

Hazardous Area Classification - dust atmospheres

new plant design and operation
and re-evaluate changes to existing plant

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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

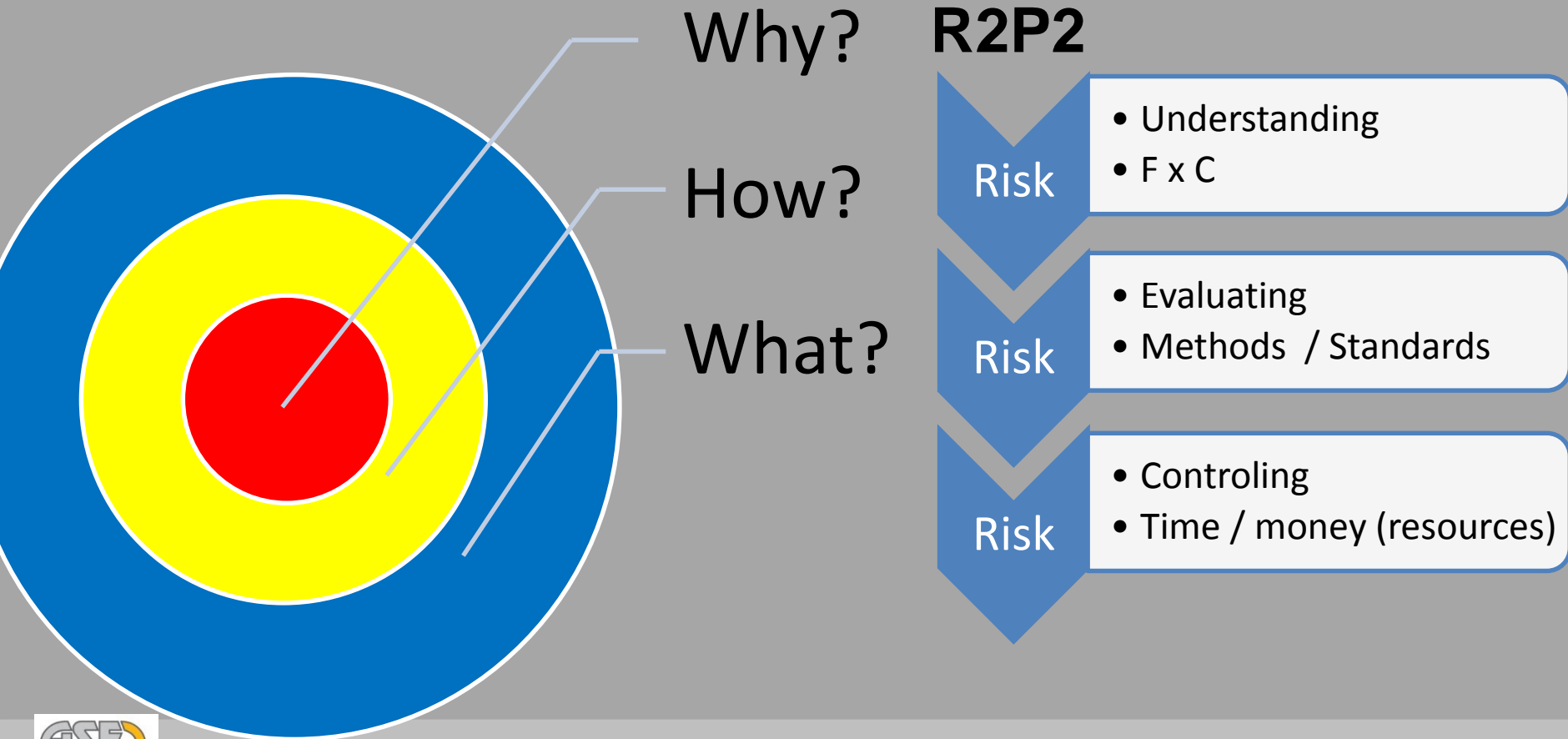
Program

Dusts hazards

AREA CLASSIFICATION

-

IEC 60079-10-2:2015

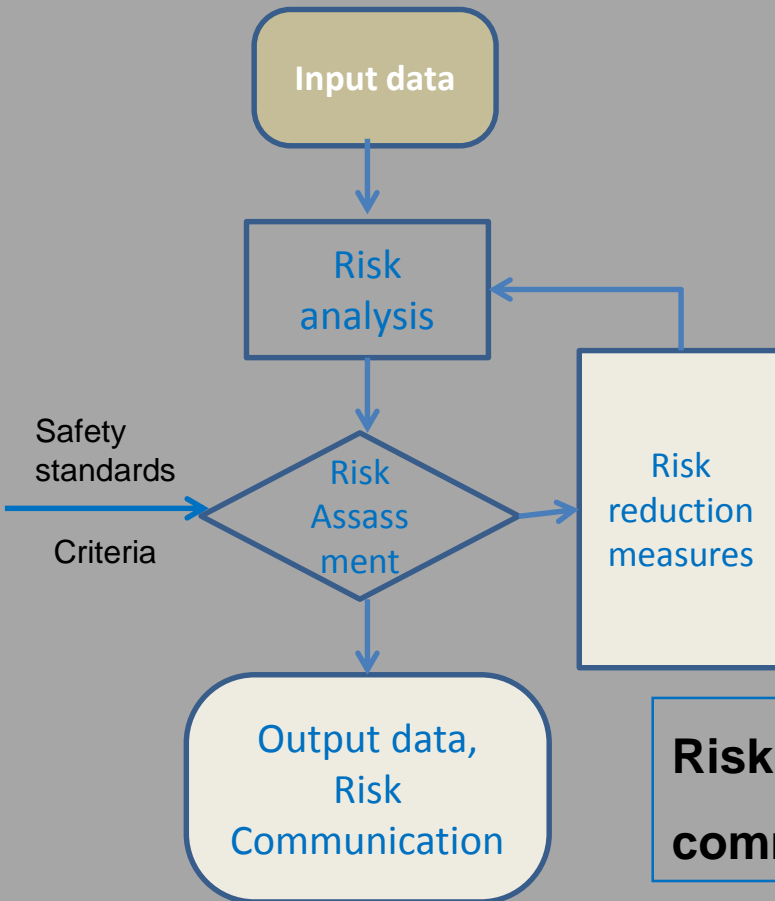


Standards

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



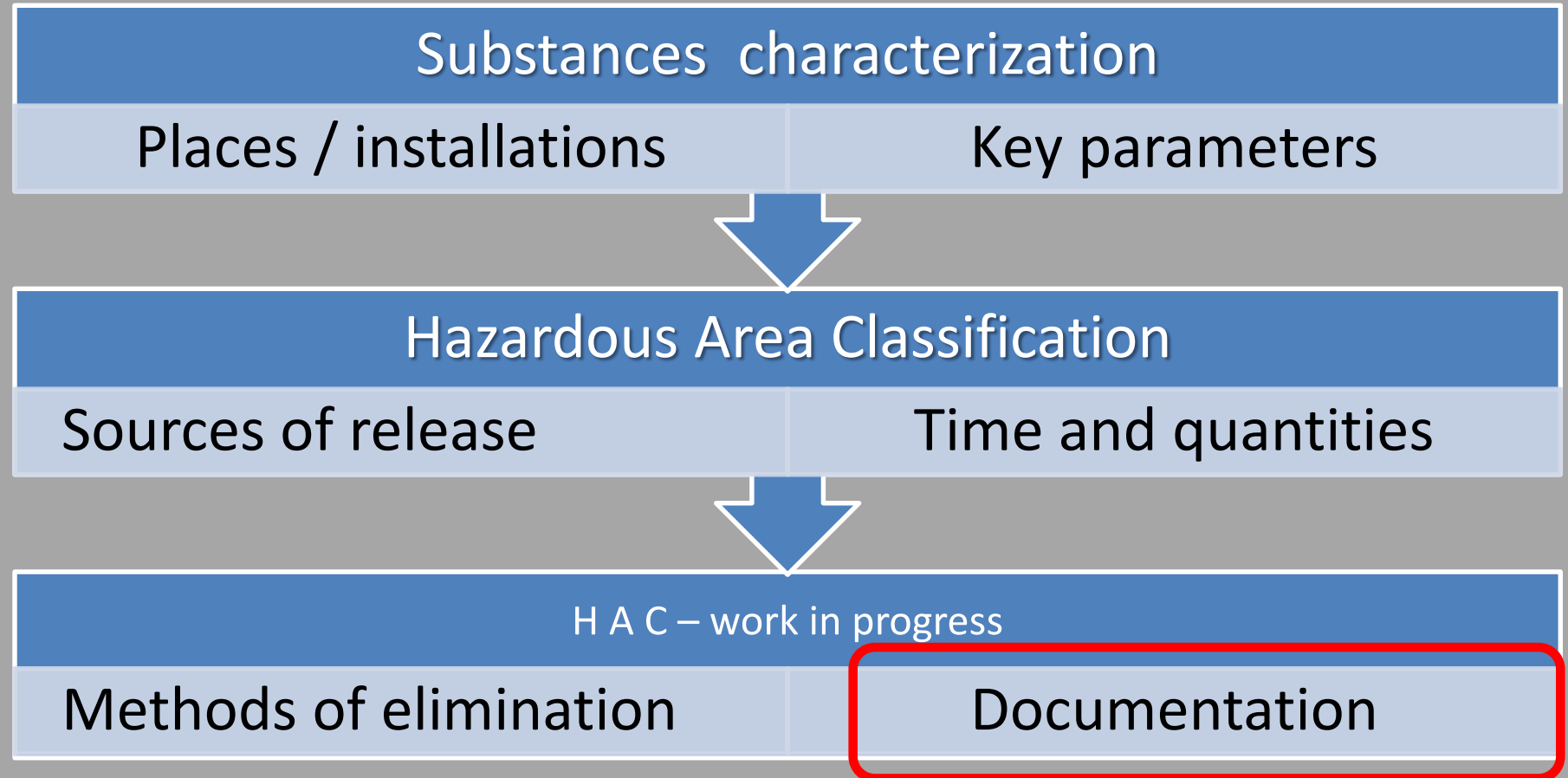
- Scenario probability analysis
- Analysis of consequences
- Criteria and standard - values
- **Cost Benefit Analysis & Optimization**
- **Safety measures implementation**
- **Technical / organizational**

Risk communication / safety measures communication

Verification, Actualization, Validation.

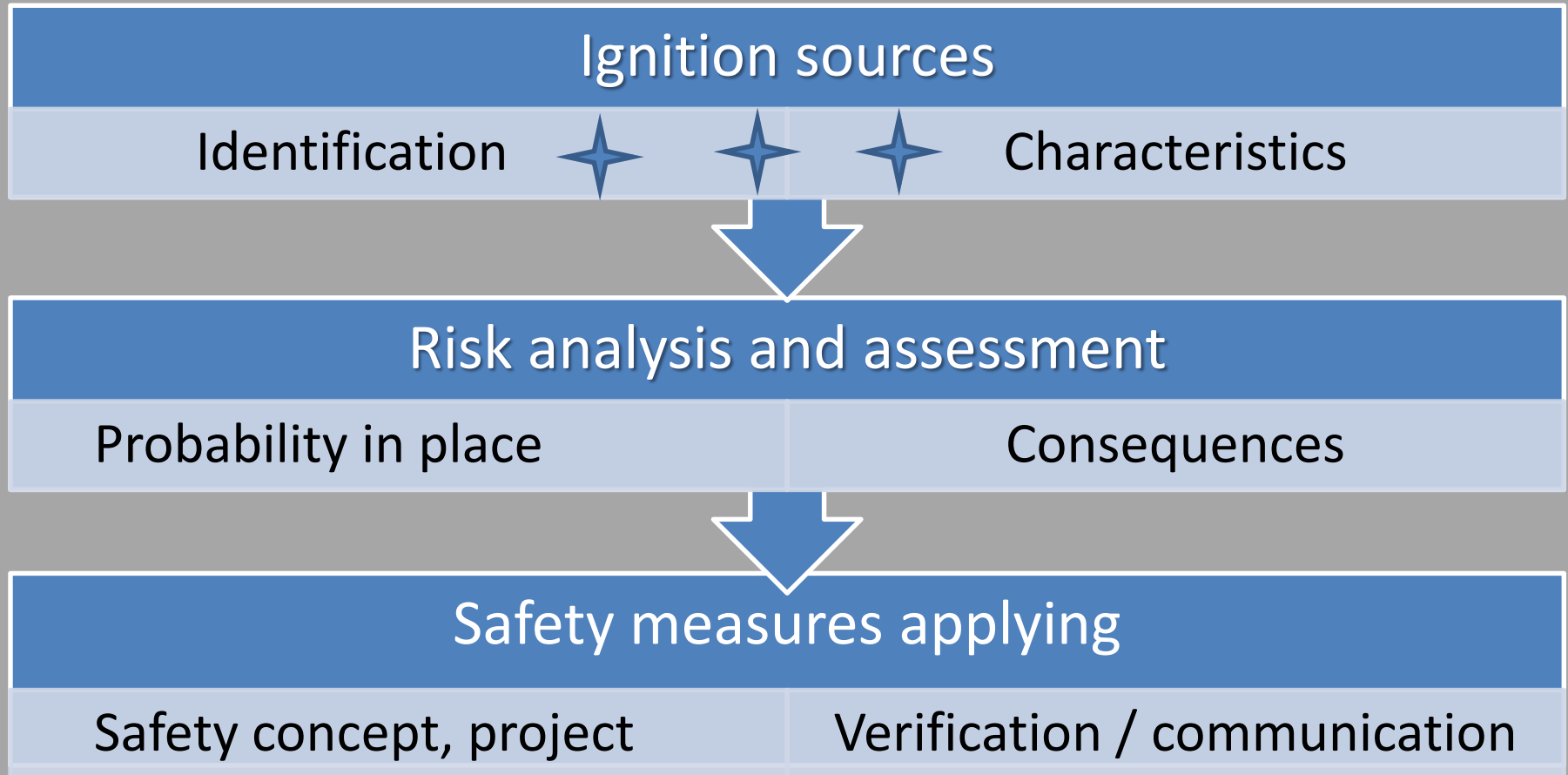
Step by step

Procedures of risk analysis



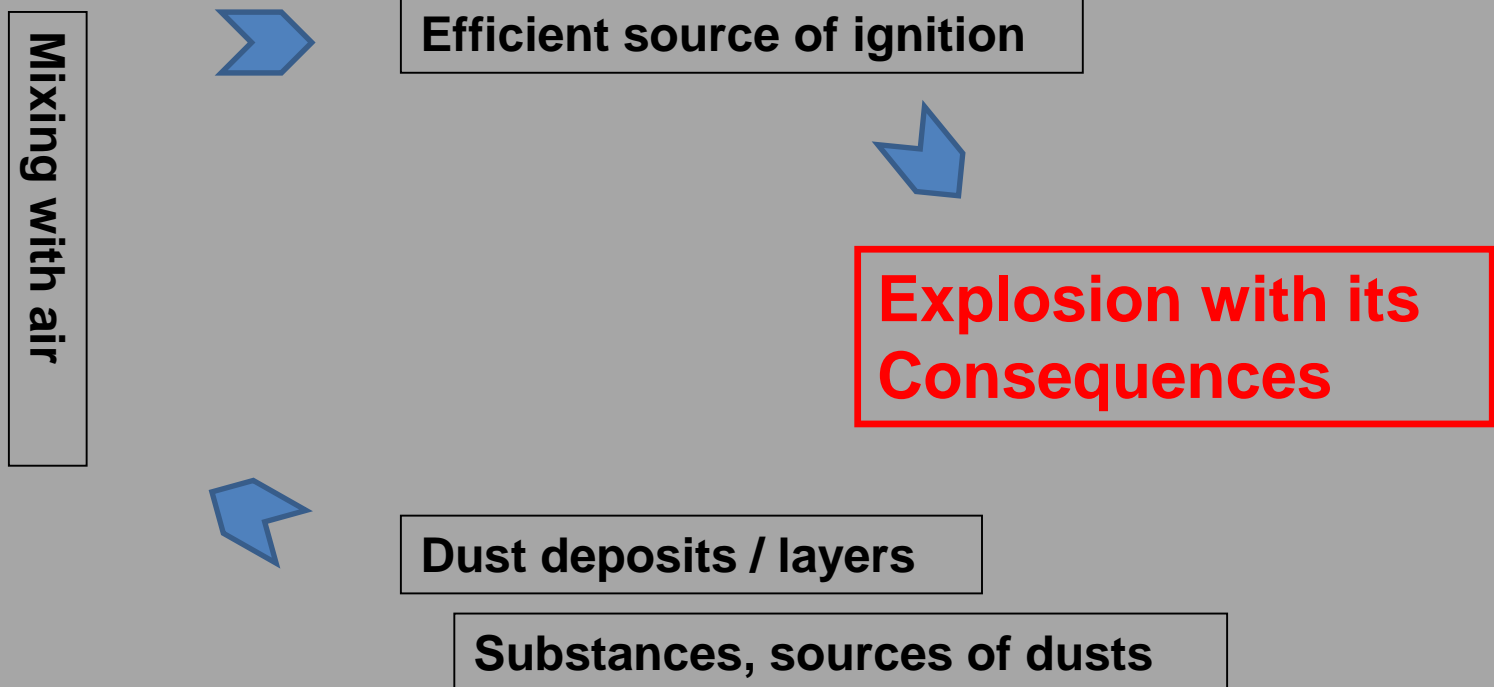
Step by step

Procedures of risk analysis



Dust Explosions

Sequence of events



Dust Explosions

Sequence of explosions

Primary explosion



Clouds of dust



Explosion with its Consequences

Dust deposits / layers

Substances, sources of dusts

Mixing with air



Efficient source of ignition

Explosion generating clouds



Dust deposits



Mixing with air



Efficient source of ignition



Explosion with its Consequences

Dust deposits

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} ; $T_{max} \leq 2/3 \times T_{Cl}$
- MIE – minimum ignition energy
- SIT – self ignition temperature (5 mm dust deposit) - T_{5mm} ;
 $T_{max} \leq T_{5mm} - 75^{\circ}C$
- Electrical Resistivity

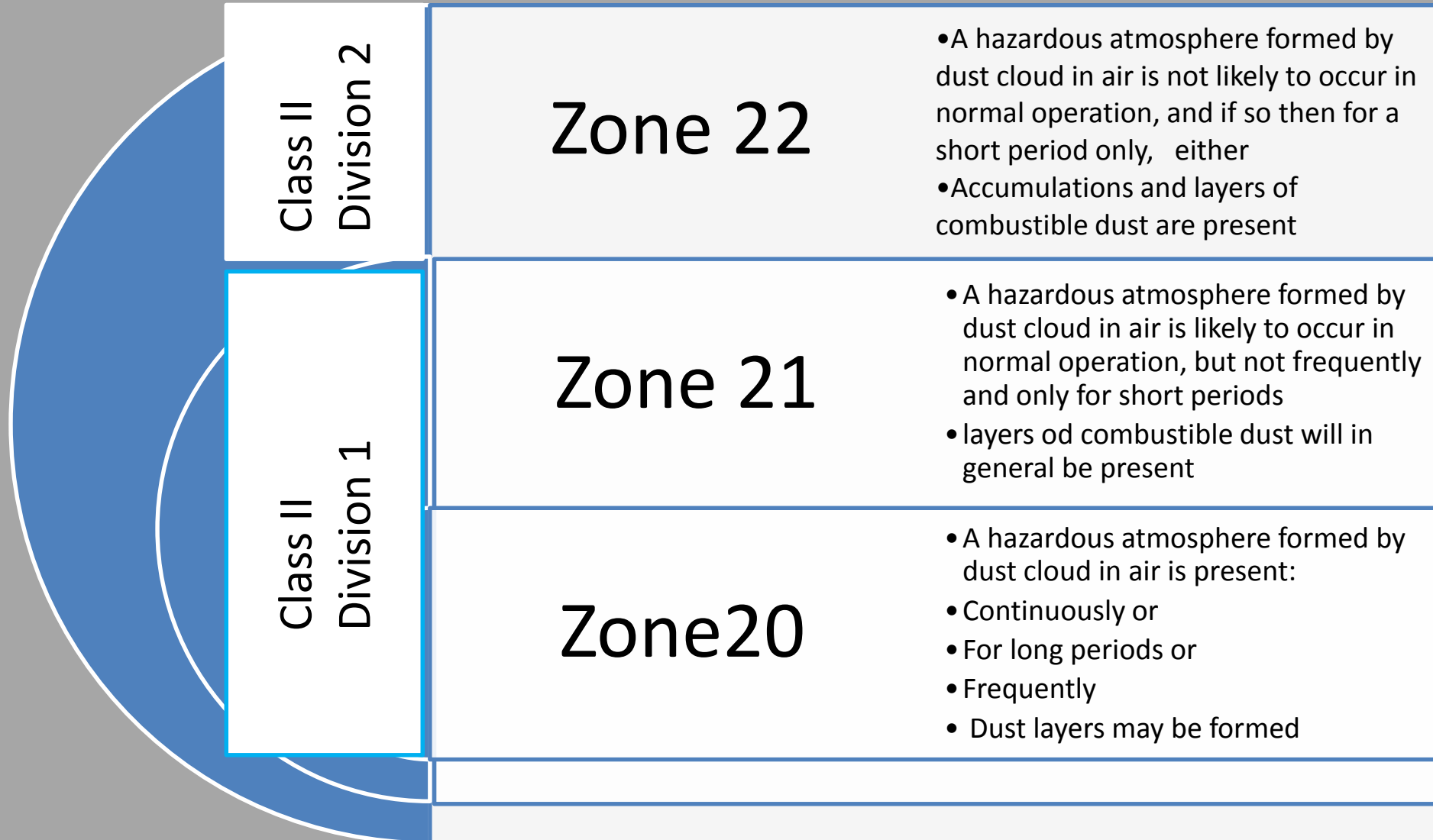
Substances characterization

Consequences

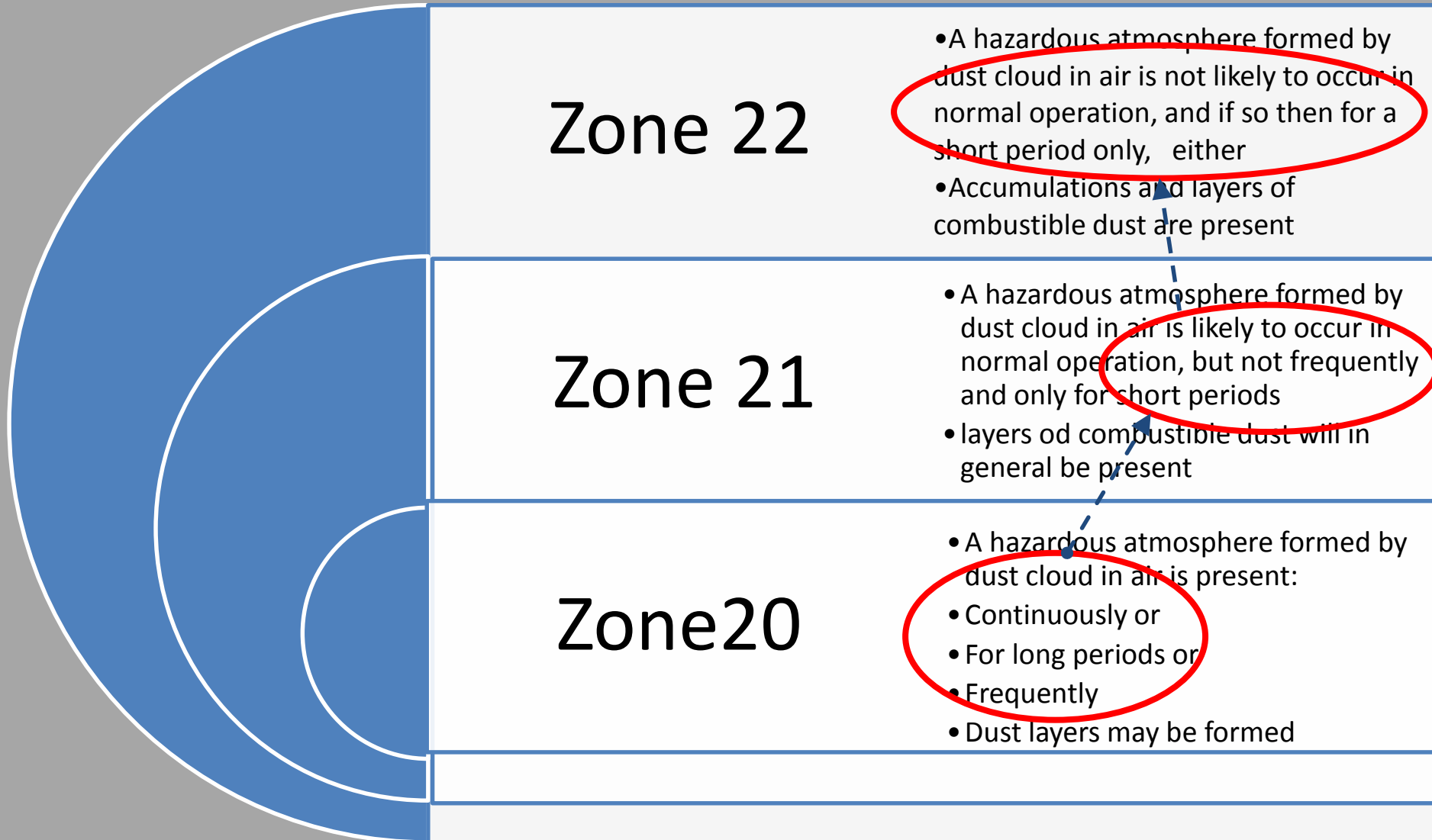
- P_{\max}
- K_{\max}

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

Zones definition



Zones definition



Explosion protection measures –preventing and mitigating

Preventing explosive dust cloud

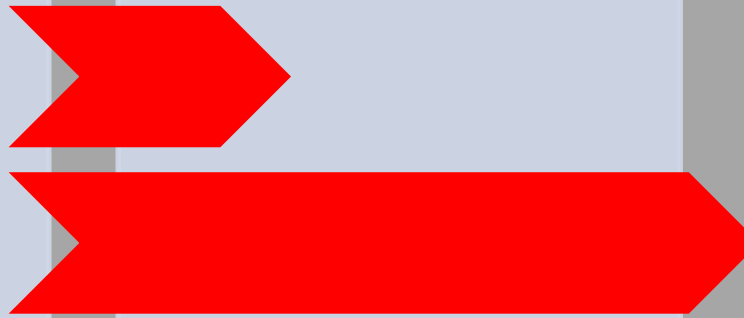
- Releases removing
- Deposit decreasing
- Inerting by N₂, CO₂ and others
- Water vapour
- Inerting by inert dust adding
- Good housekeeping /dust removing
- Mechanical integrity of installation
- Water fog
- Mitigation of primary explosions

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

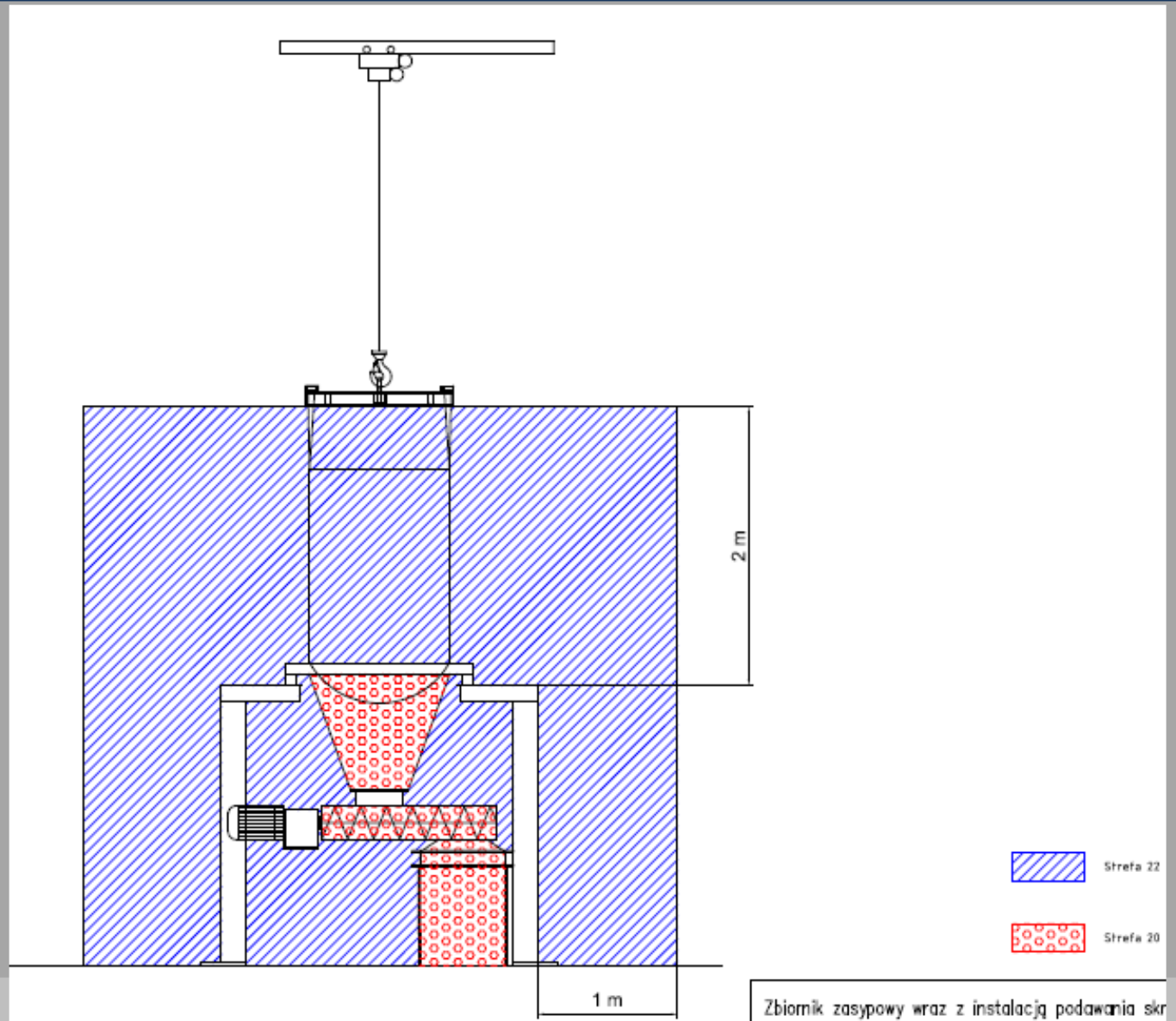
Listed all process materials with its properties

Drawings with type and extent of zones, tables with locations and identification of sources of release / plans and elevations

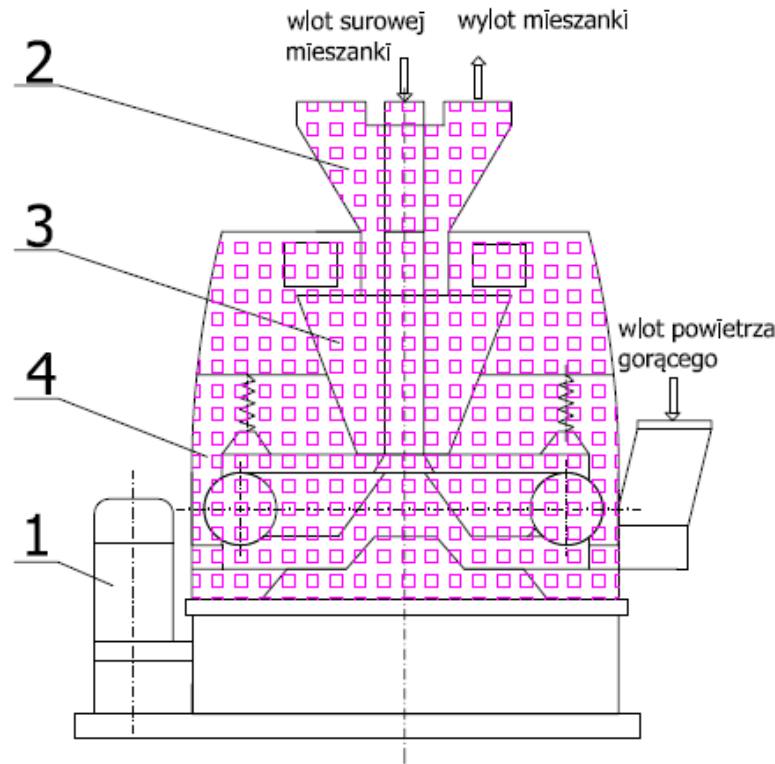
Methods for maintaining and regularly reviewing the Classification also materials and equipment changes, with distribution list

The reasons for the decisions taken to establish the type and extent of zones

Area classification shall be documented




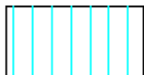
Area classification shall be documented



1. silnik elektryczny
2. głowica wlotowa
3. odsiewacz
4. komora młyna

Klasyfikacja obejmuje wszystkie młyny węglowe

 Strefa 20

 Strefa 22

Młyn węglowy			
Data	25.11.2013	Skala	
Nr rys.	15/ZEDO/2012	Opracował	G

Who can do this work? How it can be done?

Owner / Operator employees



Outsourced 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

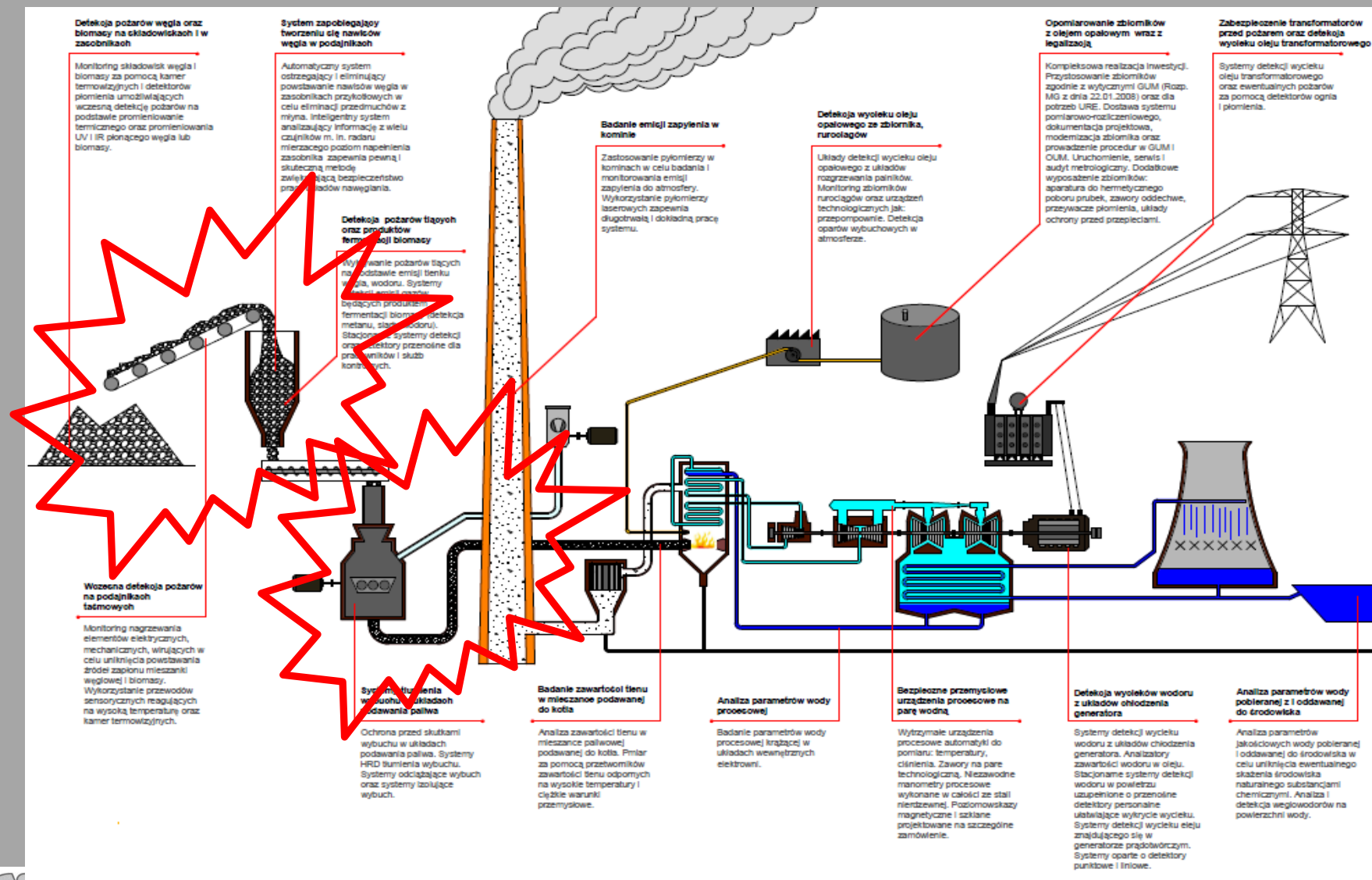
provide verified data

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