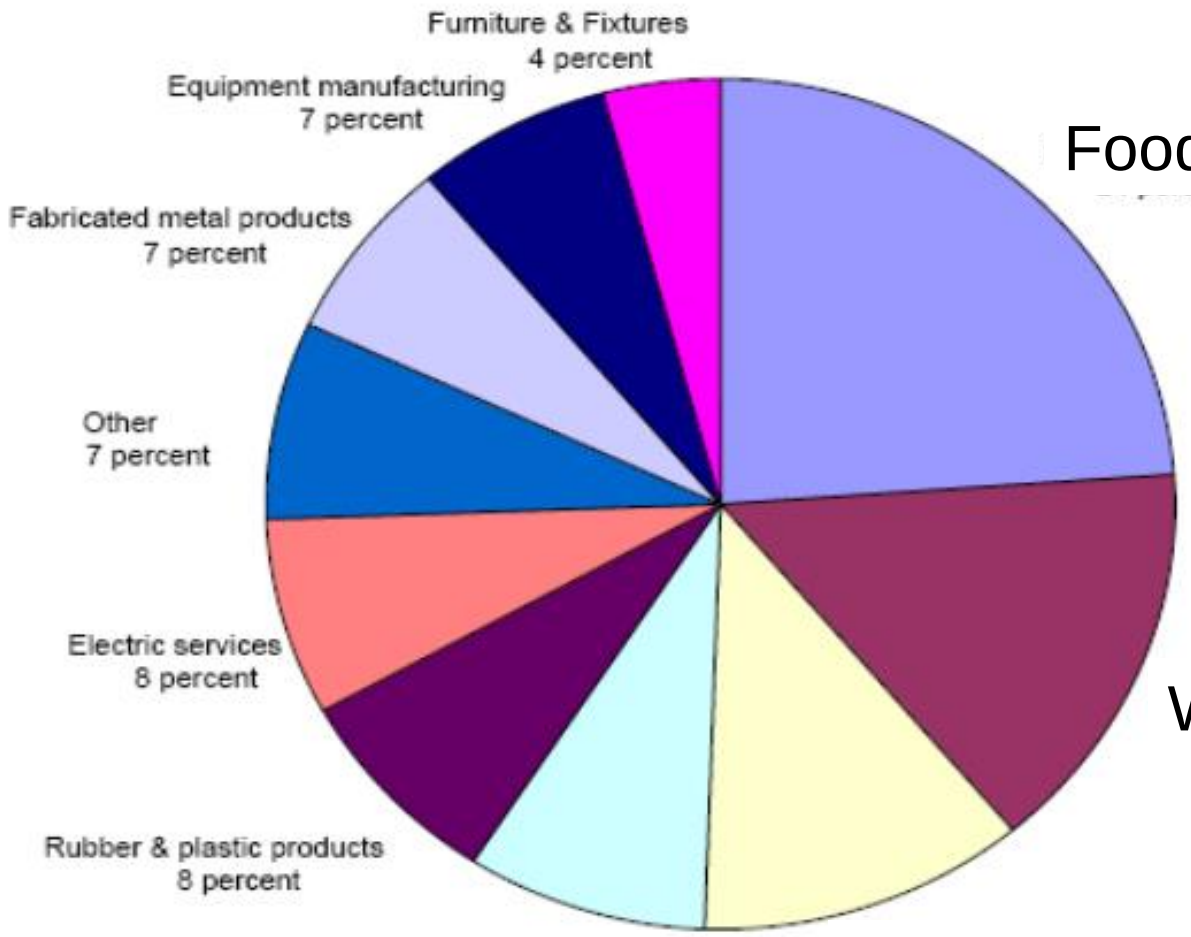
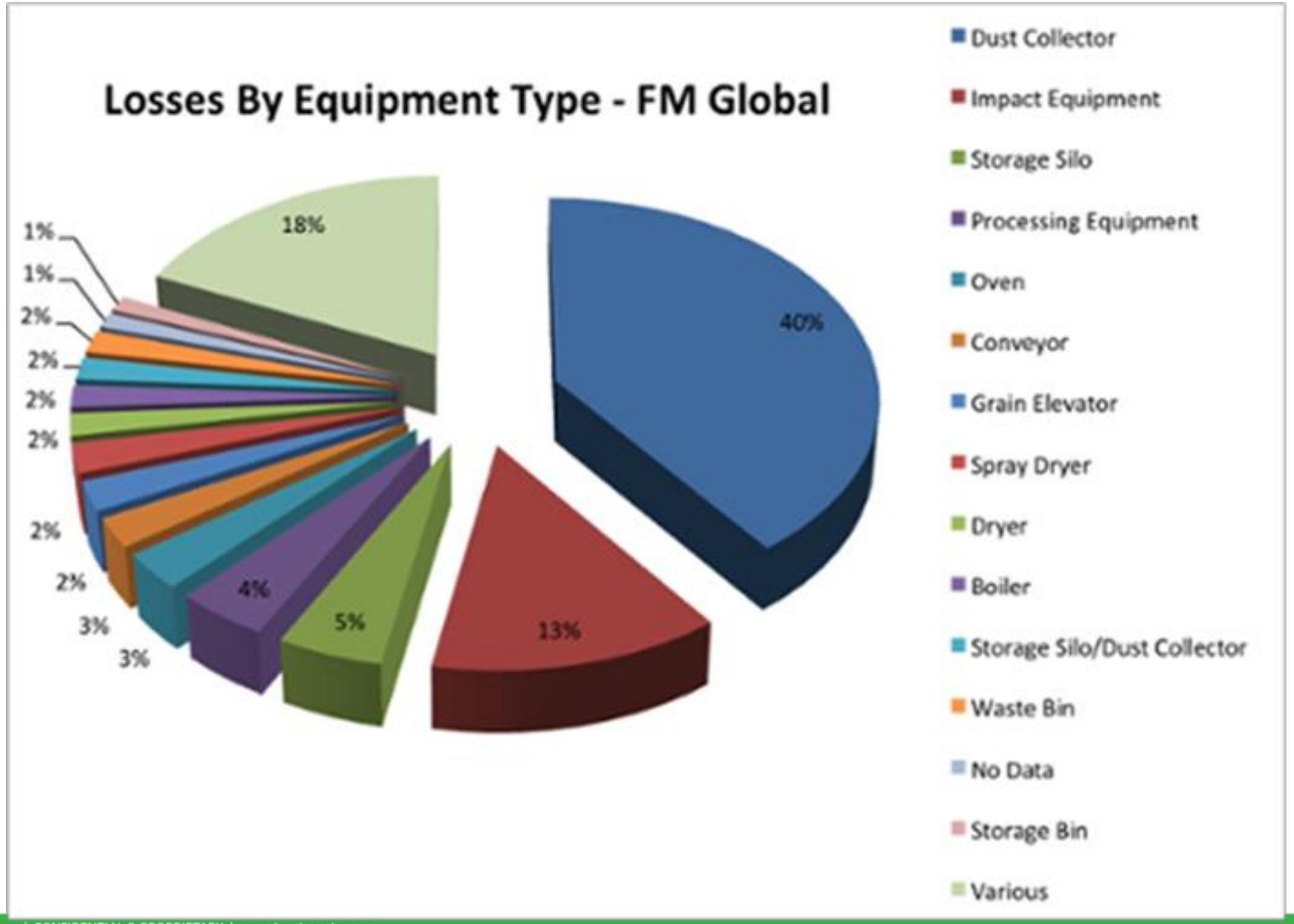


Who's at Risk?

Industries having high incidence of combustible dust issues



source OSHA NEP, 2008



Is My Dust Combustible?

- It is up to YOU, the manufacturer, to know the composition of the material(s) you process and all applicable laws
- MSDS sheets are a starting point, but most do not address explosivity
- NFPA standards 664, 654, 484 and 61

  are helpful resources
- Ideally, have your dust TESTED

Commonly Measured Properties of Combustible Dusts

Property	Definition	ASTM Test Method	Application
K_{St}	Dust deflagration index	ASTM E 1226	Measures the relative explosion severity compared to other dusts
P_{max}	Maximum explosion overpressure generated in the test chamber	ASTM E 1226	Used to design enclosures and predict the severity of the consequence
$(dP/dt)_{max}$	Maximum rate of pressure rise	ASTM E 1226	Predicts the violence of an explosion. Used to calculate K_{st}
MIE	Minimum ignition energy	ASTM E 2019	Predicts the ease and likelihood of ignition of a dispersed dust cloud
MEC	Minimum explosible concentration	ASTM E 1515	Measures the minimum amount of dust, dispersed in air, required to spread an explosion Analogous to the lower flammability limit (LFL) for gas/air mixtures
LOC	Limiting oxygen concentration	ASTM standard under development	Determines the least amount of oxygen required for explosion propagation through the dust cloud
ECT	Electrostatic charging tendency	No ASTM standard	Predicts the likelihood of the material to develop and discharge sufficient static electricity to ignite a dispersed dust cloud

NFPA industry codes requiring explosion protection

NFPA 652	Fundamentals of Combustible Dusts
NFPA 654	Manufacturing, Processing and Handling of Combustible Particulate Solids
NFPA 61	Agricultural and Food Products Facilities
NFPA 664	Wood Processing and Woodworking Facilities
NFPA 484	Combustible Metals
NFPA 30B	Manufacture and Storage of Aerosol Products
NFPA 33	Spray Application Using Flammable or Combustible Materials
NFPA 91	Exhaust Systems for Air Conveying of Vapors, Gases, Mists

Relevant Standards

NFPA #	Title
654	Prevention of Fire & Dust Explosions from Manufacturing, Processing, and Handling of Combustible Particulate Solids
664	Prevention of Fires & Explosions in Wood Processing and Woodworking Facilities
484	Standard for Combustible Metals, Metal Powders and Metal Dusts
61	Prevention of Fires and Dust Explosions in Agricultural and Food Products Facilities
655	Standard for Prevention of Sulfur Fires and Explosions

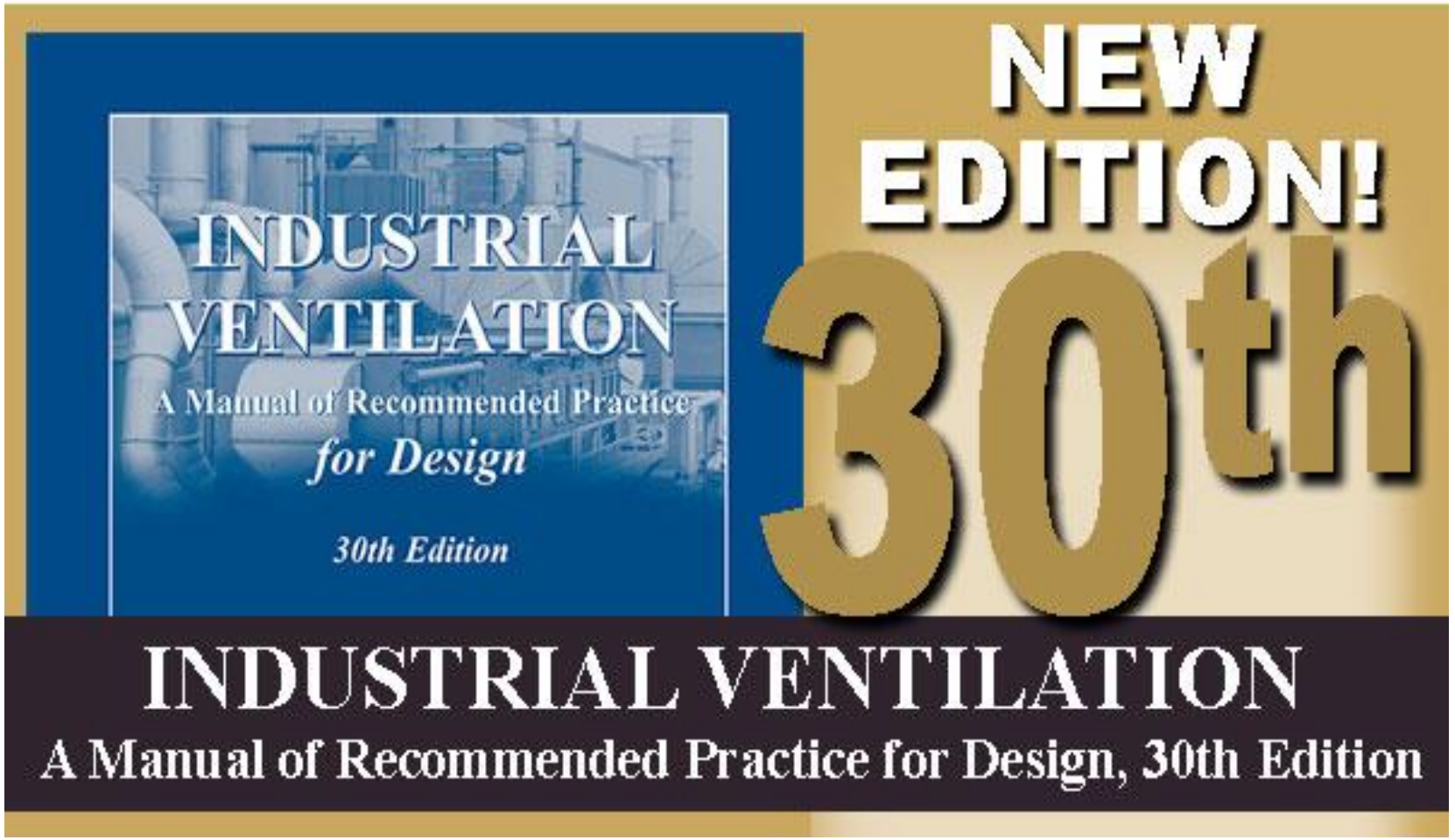
NFPA Design Standards

NFPA #	Title
68	Venting of Deflagrations
69	Explosion Protection Systems
70	National Electric Code
77	Recommended Practice on Static Electricity
499	Recommended Practice for the Classification of Combustible Dusts and Of Hazardous (Classified) Location for Electrical Installations in Chemical Process Areas
91	Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids

HASTINGS®
air energy control, inc.
creating a cleaner workplace

Dust Collector Design

NOW AVAILABLE!



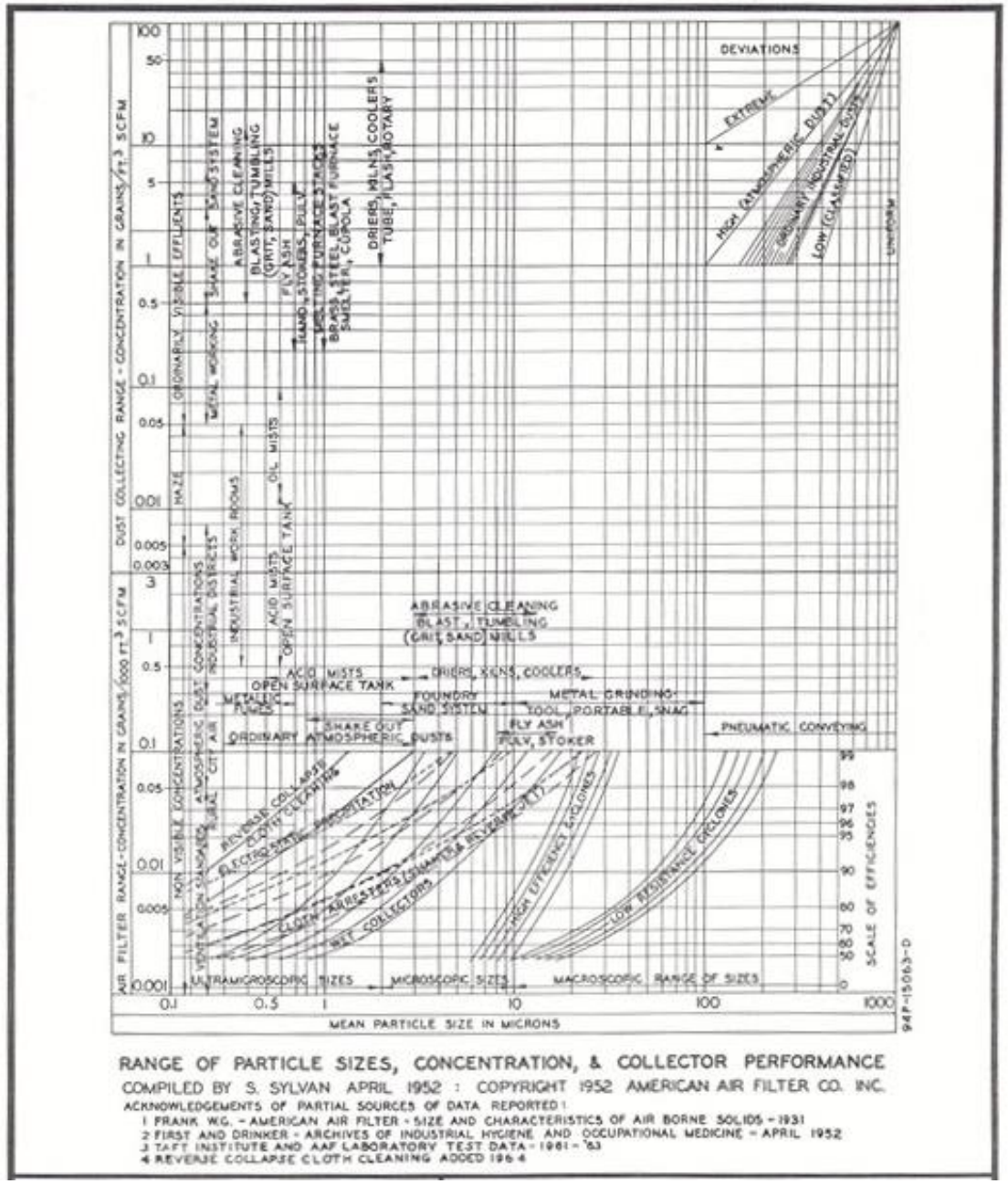
Typical air to cloth ratios

Dust	Shaker/Woven Reverse Air/Woven	Pulse Jet/Felt
Alumina	1.27	4.07
Asbestos	1.52	5.08
Cocoa, chocolate	1.42	6.10
Cement	1.02	4.07
Coal	1.27	4.07
Enamel frit	1.27	4.57
Feeds, grain	1.78	7.11
Fertilizer	1.52	4.07.
Flour	1.52	6.10
Flyash	1.02	2.54
Graphite	1.02	2.54
Gypsum	1.02	5.08
Iron ore	1.52	5.59
Iron oxide	1.27	3.56

Efficiency Chart

American Conference of Governmental Industrial Hygienists (ACGIH)

Range of Particle Size



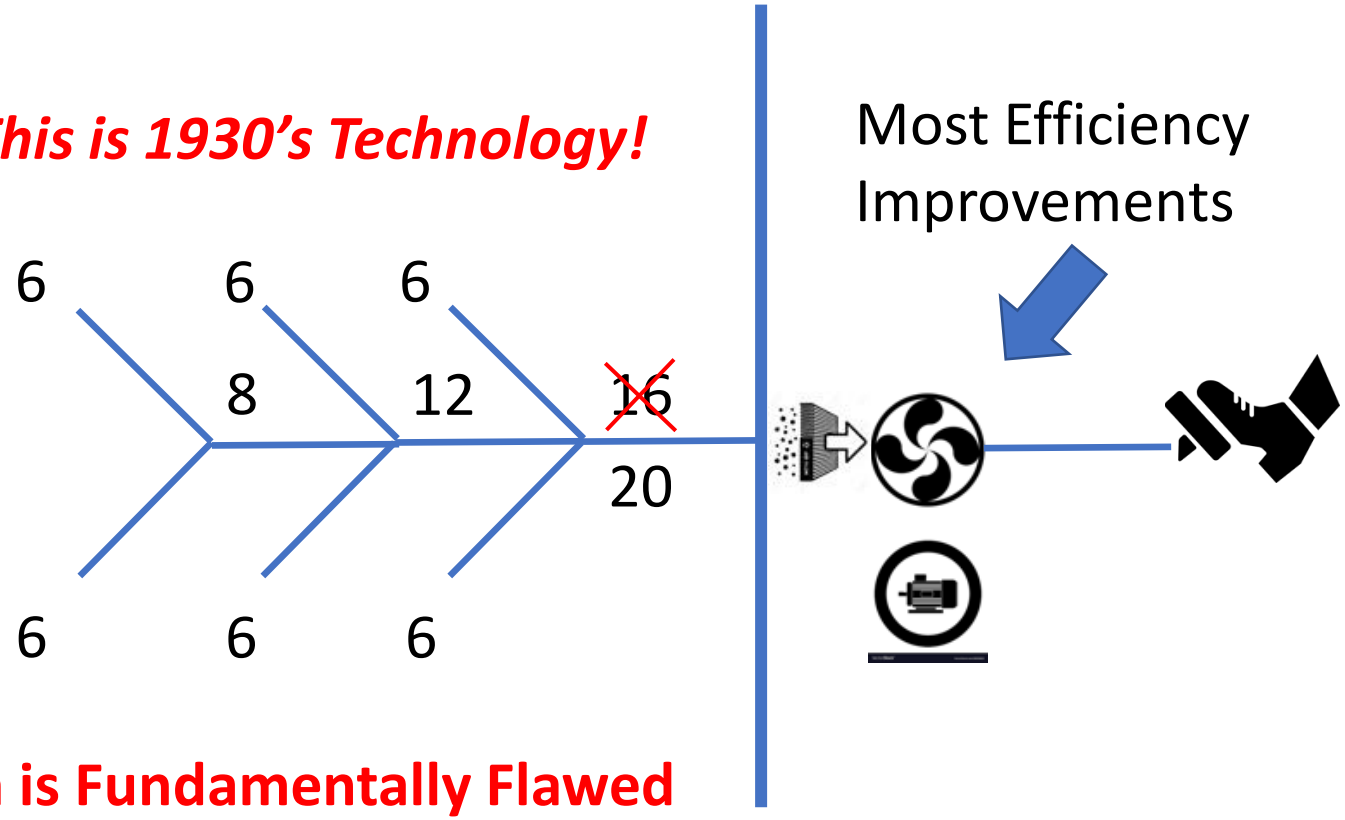
Design Considerations

- Duct Size
- Utilization Rates
- Fan Curve

Conventional Ducted Systems (Static)

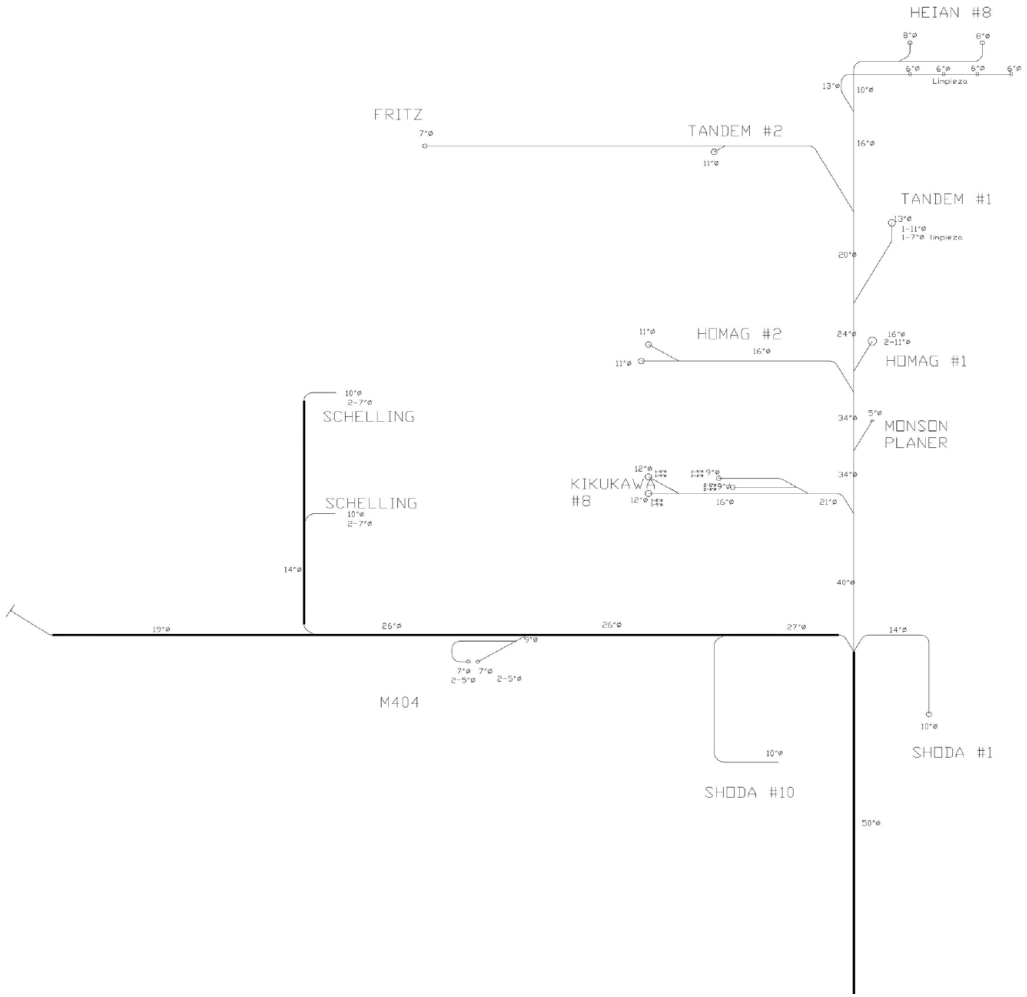
1 + 1
= ?

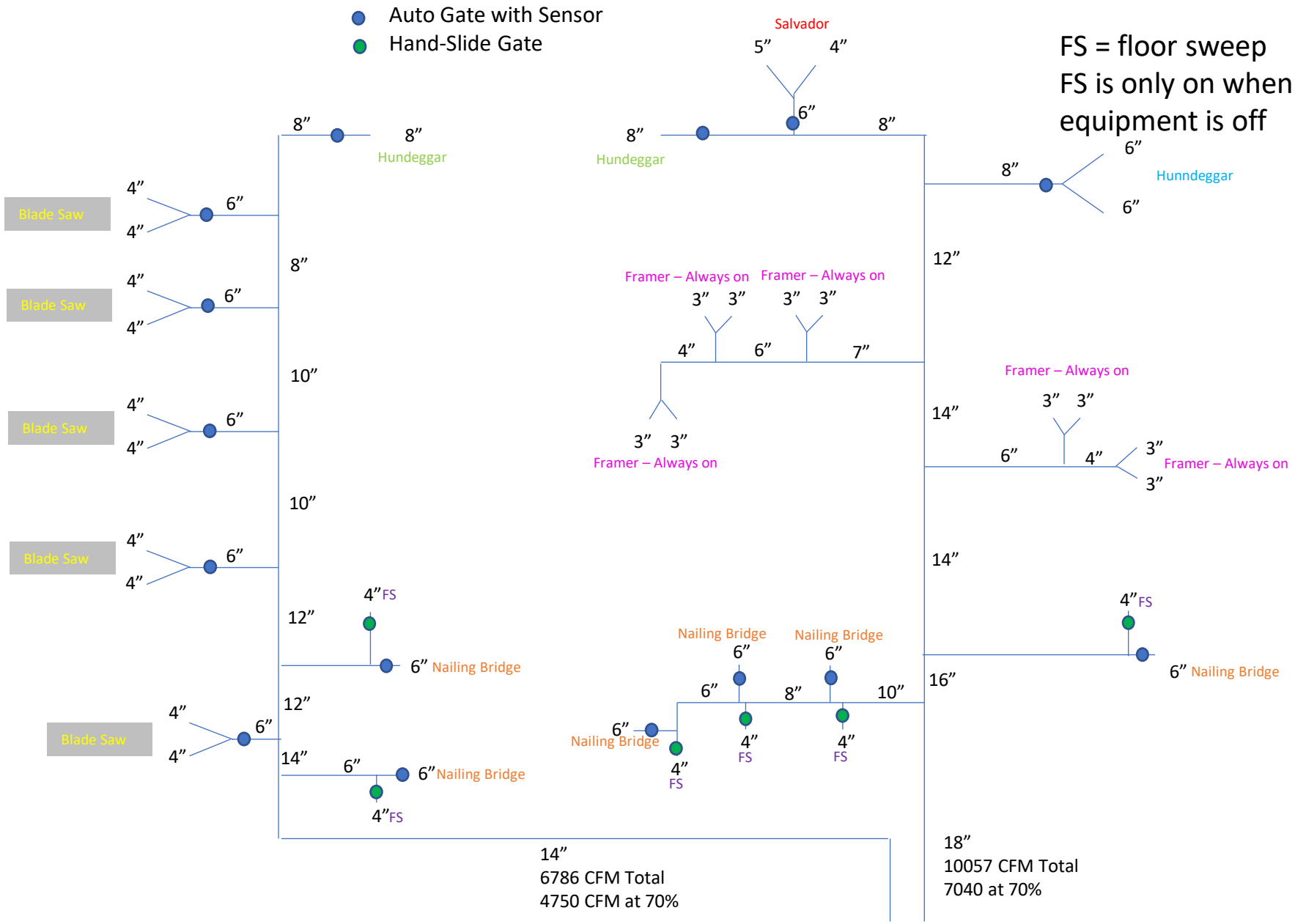
This is 1930's Technology!



The System Design is Fundamentally Flawed

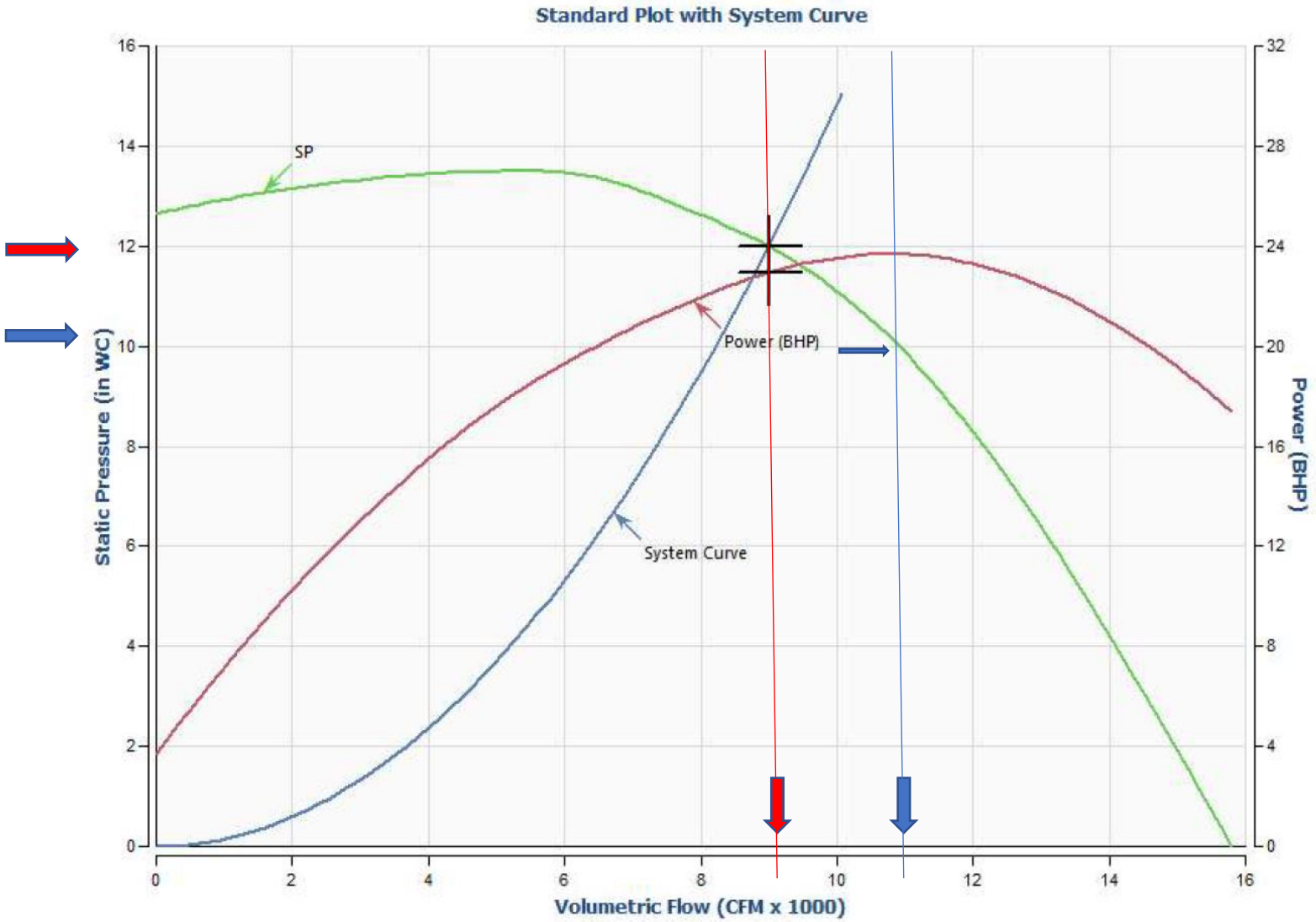
Sample Layout Drawing





What is a utilization rate?

- The percentage of time a piece of equipment runs during a shift
- A saw doesn't run during lunch, breaks, or while an operator is loading or unloading material. If the saw runs for 5 hours during an 8 hour shift, the utilization rate is (5hrs/8hrs) 62.5%
- One of the most efficient companies in the world, Toyota, has utilization rates around 74%

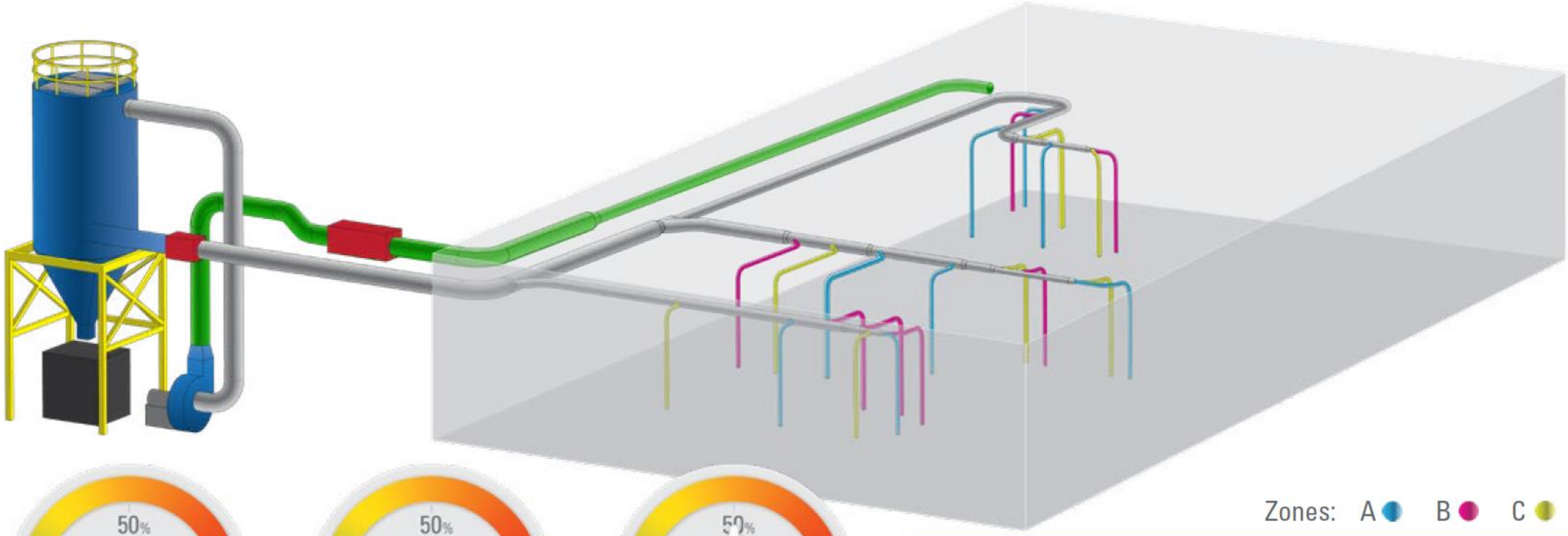


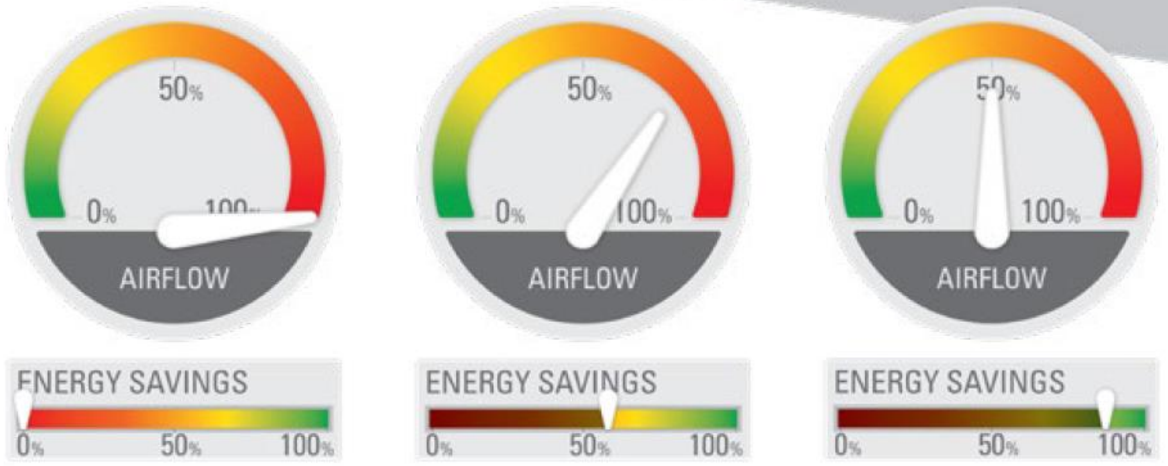
Fan Curve – Static Pressure vs Airflow

- Trade off between flow and pressure
- An increase in pressure results in a decrease in volume
- Start at 10” WC and the flow is 11,000 CFM
- Increase the pressure by 2” to 12” and the CFM decreases to 9000 CFM, a 2000 CFM difference

Challenges for dust collection

- Not flexible
- Changing Airflow
- Operators





GAUGES (L to R):

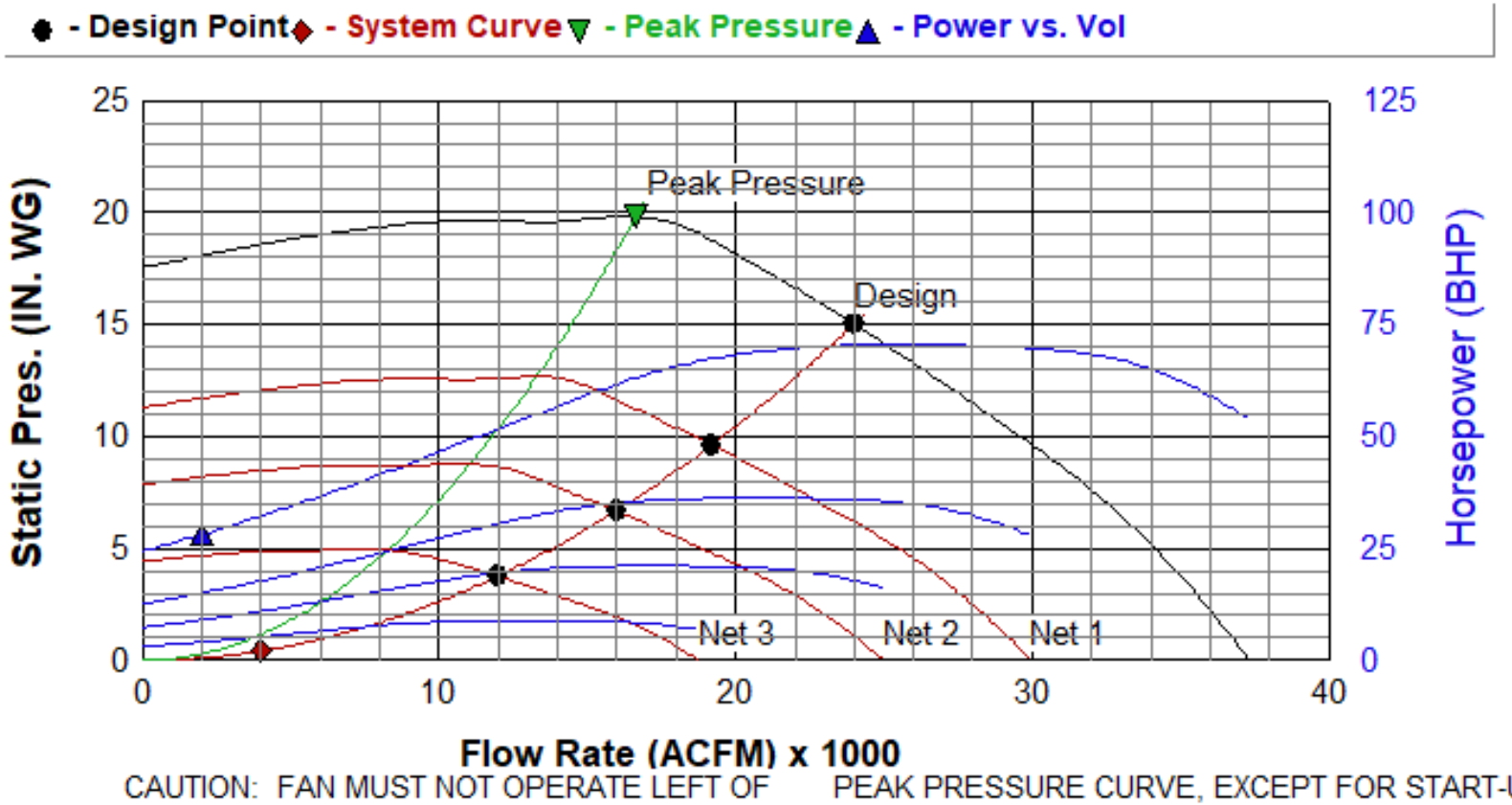
All lines open: 100% flow, 100% energy usage

Zone A closed: 25% reduction in flow, 58% energy savings

Zones A & B closed: 50% reduction in flow, 87% energy savings

Automatic Gates

Multiple Fan Curves



Steward Control

IVEC STEWARD SYSTEM

IVEC'S SMART VENTILATION ON DEMAND

Design, performance, and experience combine to create intelligent efficiency.

Solid state networking technology and over 40-years of dust collection design experience went into creating this high-performance top-of-the-line model from IVEC Systems.

Capable of controlling the individual ventilation needs of up to 200 workstations simultaneously, the Steward's unique network design allows it to be tapped for additional drops at any time, making the Steward the best solution for business operations seeking flexibility and growth.

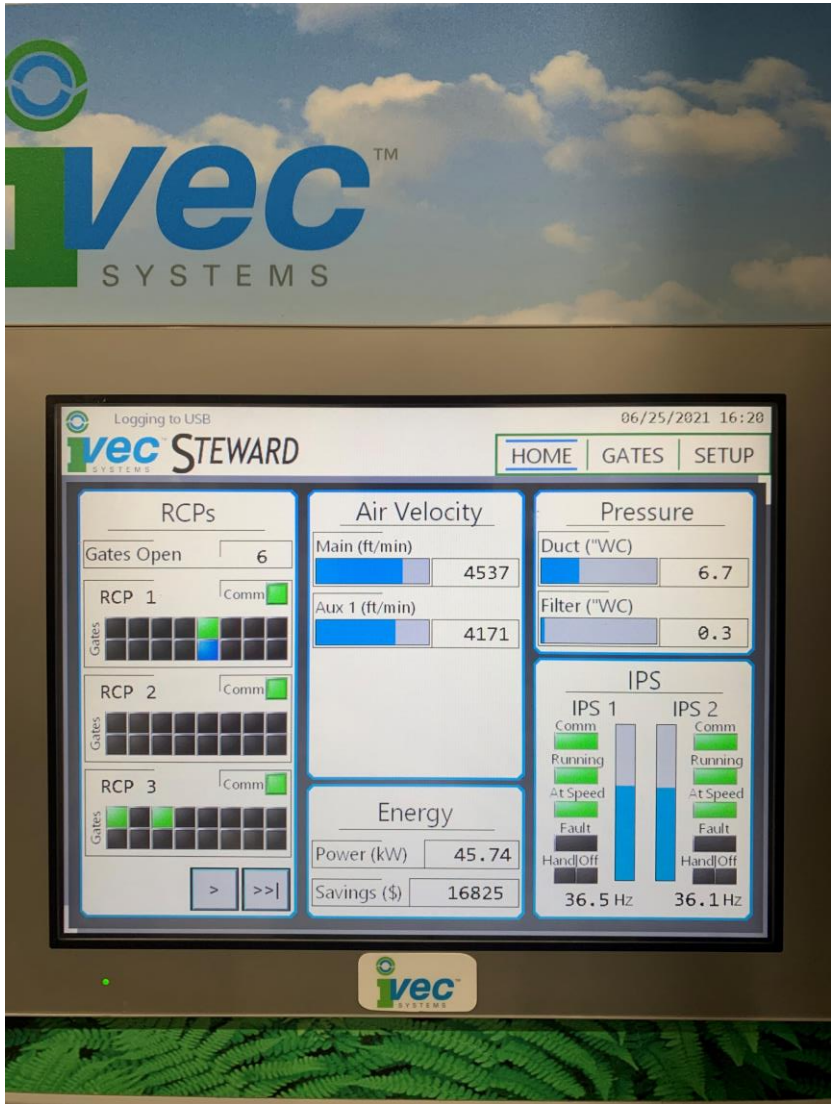
Using a host of automated switching and sensor devices, the Steward automatically controls gates to provide just the right amount of suction for each individual workstation, while carefully regulating power to the blower, delivering optimal performance to the entire shop.

FEATURES

- Designed for any size ventilation needs
- IVEC on-demand system allows for improved performance and added CFM capacity
- Fully automatic management capabilities to control all system components
- Intelligent system technology senses and informs you of possible problems
- Remote Access and Visualization (RAAV) available
- Historical data logging and energy consumption monitoring
- Control and measure velocity with IVEC Assist

BENEFITS

- Savings of up to 50-85% energy and utility costs
- Add capacity to existing systems
- Maximize your ventilation ROI
- Reduce shop noise
- Reduce maintenance intervals
- Extend equipment life
- Extended filter life



Airflow is NOT directly proportionate to Energy Savings

25% reduction in airflow = 58% energy Savings
50% reduction in airflow = 87% energy Savings

Example – Harman Audio
Energy usage for the dust collectors was 2,686,500 kWh, costing $217,606 per year
Airflow is 140,000 CFM
Utilization rate is 50%
De-rated airflow is 70,000 CFM (140,000 * .5 = 70,000 CFM)
Energy required (not the same as utilization rate) is 50%^3 or .5^3 = .125 or 12.5%
12.5% of 2,686,500 is 335,812 kWh, costing $27,200.77
Yearly Savings = $217,606- $27,200,77 = $190,405.22
Project Cost $436,050.86
OVER 7 years, the return on investment is $1,332,835
Annualized ROI 17.31%
Payback period (initial investment/annual payback) = 2.29 years

Energy Savings

Energy Savings and Payback			
Hours per week	(hrs)	50	
Weeks per year	(Weeks)	52	
Total hours per year	(hrs)	2600	
Energy Cost	($/kWhr)	$ 0.1400	
The average commerical cost in Maine is .1665/ kWh, we used .14 for this calculation			
		IVEC On Demand	**IVEC Static System**
# of Units	(#)	1	1
Power / Unit	(HP)	125	125
Average Energy Derate	(%)	58%	0%
Ave Running Power per unit	(HP)	52.5	125
	(kW)	39.1	93.2
Total Power of Project	(kW)	39.1	93.2
Annual Energy Usage	(kWhr)	101788	242353
Annual Energy Cost	($)	$ 14,250.33	$ 33,929.35
Annual Energy Savings over static System	($)	$ 19,679.02	

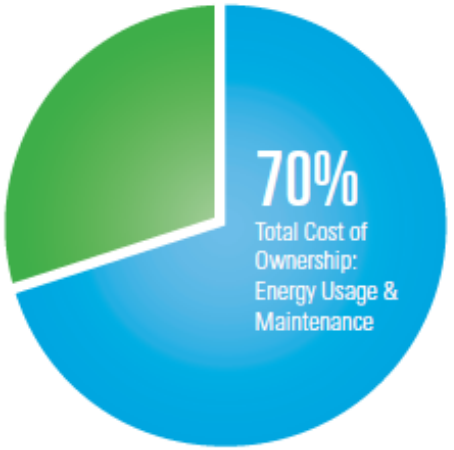
Assuming an equipment utilization rate of 75%, resulting in a 58% energy derate.

Single shift, 50 hrs/week

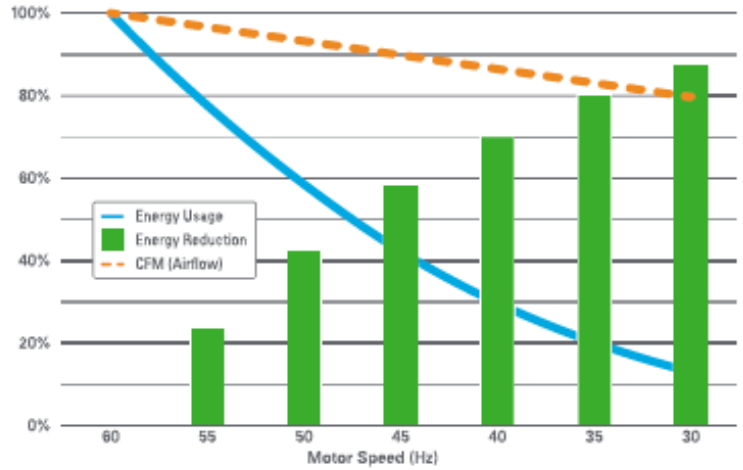
.14/kWh

ROUGHLY 70% OF THE LIFE CYCLE TOTAL COST OF OWNERSHIP FOR A COLLECTION SYSTEM IS ENERGY USAGE & MAINTENANCE

Static systems waste CFM capacity by continuously exhausting all machines, even when they are not being used. With IVEC automated controls you can gain control of available capacity to correct performance issues, add workstations, reduce operating costs, and lower noise levels. What else could you do with that CFM if you had an On-Demand IVEC system?



REDUCING CFM BY **20%** WILL USE **50%** LESS POWER



$10M+ IN GRANTS AND REBATES AWARDED BY ENERGY PROVIDERS TO IVEC CUSTOMERS

$350M+ SAVED FROM 2010 – 2020

What can you do?

- Install Magnehelic Gauges on all your collectors
- Follow housekeeping/filter change out schedule
- Daily walkthrough and inspection
- Install automatic gate system with automatic controls and sweep systems

Questions?

HWF-7

Application Photos

HWF-6 Source Capture

HWF-6 Source Capture

Multiple HWF-5 Ducted

Wet Ducted Collector

Multiple HWF-3 Ducted After-Filter


300-LINE CONTROL
START
STOP
DANGER
BALDOR


FILTER 1
HYDROTRON
1-800-289-0189
WWW.FILTER-1.COM
FILTER 1


FILTER 1
HYDROTRON