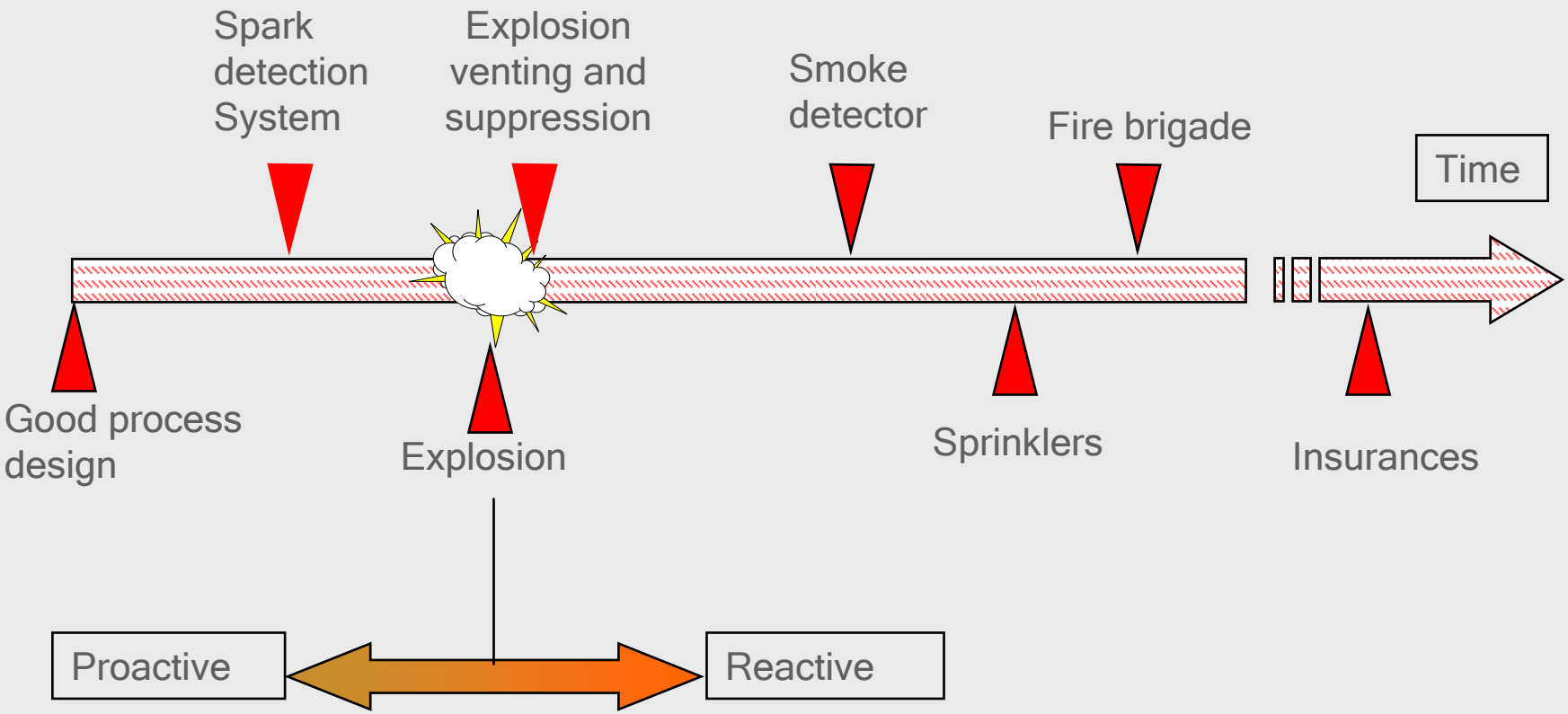
PREVENTIVE PROTECTION SYSTEMS FROM

firefly ab

SWEDEN

FIRE PREVENTION AT PELLET MILLS

High Risk Processes Require Pro-Active Measures



Fire Risks in Wood Pellet Production

Similar to particle board production

But in PB production line:

- More material
- Higher energy
- Larger motors, mills
- Often more mills, sifters, conveyors, etc.

The risk is generally higher in PB industry…

…But they have more fire problems in the wood pellet industry

Why? – Awareness!

Higher sense of safety and higher safety knowledge in the PB industry!

- Fire risks are taken into consideration already in the project stage of a new PB line
- Spark detection systems are included from the beginning in a new PB factory
- They are normally protecting the important risk zones in a PB line

The wood pellet industry is where the PB industry was 20 years ago!

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Ignition Sources

Which particles are dangerous?

Enough temperature (MIT for dust cloud)

Enough temperature (MIT for dust layer)

Enough energy MIE

TABLE 5-9A. Explosion Characteristics of Various Dusts

(Compiled from the following reports of the U.S. Department of Interior, Bureau of Mines: RI 5753, The Explosibility of Agricultural Dusts; RI 6516, Explosibility of Metal Powders; RI 5971, Explosibility of Dusts Used in the Plastics Industry; RI 6597, Explosibility of Carbonaceous Dusts; RI 7132, Dust Explosibility of Chemicals, Drugs, Dyes and Pesticides; and RI 7208, Explosibility of Miscellaneous Dusts.)

Type of Dust	Explosibility Index	Ignition Sensitivity	Explosion Severity	Maximum Explosion Pressure psig*	Max Rate of Pressure Rise psi/sec*	Ignition Temperature†		Min Cloud Ignition Energy joules	Min Explosion Conc oz/cu ft‡	Limiting Oxygen Percentage§ (Spark Ignition)
						Cloud °C	Layer °C			
Agricultural Dusts										
Cellulose	2.8	1.0	2.8	130	4,500	480	270	0.080	0.055	C13
Cellulose, alpha	>10	2.7	4.0	117	8,000	410	300	0.040	0.045	—
Cocoa, natural 19% fat	0.6	0.5	1.1	68	1,200	510	240	0.10	0.075	—
Coffee, fully roasted	<0.1	0.2	0.1	38	150	720	270	0.16	0.085	C17
Corn	6.9	2.3	3.0	113	6,000	400	250	0.04	0.055	—
Cornstarch commercial product	9.5	2.8	3.4	106	7,500	400	—	0.04	0.045	—
Cork dust	>10	3.6	3.3	96	7,500	460	210	0.035	0.035	—
Cotton linter, raw	<0.1	<0.1	<0.1	73	400	520	—	1.92	0.50	C21
Cube root, South American	6.5	2.7	2.4	69	2,100	470	230	0.04	0.04	—
Grain dust, winter wheat, corn, oats	9.2	2.8	3.3	131	7,000	430	230	0.03	0.055	—
Lycopodium	16.4	4.2	3.9	75	3,100	480	310	0.04	0.025	C13
Milk, skimmed	1.4	1.6	0.9	95	2,300	490	200	0.05	0.05	N15
Rice	0.3	0.5	0.5	47	700	510	450	0.10	0.085	—
Soy flour	0.7	0.6	1.1	94	800	550	340	0.10	0.06	C15
Sugar, powdered	9.6	4.0	2.4	109	5,000	370	400‡	0.03	0.045	—
Wheat flour	4.1	1.5	2.7	97	2,800	440	440	0.06	0.05	—
Wheat starch, edible	17.7	5.2	3.4	100	6,500	430	—	0.025	0.045	C12
Wood flour, white pine	9.9	3.1	3.2	113	5,500	470	260	0.040	0.035	—

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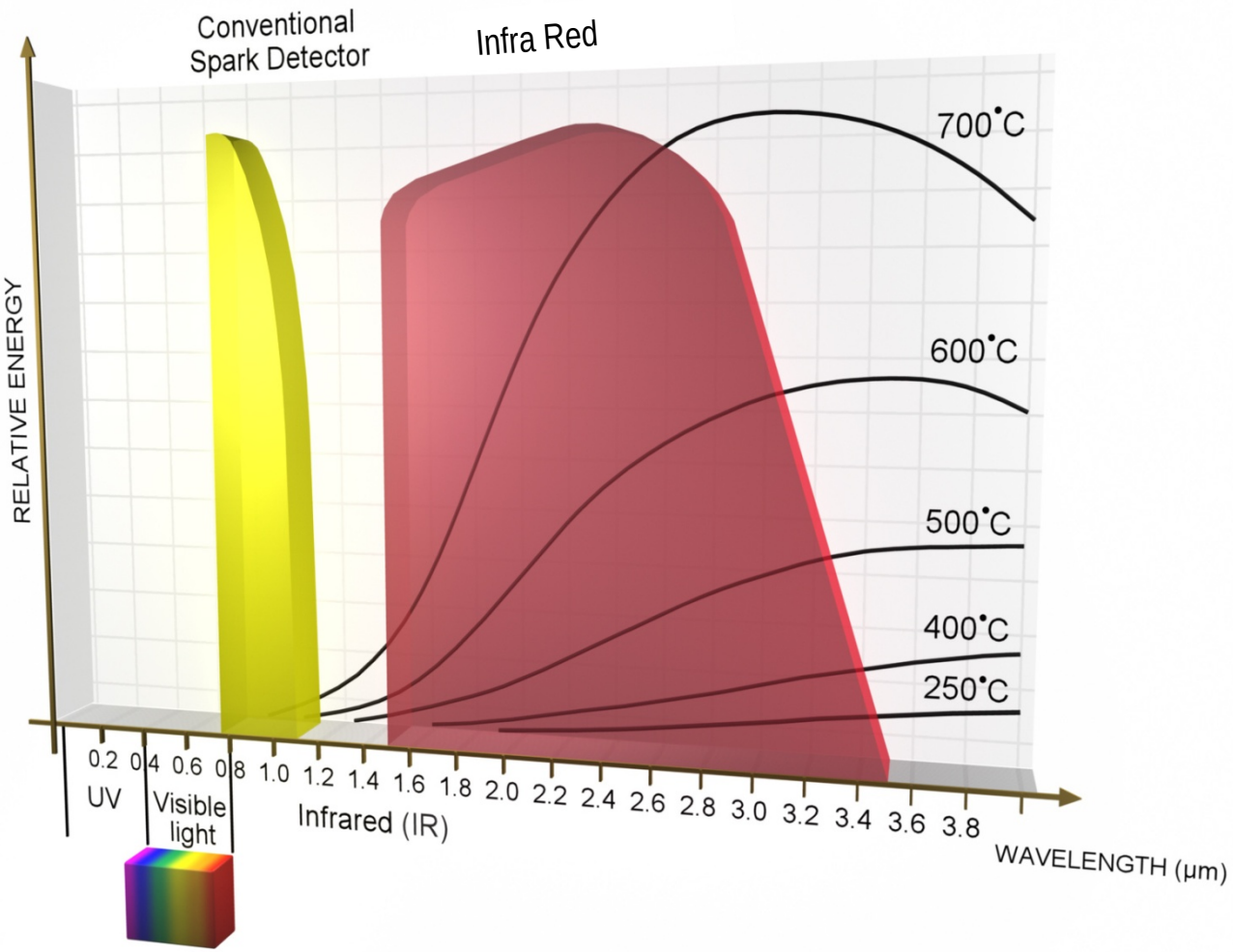
Spectral Response of Detectors



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Monitoring heat /light sources in the process flow

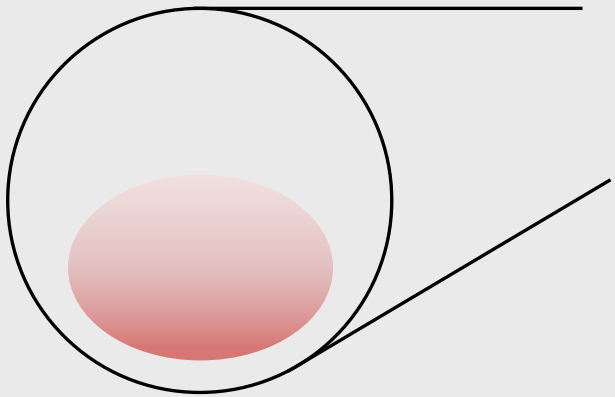
Material should be dispersed

Layers of material can cover dangerous particles and absorb the heat.

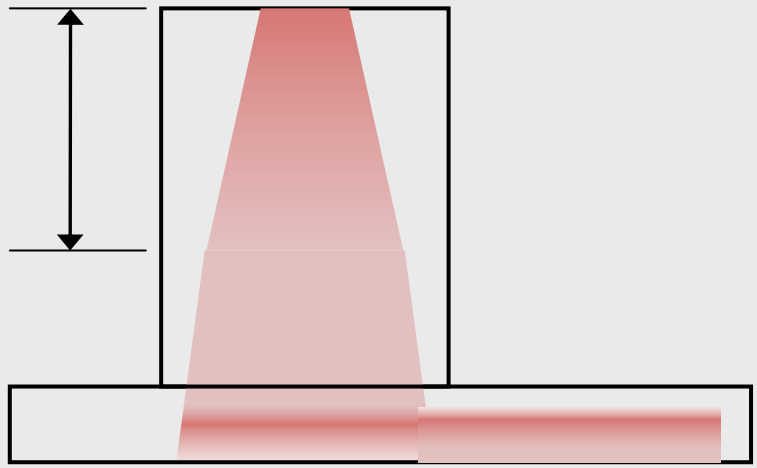
Conveyors, screws, sliding material cannot be monitored with 100% certainty.

Monitoring heat /light sources in the process flow

Pneumatic transport



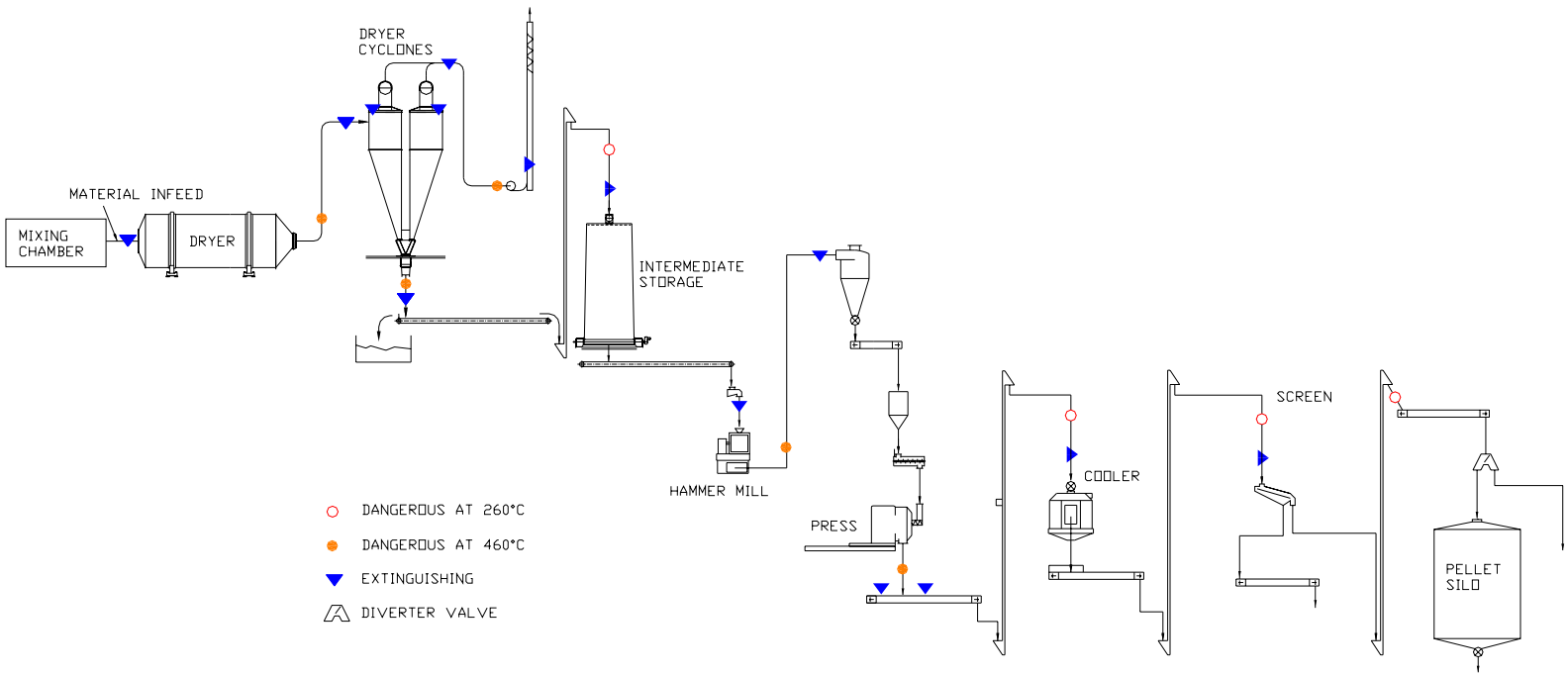
Falling material



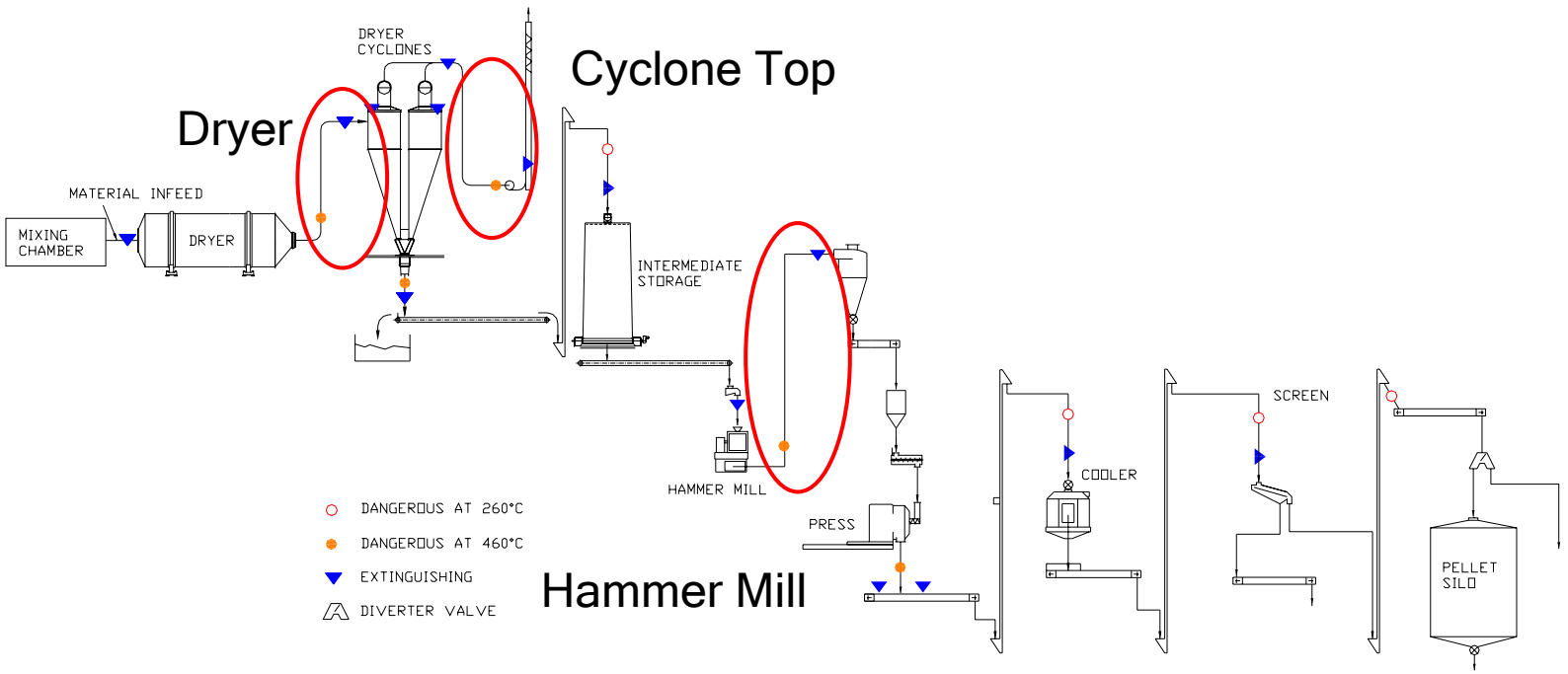
Particle energy can be detected.

Water can penetrate the material to extinguish the threat.

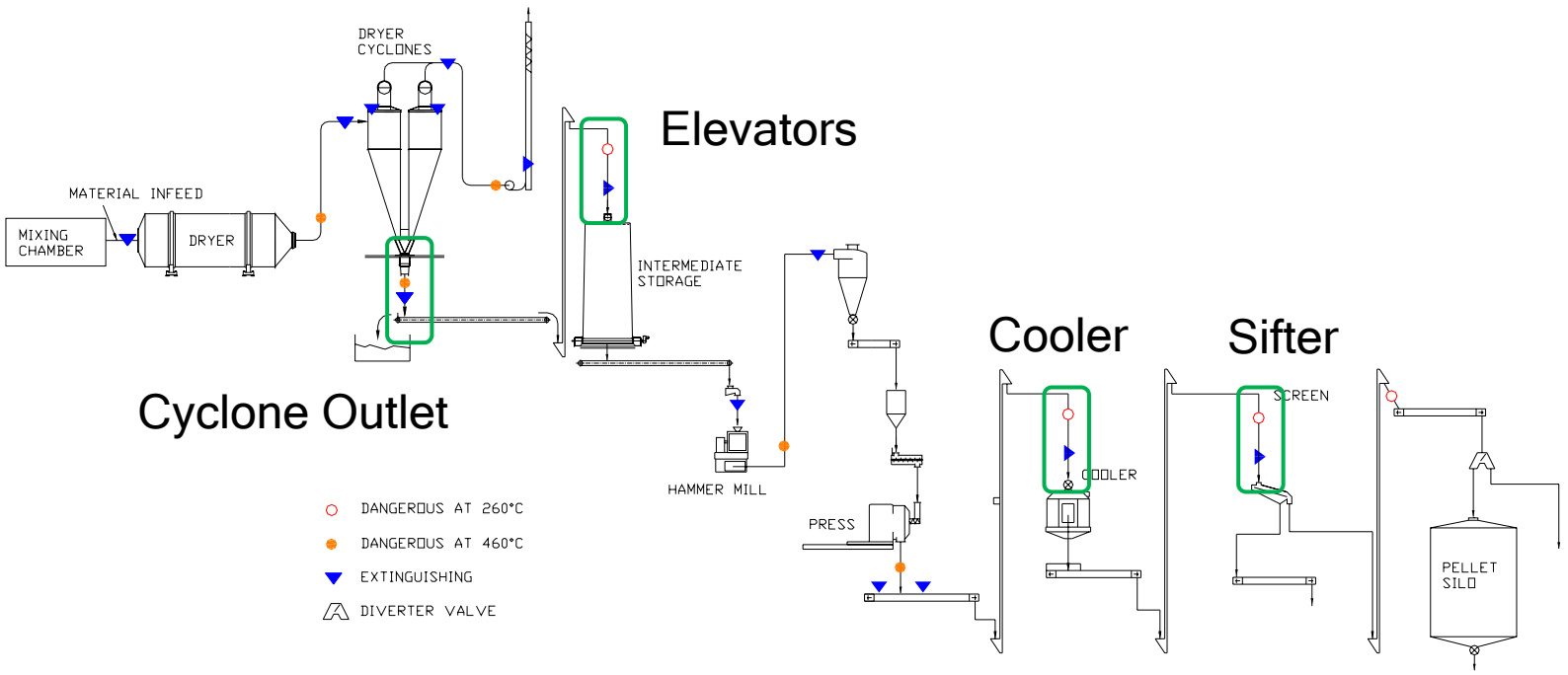
A typical Pellet Mill process



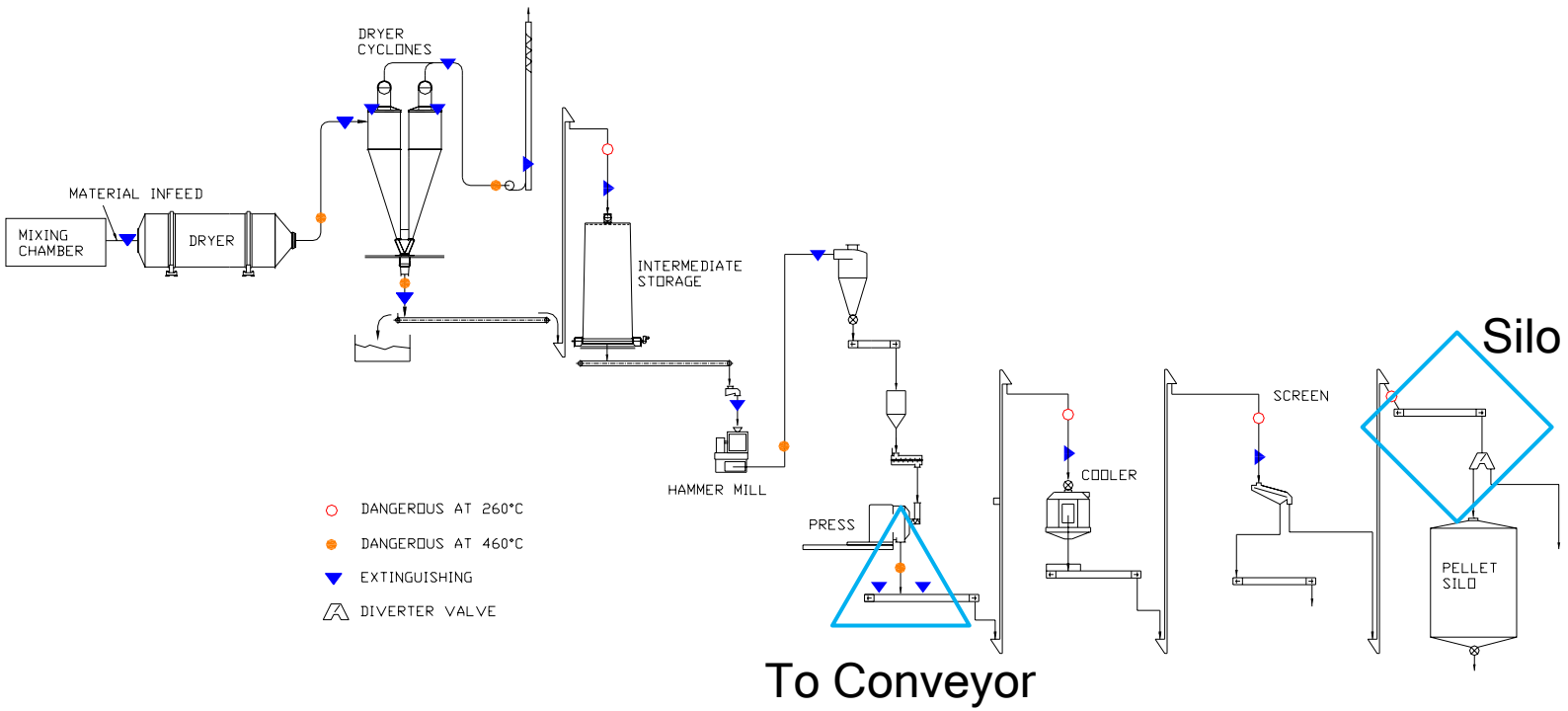
Pneumatic ducts



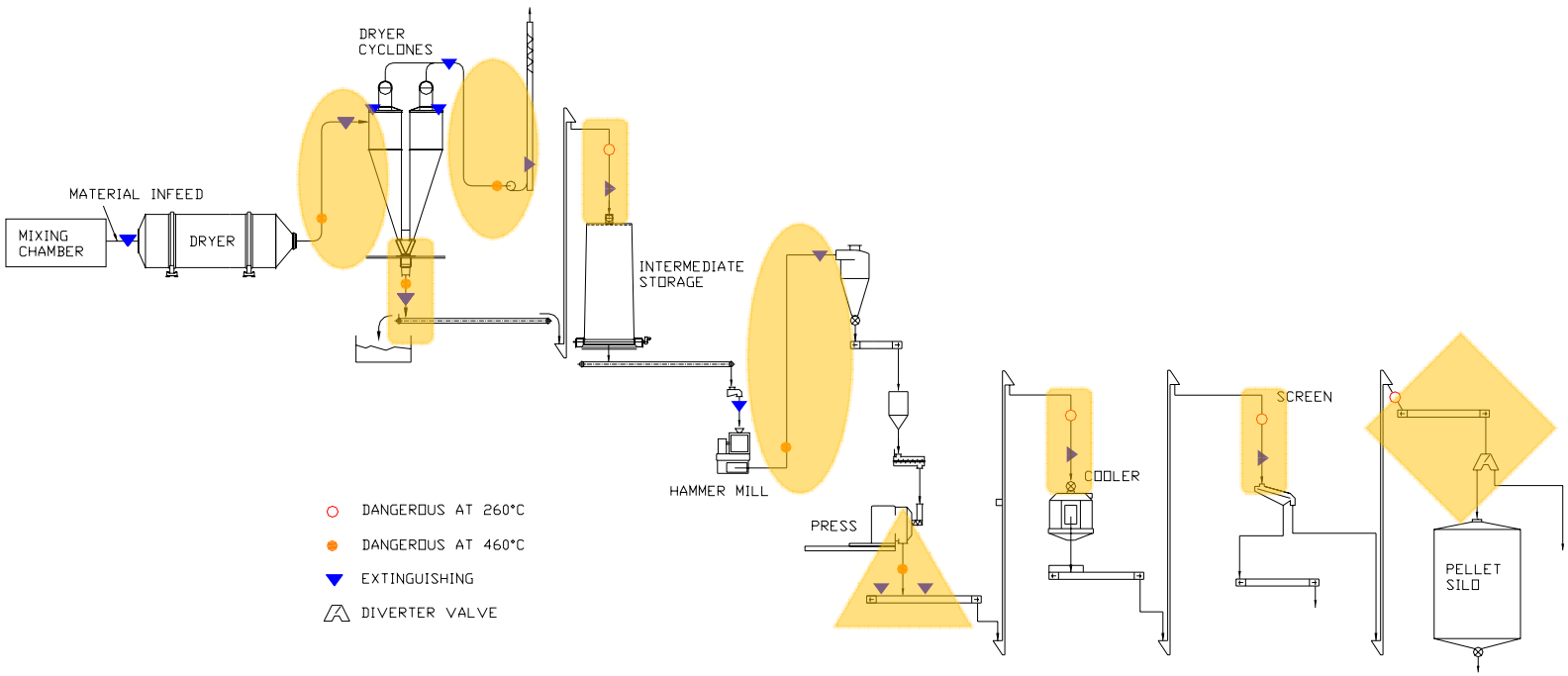
Fall chutes


DRYER
CYCLONES
Elevators
MATERIAL INFEED
MIXING
CHAMBER
DRYER
INTERMEDIATE
STORAGE
Cyclone Outlet
HAMMER MILL
Cooler
Sifter
SCREEN
COOLER
PRESS
PELLET
SILO
DANGEROUS AT 260°C
DANGEROUS AT 460°C
EXTINGUISHING
DIVERTER VALVE

Other cases



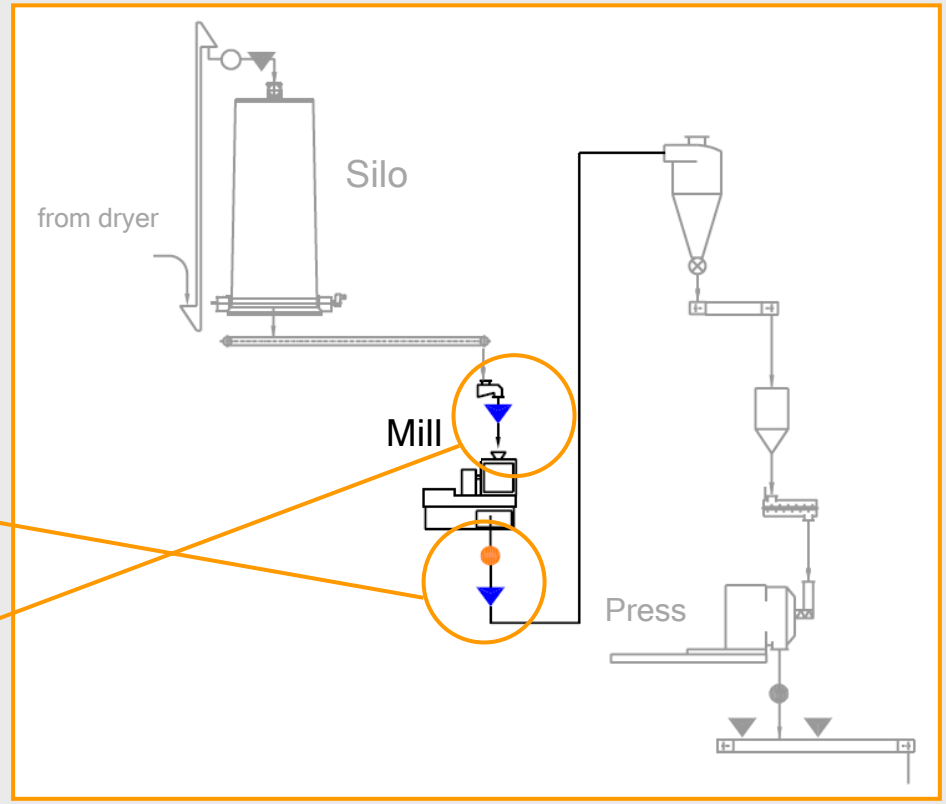
Protecting the whole process



Risks with Hammer Mill Process

The Hammer Mill

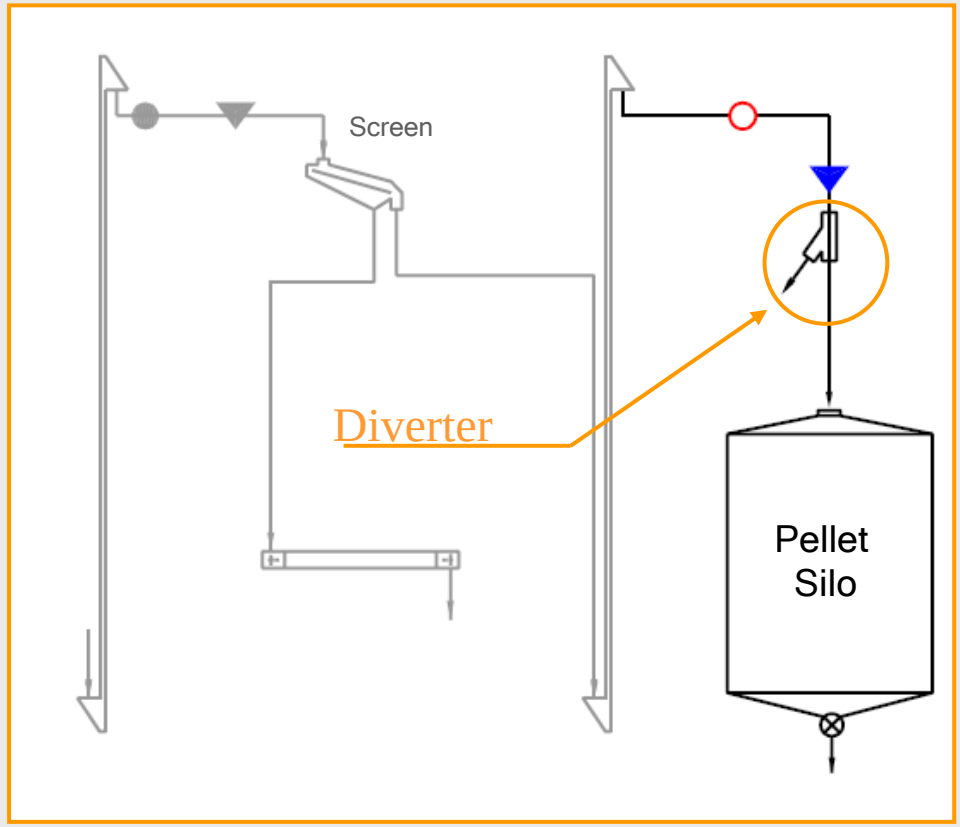
- Frequent sources of fires!
  - Pieces of Metal / stones / etc
  - Overheating (overloading, material build-ups etc.)
  - Failure
- Detection (400°C) and extinguishing after the mill
- Suppression in the mill when there is a High Risk



Risks with Pellet Storage and Handling – PELLET SILO

Pellet silo

- Material storage = Lower ignition temperature (260°C)
- Detection at inlet to silo (250°C)
- Water Extinguishing
- Note! Avoid water entering the silo (e.g. with a Diverter valve)
- Risk for transfer to lorry vehicles etc



Good housekeeping must be a priority

- Good housekeeping prevents small problems becoming big problems.

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Keys to safer Pellet manufacturing

- Consider the risk for fire and dust explosions already in the design of the process

- Protection of all main risk zones
- Detecting the right temperature
- Efficient water extinguishing
- Proper housekeeping
- Proper service and maintenance of machines
- Proper service of the spark detection system

Research* shows that detecting ONLY sparks has less effect than first thought. You need to detect BOTH sparks and hot particles in your process to minimize fires and dust explosions.

*Prof. Rolf K. Eckhoff, “Dust explosions in the process industries” (2nd edition)