Hazardous Area Classification - dust atmospheres
new plant design and operation
and re-evaluate changes to existing plant

Ireneusz Rogala
Program

Dust Explosions
An Overview,

Dust hazardous area classification
- Basis and Extensions
- Role of data preparation,
- Data acquisition and verification

Explosion hazards in process safety analysis - co-relations

Final conclusions
Program

**Dusts hazards**

AREA CLASSIFICATION - IEC 60079-10-2:2015

**R2P2**

- Why?
  - Risk
    - Understanding
    - \( F \times C \)

- How?
  - Risk
    - Evaluating
    - Methods / Standards

- What?
  - Risk
    - Controlling
    - Time / money (resources)
Standards

IEC 60079-10-2:2015 RLV is concerned with the identification and classification of areas where explosive dust atmospheres and combustible dust layers are present, so as to permit the proper assessment of ignition sources in such areas.
Risk analysis cycle - iterative approach

- Scenario probability analysis
- Analysis of consequences
- Criteria and standard - values
- Cost Benefit Analysis & Optimization
- Safety measures implementation
- Technical / organizational

Risk communication / safety measures communication

Verification, Actualization, Validation.
Step by step

Procedures of risk analysis

Substances characterization
- Places / installations
- Key parameters

Hazardous Area Classification
- Sources of release
- Time and quantities

H A C – work in progress

Methods of elimination

Documentation
Step by step

Procedures of risk analysis

Ignition sources

- Identification
- Characteristics

Risk analysis and assessment

- Probability in place
- Consequences

Safety measures applying

- Safety concept, project
- Verification / communication
Dust Explosions

Sequence of events

Mixing with air

Efficient source of ignition

Explosion with its Consequences

Dust deposits / layers

Substances, sources of dusts
Dust Explosions

Sequence of explosions

Primary explosion

Clouds of dust

Explosion with its Consequences

Dust deposits / layers

Substances, sources of dusts

Efficient source of ignition

Explosion with its Consequences

Mixing with air

Dust deposits

Efficient source of ignition

Explosion generating clouds
Substances characterization

**Formation of atmosphere**
- Combustibility
- Source of release
- Size,
- Quantities
- Process conditions
- Limiting Oxygen Concentration - LOC

**Effectiveness of ignition**
- MIT – minimum ignition temperature - \( T_{Cl} \); \( T_{\text{max}} \leq 2/3 \times T_{Cl} \)
- MIE – minimum ignition energy
- SIT – self ignition temperature (5 mm dust deposit) - \( T_{5mm} \); \( T_{\text{max}} \leq T_{5mm} - 75^0C \)
- Electrical Resistivity
Substances characterization

**Consequences**

- \( P_{\text{max}} \)
- \( K_{\text{max}} \)

- Maximum explosion pressure at normal condition
- Normalized pressure increase rate
Zones definition

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<th>Class II Division 2</th>
<th>Zone 22</th>
<th>Class II Division 1</th>
<th>Zone 21</th>
<th>Zone 20</th>
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<td>• A hazardous atmosphere formed by dust cloud in air is likely to occur in normal operation, but not frequently and only for short periods • Layers of combustible dust will in general be present</td>
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Explosion protection measures – preventing and mitigating

**Preventing explosive dust cloud**
- Releases removing
- Deposit decreasing
- Inerting by N2, CO2 and others
- Water vapour
- Inerting by inert dust adding
- Good housekeeping /dust removing
- Mechanical integrity of installation
- Water fog
- Mitigation of primary explosions

**Preventing ignition sources**
- Electric devices compliance
- Non electric devices
- Hot surfaces
- Electro static Discharges
- Smouldering combustion in dust
- Heat from mechanical impact (metal sparks and hot points)

**Mitigation**
- Partial Inerting
- Isolating (making sections)
- Venting
- Pressure resistant construction
- Suppression with automatic systems
- Good housekeeping
Area classification and other steps connected with, shall be documented

**Hard copy or electronic version which should include:**

- Recommendations from relevant codes and standards
- Assessment of dust dispersion from all sources of release
- Process parameters, which influence the formation of explosive dust atmosphere and dust layers
- Operational and maintenance parameters,
- Housekeeping programs
- Listed all process materials with its properties
- Drawings with type and extent of zones, tables with locations and identification of sources of release / plans and elevations
- Methods for maintaining and regularly reviewing the Classification also materials and equipment changes, with distribution list
- The reasons for the decisions taken to establish the type and extent of zones
Area classification shall be documented
Area classification shall be documented.
Who can do this work? How it can be done?

- Owner / Operator employees
  - Outourced team experts

What competency do they have?

How to buy? Who’s opinion is valid? How to cooperate and communicate?

Unit Ex 002 - classification of hazardous areas
Examples - housekeeping

Good housekeeping

Removes dusts from area - decreases hazardous area size

Removes dusts from area - decreases amount of dust and consequences

Should be checked to provide information for proper scheduling

Should be checked for risk analysis verification
New projects and existing installations

Differences -

- easy to create good solution
- benchmarking reference data
- need time to verify data
- provide verified data
- management of change
- avoid a routine in assessment
Examples - process analysis
Summary

Hazardous Area Classification for explosive dusts

Well recognized and clear IEC Standard IEC 60079-10-2:2015

Multidimensional task for very well prepared experts

Significant influence on spending's for safety measures
Thank you

Ireneusz Rogala