FEDERAL ENVIRONMENTAL AGENCY, FRG

Prevention of Dust Explosion Hazards in Germany - a regulators view

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- Dust Explosion Hazard
- Protection from Hazards of Dust Explosions
- Dust Explosion Hazard Control in Germany
- View: Arrangement in Europe

Dust Explosion Hazard

Dust Explosion Hazard is present under following condition:

- Combustible dust
- Fine dispersed solids (< 500 um) in mixture with air

Dust Explosion Hazard

First Condition:

- Combustible dust

Physical property of substance.

Combustible dusts are present in a wide range of industries

Dust Explosion Hazard

Most concerned industries:

- Wood and timber industry
- Paper industry
- Coal / peat
- Nutrition and feed industry
- Plastic and raisin industry
- Metal incorporating industry

Dust Explosion Hazard

Second Condition:

- Fine dispersed solids (< 500 um) in mixture with air

Process condition almost everywhere present where dust or solids are handled.

Dust Explosion Hazard

Lessons Learnt from Accidents (1/4)

- Systematic evaluation of accidents over 25 years by Berufsgenossenschaftlichem Institut für Arbeitssicherheit (BIA)
- over 600 events registered
- dark number roughly 90 per cent

Dust Explosion Hazard

Lessons Learnt from Accidents (2/4)

Events of last Ten Years 1985 - 95, (N = 174)

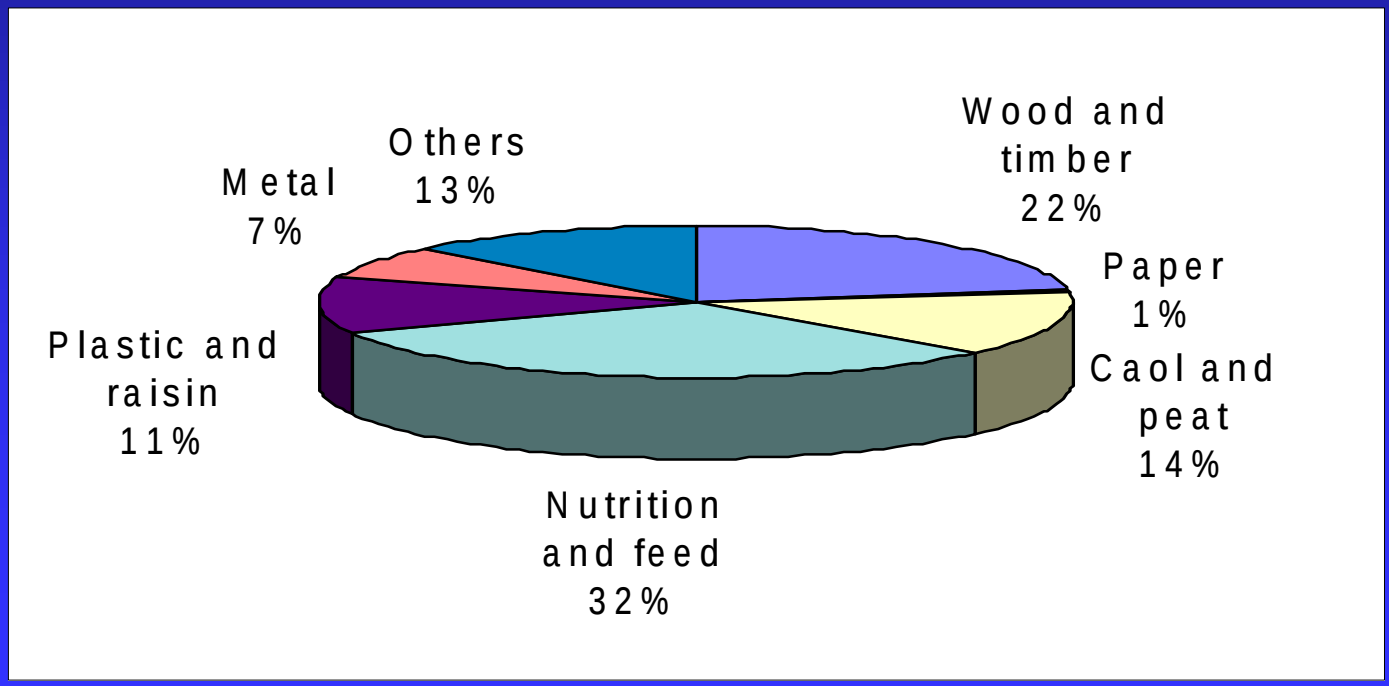
- 33 victims dead, 194 injured
- Property damage over 500.000 ECU in approx. 11 per cent
- Accident enforcement due to secondary events in approx. 16 per cent

Dust Explosion Hazard

Lessons Learnt from Accidents (3/4)

Events of last ten Years 1985 - 95, (N = 174)

Involved Substances



Dust Explosion Hazard

Lessons Learnt from Accidents (4/4)

Events of last ten Years 1985 - 95, (N = 174)

Involved Substances, Section “Others”

Material / materials group	Numer of Events
Sulphur	3
Substances in foundries	1
Hormone preparation	1
Rubber	1
Antracene	1
Calziumsterate	1
Glycerinmonosterate	1
Plumbumsterate	3
Friction lining mixture	1
Dust from waste incineration	1
Paraffin wax dust	1
Teramethylthiuramdisulphide	1

Dust Explosion Hazard

Character and Effect of Dust Explosions

- Blast wave and thermal radiation
- Debris
- Release of toxic substances

Dust Explosion Hazard

Character and Effect of Dust Explosions (1/3)

Blast wave and thermal radiation

Short range effects endangers mainly people in the near surroundings

Dust Explosion Hazard

Character and Effect of Dust Explosions (2/3)

Debris

- Throw distances of debris depend on initial acceleration, mass, flight characteristics, height and angle of throw.
- For structur rigidities of < 20 kN/qm and 30 m hight debris throw:
  - 2/3 within 20 m diameter
  - 1/3 between 20 - 50 m diameter
  - Depending on gliding characteristic > 50 m

Dust Explosion Hazard

Character and Effect of Dust Explosions (3/3)

Release of toxic substances

Depending on amount and nature of substance short and long term toxic and/or ecotoxic effects

Protection from Hazards of Dust Explosions

System of Regulation

- Safe Handling of Combustible Dusts at the Workplace
- Protection from Hazards of Dust Explosions in the Neigbourhood
- Protection from Hazards of Dust Explosions in the Environment

Dust Explosion Hazard Control in Germany

- Key Concept for Management high Hazard Potentials
- Regulation of dust explosion hazards in the Major Accident Regulation (Hazardous Incident Ordinance)
- Practical experiences

Dust Explosion Hazard Control in Germany

Key Concept

- Integrated Safety Concept on the basis of SEVESO I directive (82/501/EEC)
- Three Step Barrier Concept

Dust Explosion Hazard Control in Germany

Regulation of dust explosion hazards in the Major Accident Regulation (1/5)

- Regulation since 1991
- Definition of Dust Explosibility due to Technical Regulation VDI 2263 “Dust Fires and Dust Explosions”
- Definition of the Process State where a “Explosive Dust-Air-Mixture is likely to be present” due to Technical Regulation ExRL, so called “Zone 10”

Dust Explosion Hazard Control in Germany

Regulation of dust explosion hazards in the Major Accident Regulation (2/5)

Definition of “Zone 10”

“Zone 10” consists of areas in which a dangerous potentially explosive atmosphere exists *frequently or for long periods* due to the presence of dust.

Dust Explosion Hazard Control in Germany

Regulation of dust explosion hazards in the Major Accident Regulation (3/5)

For practical reasons

"*frequently or for long periods*" is understood as "*most of the time of the industrial process*".

This is interpreted as a time span of at least 50 per cent of the operating time.

Dust Explosion Hazard Control in Germany

Regulation of dust explosion hazards in the Major Accident Regulation (4/5)

Practical Experience

- The Definition of the Time Span was not sufficently Precise
- “Zone 10” normally exists only in Interior of Devices and Pipelines
- Secundary Effects were not covered

Dust Explosion Hazard Control in Germany

Regulation of dust explosion hazards in the Major Accident Regulation (5/5)

New Proposal

Comparison of the Arrangements
(Volumes in $m^{3)}$

Obligations	Present	New Proposal	
	(Zone 10)	within devices	outside places
„lower tier“	50 (100)*	10	100
„upper tier“	100	100	1000
No Exeption	100	1000	10.000

* for explosion proof construction

View: Arrangement in Europe

- Dust Explosion Hazard are not explicitly regulated in present SEVESO II
- Dust Explosion Hazard is comparable to other regulated Hazards in SEVESO II
- Major Dust Explosion Hazard requires SEVESO Type Regulation (e.g. MAPP, SMS)
- Volumes can act as Yardsticks for Obligations