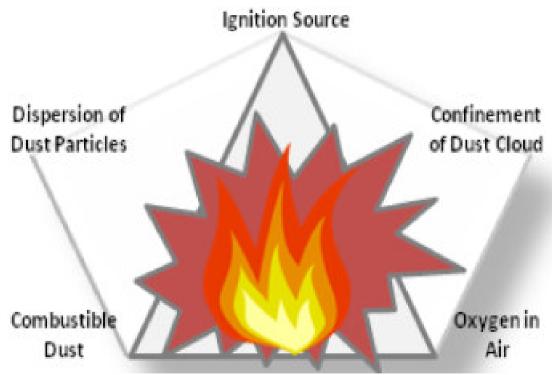






WHAT ARE THE CONDITIONS TO GENERATE A DUST EXPLOSION?

Dust Fire & Explosion Pentagon



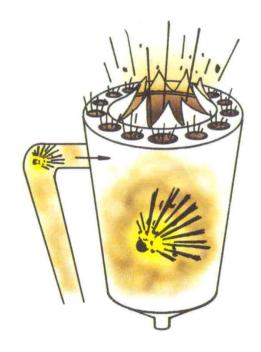
Before dust can explode:

- The dust must be combustible.
- The dust must be capable of becoming airborne.
- The dust must have a size distribution capable of flame propagation.
- The dust concentration must be within the explosion limits.
- An ignition source must be present.
- The atmosphere must contain sufficient oxygen to support and sustain combustion.



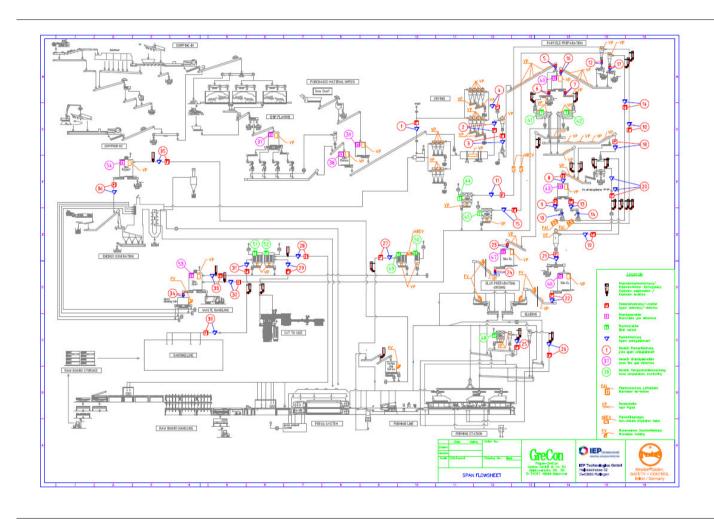
EXPLOSION PROTECTION PRINCIPLES





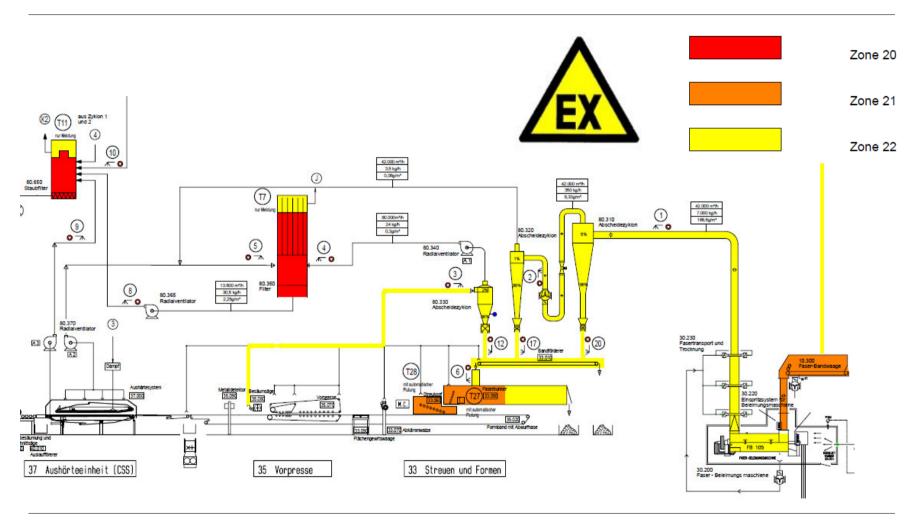


Typical Plant Layout (example particle board plant)



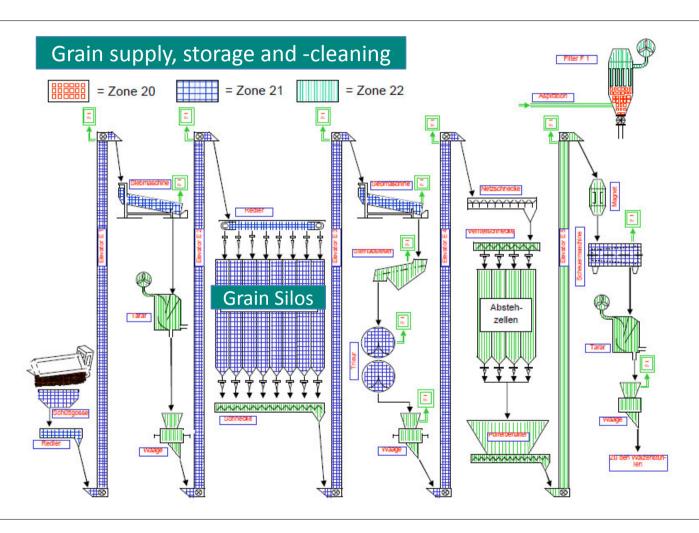


Layout (Example MDF-Plant)



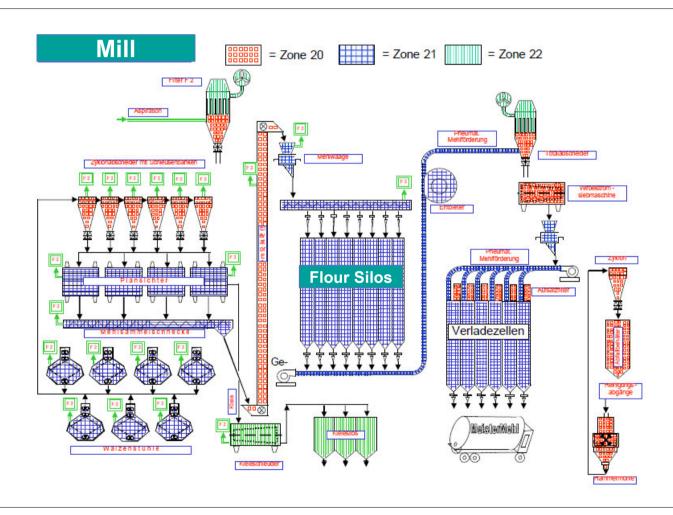


Typical Layout (Example of a flour mill)



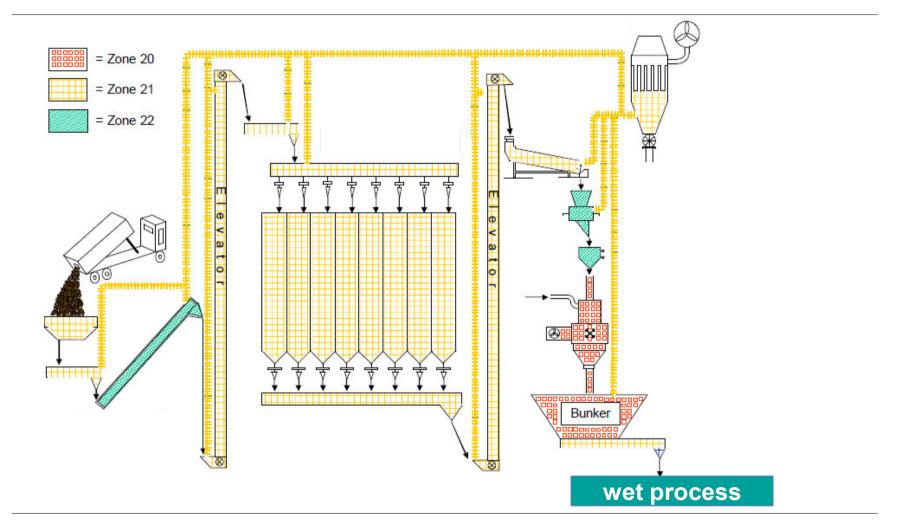


Typical Layout (Example of a flour mill)



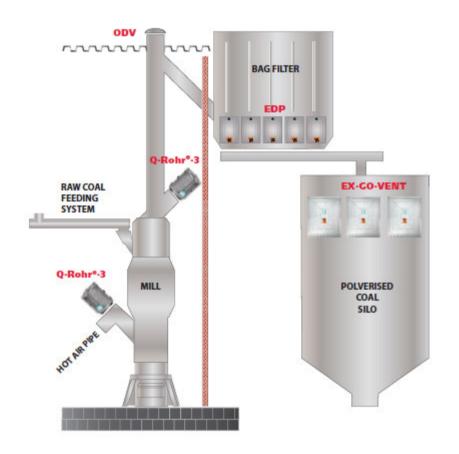


Typical Layout (Example of a brewery)





Typical Layout (coal grinding plant / cement)





Explosion risk at typical plant equipment:

Equipment	probability of explosion	Effect of explosion	Risk				
Chain conveyor	Very low	Moderate	Small				
Screw conveyor	Low	Moderate	Small				
Bucket elevator	High	Large	Very large				
Silo and bunker	Low	Very Large	Large				
Filter	High	Large	Very large				
Grader	Low	Moderate	Small				
Mill system	High	Large	Very large				

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→ But how to protect them?



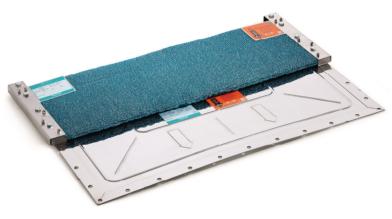
DUST COLLECTORS – OUTSIDE



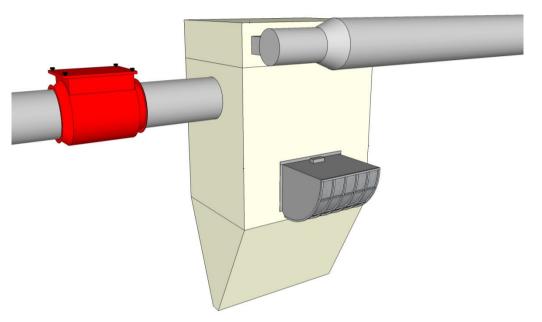


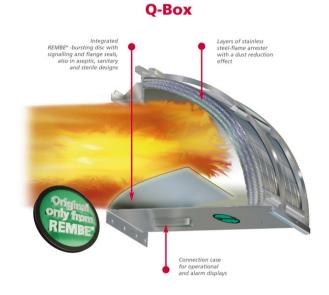
DUST COLLECTORS – OUTSIDE

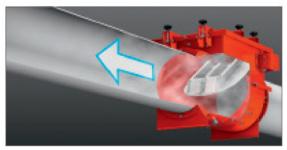


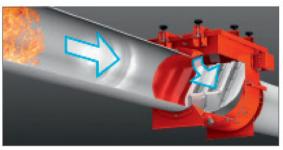


DUST COLLECTORS – INSIDE











FLAMELESS VENTING







SILOS



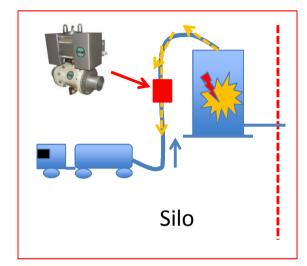


VENTING OF SILOS





ISOLATION OF SILOS









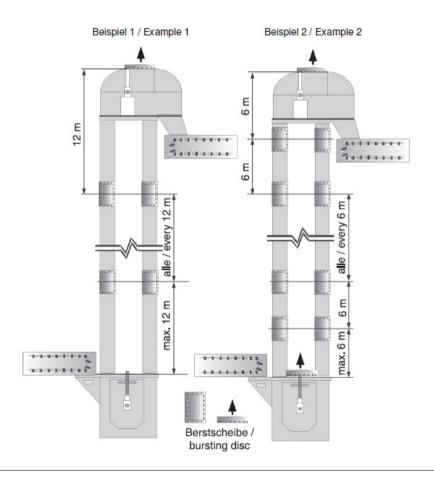


SILOS → ELEVATORS



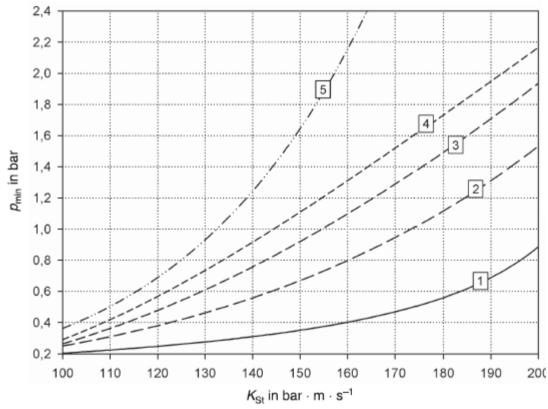


ELEVATORS PROTECTION ACC. TO VDI 2263-8.1





ELEVATOR PROTECTION ACC. TO VDI 2263-8.1



Number	Venting										
1	head + boot + shafts (3 m distance)										
2	head + boot + shafts (6 m distance)										
3	head + shafts (3 m distance)										
4	head + shafts (6 m distance)										
5	head + shafts (12 m distance) or only head to a maximum shaft length of 12 m										

Figure 3. Required minimum explosion resistance p_{\min} of the elevator depending upon the K_{St} value

Due to the reduction in heat dissipation in the case of plastic buckets, the explosion resistance values of the elevators are to be increased as follows:

K _{St} in bar·m·s ⁻¹	Percent increase
< 100	20%
100 to 150	35%
> 150 to 200	50%



VENTING OF ELEVATORS







MILLS

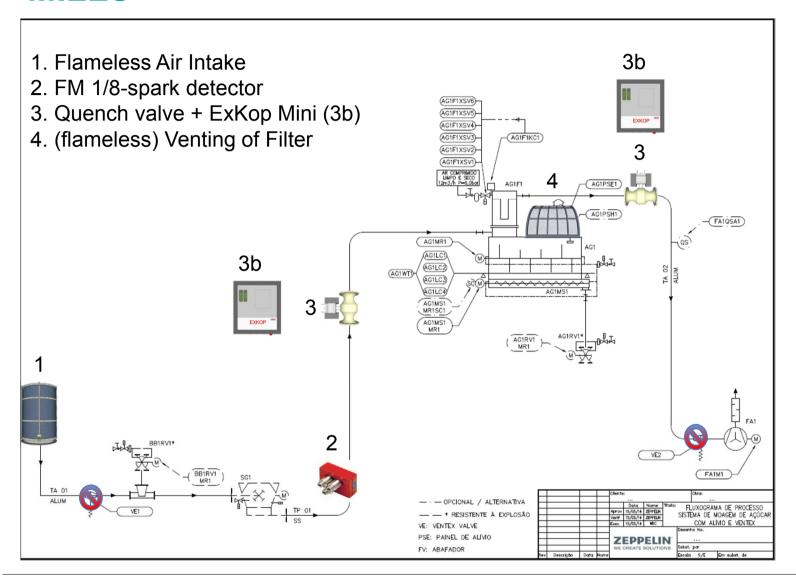
Q-Box





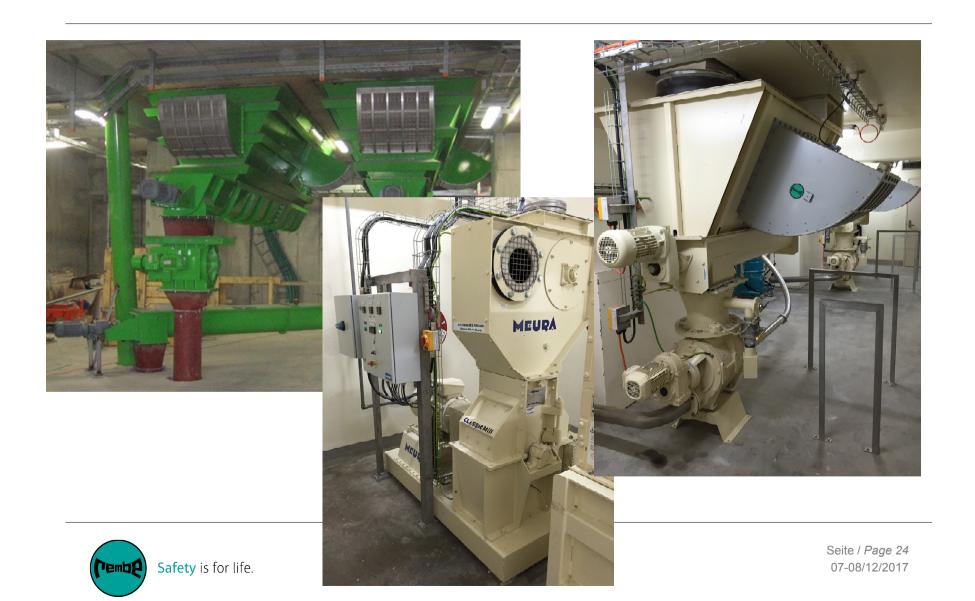


MILLS

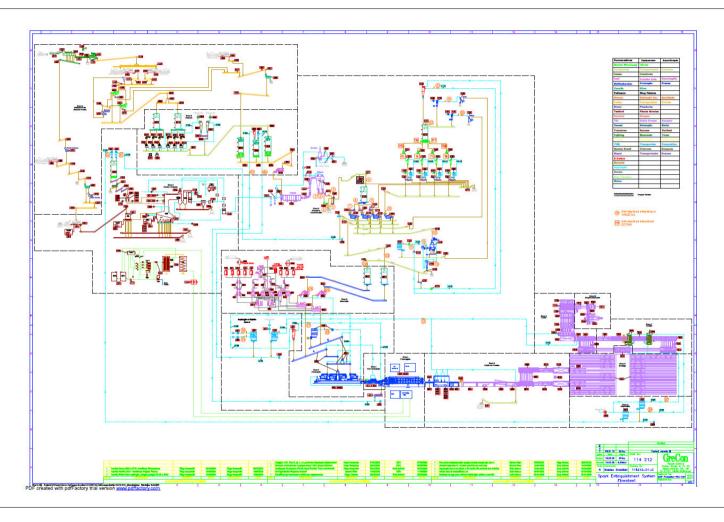




MILLS



The real Challenge: Complex Facilities





The real Challenge: Complex Facilities

	Explosion Prevention and Protection	Isolation	Remarks	Risk Matrix
F	Flats, <u>unifocut</u> the suggested changes. Faudo-Ground monitoring system. FM Mis. spark detector ETM 958: \$20.0 at 200 G-Box II 305 s 50 (EDP) G-Box II 505 s 50 (EDP) G-Box II 505 c 50 (EDP) G-Box II 505 c 50 (EDP) G-Box II 505 c 50 (EDP) Sendarg-Doxel (SAC) (or G-Box II 305 s 50 Se	Operanoushus (10 kilo) Quenchinakus (10 kilo) Guenchinakus (10 kilo) Eakop min controller (KGPKTD) Eakop min controller (KGPKTD) Eakop (Einkest (3 kilo) Eakop (Einkest (Firk <u>utilit</u> the suppressed changes	
Sugar truck unloading station	8 1		Not in Compliance with ASINZ \$ 4745 3.6.2. Earthing of the trucks is highly recommended even though pneumatic filling would cause higher risks of ligition.	6 7
Elevator sugar recieval	2 2	1 1	Not in Compliance with ASNR 2 94745 3.6.13. Lack of preventative measures and comparetively high dust concentration lead to a Zone 20 in the elevator. As ignitions sources cannot be safely prevented. The flameless vents have to be placed on the head and the boot with a distance not greater than 5m acc. to ASINZ 94745 3.6.13. Explosion Propagation is highly unlikely us the pipe screes but has to be prevented via the aspiration pipe using a quick closing pinch valve. ATTENTION. The flexible pinnt where broken during the site visit and have not been grounded.	5 6
Flour truck unloading station	8 1 1	1 1	Not in compliance with ASRIX S 4745 3.6.10 as electrostatic discharges or sparks generated by the truck blower could lead to effective ignition sources in the slo. A grounding monitoring system are set all as a spark detection system will observe have to be nativaled. The spark detection system will observe have to be nativaled. The spark detection system will observe he Quenchivalve in order to prevent sparks from entering the site. The grounding system will safely prevent spark discharges in the proposition of the prop	4 5
Big Flour Silo	9 1 3		propagation mitigation measures are not in place. The (right) explosion panel that is facing the building has to be equipped with a Targo-Vent-Module to deflect the fame upwards. The above mentioned Quenchvalve has to be installed within a distance of 6m from the silo to additionally act as an isolation device triggered by the Concession.	3 4
Sugar Silo S1@ B3E	10 3	1 .	Not in compliance with ASINZ 3 4745 3.6.17, 7.3.3, 3.7.1.2.2, 7.3.6 and 3.6.2 as the vents are obviously unapproved explosion vents, as we highly doubt enough explosion resistance of the vent duct and since explosion propagation mitigation measures are not in place. Three explosion parties should be installed in a new 5 vent duct. One Quenchivally should furthernoe be installed within a distance of 6m after 510 3 on the appriation pipe to act as an isolation device triggered by the RSK's of the 3 510s. The Exkop Controller of the sugar recieving Elevator can be used as it has an additional input. ATTENTICIN: The flexible joints are broken and dust spillage was writeressed during the inspection. They furthernore need to be grounded.	Probable
Sugar Silo S2 @ B3E	10 3		Not in compliance with ASRIZ 3 4745 3.6 17, 7.3.3, 3.7.12.2, 7.3 6 and 3.6.2 as the vents are obviously unapproved explosion vents, as we highly doubt enough explosion resistance of the vent duct and since explosion propagation mitigation measures are not in place. Three explosion panels should be installed in a new 5 vent duct. One Quenchivalve should furthermore be installed within a distance of 6m after 30io 3 on the aspiration pipe to act as an isolation device triggered by the RSK's of the 3 30ios. The Eskop Controller of the sugar recieving Elevator can be used as it has an additional input. ATTENTICIN: The flexible joints are broken and dust spillage was writeressed during the inspection. They furthermore need to be grounded.	1 2
Sugar Silo S3 @ B3E	3 3		Not in compliance with ASM2 S 4145 3.6.17, 7.3.3, 3.1.12.2.7.3.6 and 3.6.2 as the vents are obviously unapproved explosion vents, as we highly doubt enough explosion resistance of the vent duct and since explosion propagation mitigation measures are not in place. Three explosion panels should be installed in a new vent duct. The Quenchvalve should furthermore be installed within a distance of 6m after 30io 3 on the aspiration pipe to eat as an isolation device triggered by the RSK's of the 3 30ios. The Exkop Controller of the sugar recieving Elevants can be used as it has an additional input. ATTENTION: The flexible joints are broken and dust spillage was writeressed during the inspection. They furthermore need to be grounded.	Severity
Dust Collector H(D)P2	10 1	1	that the valve is due to the high cleaning pulse pressure expected to be filled with accumulated due to the low set pressure. The Valve hould be replace by a Boxes. In addition: As an explosion will propagate to all interconnected equipment explosion isolation is mandators. We recommed to redesign the raw gas duct	1-
Vacuum hopper V1HP1	9 1 1		Not in Compliance with ASINZ 4745 3.7.12.2, 3.6.6. The vacuum reciever is not equipped with explosion protection. It has to be equipped with an approved flameless vere. Due to the short mounting distance explosion isolation to the interconnected dust collector is not required.	
DC-HI72	9 1	1 1 1	s distance of 6m from the recieving bin inlet to act as an isolation device. We furthermore highly recommend a SAC as the sticky, dusty conditions inside the building might lead to obstructions of the flame arrestor of the existing REMBE Q-Box. Interlock between Q-Box and Quenchvalve via the Exkop Controller avoids additional	
S167-DC Sugar Day bin	10	2 1	directly danger with X-mix in to 1, 10,0 or 1, 12,2, out in the class collection is equipped with replaced by a CR-Poth in the same dimensions as all other options would require so directly danger to the building or the vessel in addition. As an explosion will propagate to all interconnected equipment explosion isolation is mandatory. We	
Batter manufacturer DC (Type: Nederman)	6		Not in Compliance with AS/NZ 4745 3.6.5; 4.7.2. i) as grounding / earthing is not in place and since ignitionen sources might arise from moving parts. In addition, 5 Nederman clearly marked the equippement not being used for flammable dusts. However as only high MIE dusts with low igniteability are handled, preventative measures such as grounding and regular minetnanose will reduce the risk.	
CHKDC01(Type: Nederman)	6		Not in Compliance with AS/NZ 4745 3.6.6; 4.7.2. i) as grounding I earthing is not in place and since ignitionen sources might arise from moving parts. In addition, Notedeman clearly marked the equippement not being used for flammable dusts. However as only high MIE dusts with low ignite ability are handled, preventative measures such as grounding and recular arimtenance will reduce the risk.	
CHKDC02 (Type: Nederman)	6		Not in Compliance with ASINZ 4745 3.6.6; 4.7.2. i) as grounding I earthing is not in place and since ignitionen sources might arise from moving parts. In addition, Notedeman cleatly marked the equippement not being used for flammable dusts. However as only high MIE dusts with low ignite ability are handled, preventative measures such as grounding and requisal maintenance will reduce the risk.	1



The real Challenge: Complex Facilities

			Explosion Prevention and Protection								Isolation												Remarks	
RISK OVERVIEW	Pisk <u>without</u> the suggested changes	Farado - Ground monitoring system	FM 1/8 - spark detector	EGV 586 x 920	TARGO-VENT 920 × 920	Q-Box II 305 x 610 (EDP)	Q-Box II 586 x 920 (EDP 2000 mmWC)	Q-Rohr-3 DN 600	Sanitary Cover (SAC) for Q-Box II 305 \times 610	Sanitary Cover (SAC) for Q-Box II 586 x 920	RSK - Signaling Unit	Quenchvalve II DN 80	Quenchvalve II DN 100	Quenchvalve II DN 125	Quenchvalve II DN 250	Exkop mini controller (AGFIKFD)	Exkop mini controller (KFDKFD)	Exkop (5 inlets / 9 outlets)	G-right compact of Long loo	Q-Flap Compact St LDN 200	Graph Compact Strongs	Q-Flap Compact St 1DN 400	10 C C C C C C C C C C C C C C C C C C C	Sagueston charges
Sugar truck unloading station	8	1							\dashv															4 Not in Compliance with ASINZ S 4745 3.6.2. Earthing of the trucks is
Elevator sugar recieval	10						2			2			1				1							Not in Compliance with AS/NZ S 4745 3.6.13. Lack of preventative marks prevented. The flameless vents have to be placed on the head and I screws but has to be prevented via the aspiration pipe using a quick
Flour truck unloading station	8	1	1											1		1								Not in compliance with AS/NZ S 4745 3.6.10 as electrostatic discharg well as a spark detection system have to be installed. The spark detection system have to be installed. The spark detection system have to be installed.
Big Flour Silo	9				1						3													Not in compliance with AS/NZ S 4745 3.6.17, 7.3.3, 3.7.1.2.2, 7.3.6 and not in place. The (right) explosion panel that is facing the building hinstalled within a distance of 6m from the silo to additionally act as a
Sugar Silo S1@ B3E	10			3							3				1									Not in compliance with ASINZ S 4745 3.6.17, 7.3.3, 3.7.1.2.2, 7.3.6 and and since explosion propagation mitigation measures are not in plaidistance of 6m after Silo 3 on the aspiration pipe to act as an isolatio additional input. ATTENTION: The flexible joints are broken and du
Sugar Silo S2 @ B3E	10			3							3													Not in compliance with AS/NZ S 4745 3.6.17, 7.3.3, 3.7.1.2.2, 7.3.6 and and since explosion propagation mitigation measures are not in plaidistance of 6m after Silo 3 on the aspiration pipe to act as an isolatio additional input. ATTENTION: The flexible joints are broken and du
Sugar Silo S3 @ B3E	10			3							3													Not in compliance with AS/NZ S 4745 3.6.17, 7.3.3, 3.7.1.2.2, 7.3.6 and and since explosion propagation mitigation measures are not in plaidistance of 6m after Silo 3 on the aspiration pipe to act as an isolation additional input. ATTENTION: The flexible joints are broken and du
Dust Collector H(O)P2	10						1			1										1				Not in Compliance with AS/NZ 4745 7.3.6, 3.7.1.2.2, 3.6.6. The dust of cleaning pulse pressure expected to be filled with accumulated dust interconnected equipment explosion isolation is mandatory. We rec



REMBE SOLUTIONS:

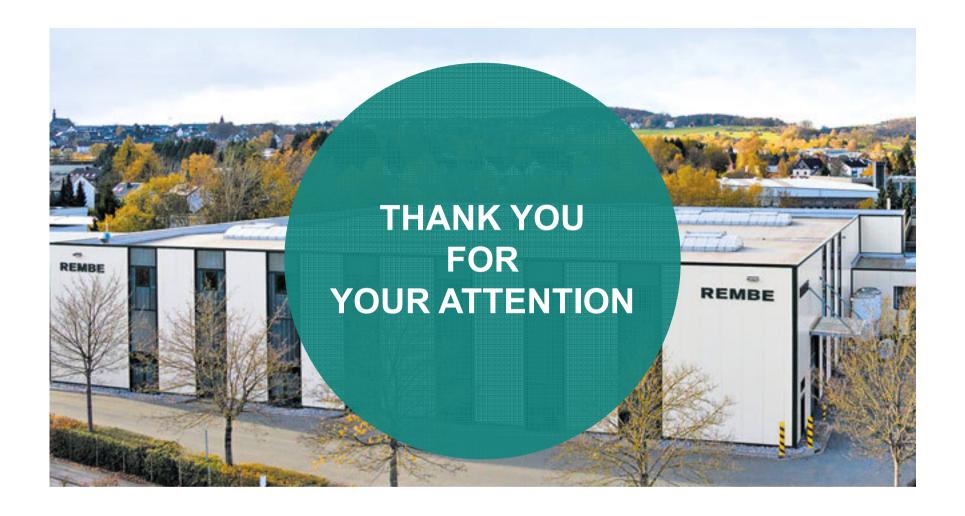
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