



危险区域划分

Area classification

——最新 IEC60079-10-1/-2解读

Application of latest edition of IEC 60079-10-1/-2



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煤矿事故造成大量人员伤亡。 Accidents in **coal mines** occurred and lead to heavy casualties.

原因： 电气设备的电火花是引起瓦斯爆炸的主要原因。
Causes : result of ignition of **Fire damp** by sparks (often generated by electrical apparatus) leading to those catastrophic accidents .

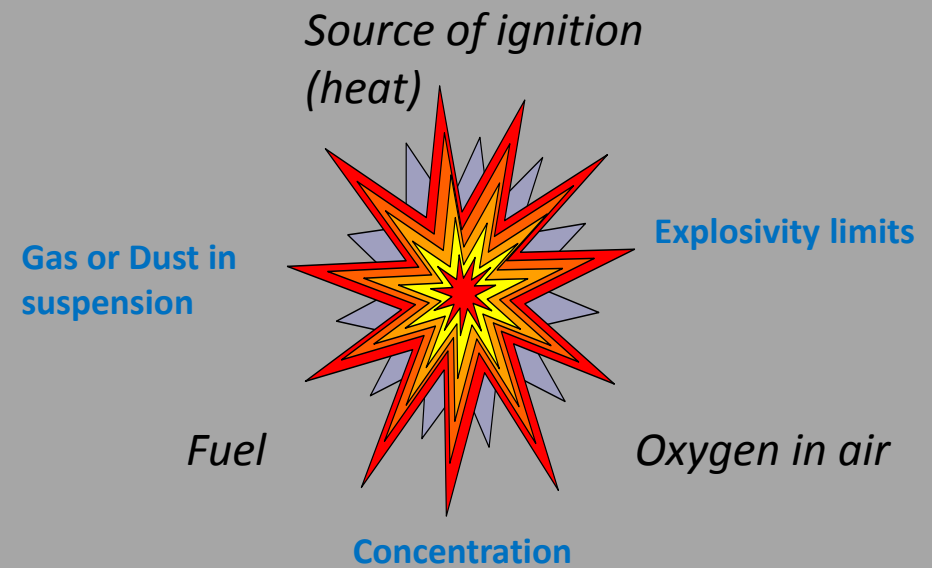
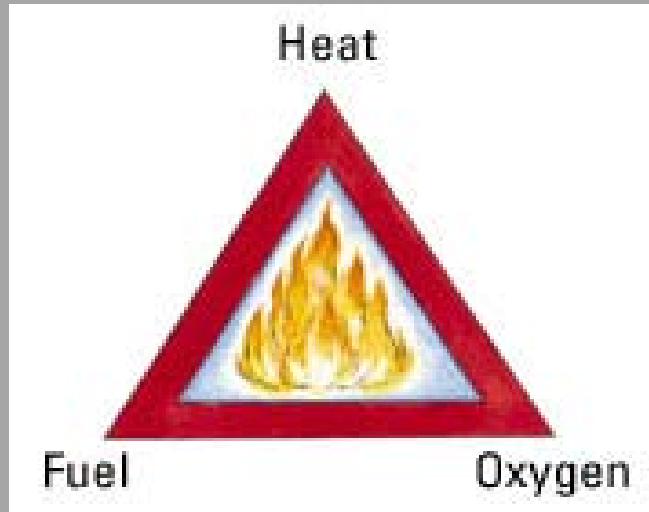


01

- 化工生产过程中的绝大部分材料属于具有易燃易爆的物质，容易引发燃烧和爆炸。 Many explosive or combustible material used in Oil & gas and chemical industries and also generated many accidents (**fire ,explosion**).
- **原因：防爆电气设备选型和使用导致的安全问题** Cause: Safety problems related to the design and use of electrical apparatus in hazardous areas



HEXAGON EXPLOSION





01

➤ 爆炸性环境应采取以下安全措施 In a situation in which there may be an explosive (flammable) atmosphere , the following steps should be taken:

- a) 消除点燃源周围出现爆炸性气体环境的可能性 eliminate the likelihood of an explosive gas atmosphere occurring around the source of ignition, or
- b) 消除点燃源 eliminate the source of ignition.

如果不可能，应选择保护性措施、过程设备、系统和程序等 a) 和 b) 共同存在的可能性减少至可接受的程度 Where this is not possible, protective measures, process equipment, systems and procedures should be selected and prepared so the likelihood of the coincidence of a) and b) is so small as to be acceptable.



01

- **区域划分 Area classification :**
- 通过分析和定义可能出现爆炸性气体环境的场所进行**正确的设备选用**，确保安全的方法。method of analysing and classifying the environment where explosive gas atmospheres may occur so as to facilitate **the proper selection and installation of equipment** to be used safely in that environment.
- 制定工厂操作和维护安全规程的依据。Allows **preparation of safety procedures** for plant operation and maintenance.
- 通过优化设计降低整体安装的风险。The area classification process **reduces the overall installation risk** level through design improvements.



02 气体区域划分标准

- 油气生产处理工厂 Oil & gas production and processing plants :
 - 陆上 onshore
 - 海上 offshore : platforms, FPSO (Floating Production Storage Offloading vessels)
- 油气罐，开采船 Oil and gas tankers, drilling ships
- 炼油厂 Oil refineries
- 化工厂 Petrochemical and Chemical processing plants
- 气体管线和配送站 Gas pipelines and distribution centers
- 加气站或加油站 Re-fuelling stations or petrol stations



02 气体区域划分标准

标准适用于爆炸性气体、蒸气与空气构成混合物的环境，但不适用于：

It is intended to be applied where there may be an ignition hazard due to the presence of flammable gas or vapour, mixed with air, but it **does not** apply to:

- a) 瓦斯矿井 mines susceptible to firedamp;
- b) 爆炸物处理和制造工业 the processing and manufacture of explosives;
- c) 标准未规定的灾难性或罕见故障 catastrophic failures or rare malfunctions which are beyond the concept of abnormality dealt with in this standard (see 3.7.3 and 3.7.4);
- d) 医疗室 rooms used for medical purposes;



02 气体区域划分标准

- e) 使用低压燃料气体的商业和工业场所 commercial and industrial applications where only low pressure fuel gas is used for appliances e.g. for cooking, water heating and similar uses, where the installation is compliant with relevant gas codes;
- f) 家用环境 domestic premises;
- g) 可燃性粉尘或纤维 where a hazard may arise due to the presence of combustible dusts or combustible flyings but the principles may be used in assessment of a hybrid mixture (refer also IEC 60079-10-2).



02 气体区域划分标准

相比前一版本标准，新版标准作了大量的修改，更加贴合实际的工业现场环境。通过使用zone的方法划分危险区域，从而确保正确的设备选型和安装，并提供了一些新的评估手段。

Incorporates significant changes to address shortcomings of previous editions and provides new evaluation tools.



02 气体区域划分标准 新版本的技术修订内容





02 气体区域划分标准 新版本的技术修订内容

扩展区域划分的方法

- 简单方法：采信国际或地区出版物的典型图表
- 组合方法：在设备设计阶段采用简单方法，后期通过释放源评估方法（附录F）进行优化评估
- 基于经验评估：已有同类区域划分的经验可作为新区域划分的依据。

Germany	DGUV-Regel 113-001 "Explosionschutz-Regeln (Rx-RL)" TRBS 2152.
Italy	GUIDA CEI 31-35 & GUIDE CEI 31-35/A
Sweden	Klassning av explosionsfarliga områden
Switzerland	SUVA Merkblatt Nr. 2153



02 气体区域划分标准 新版本的技术修订内容

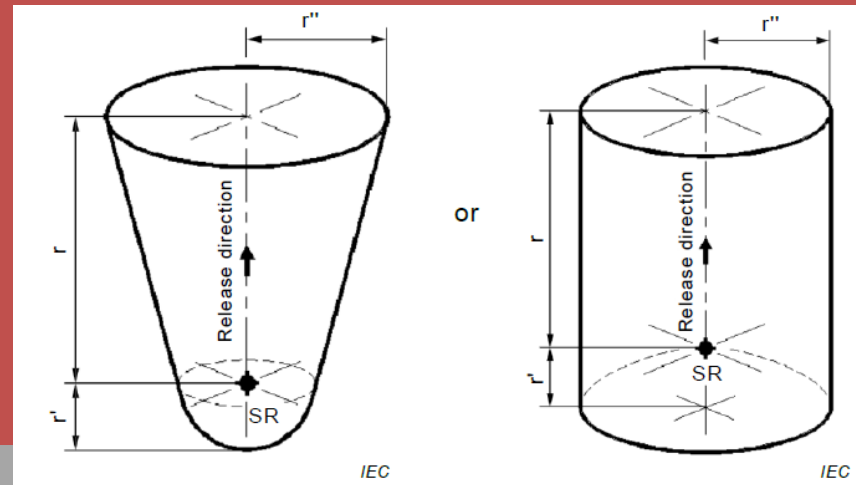
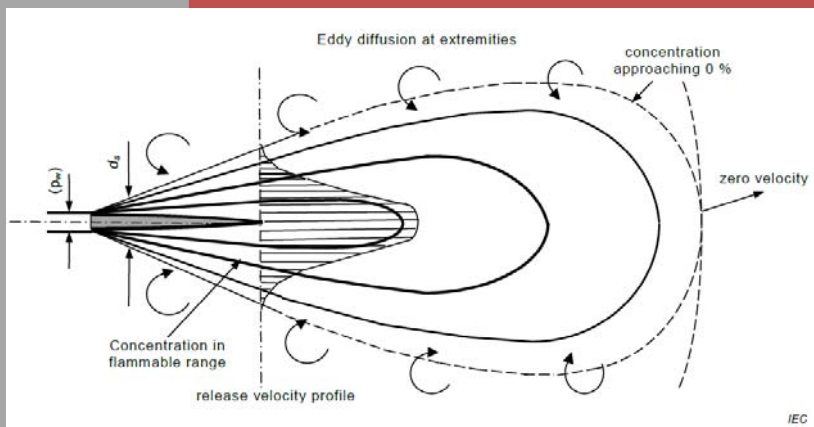
释放形式

物质特性影响释放及区域的范围：气体物质，压力液化的气体，温度液化的气体，液池等。 Characteristics have influence on the release behavior and the shape of hazardous area.

新版本的技术修订内容

释放形式

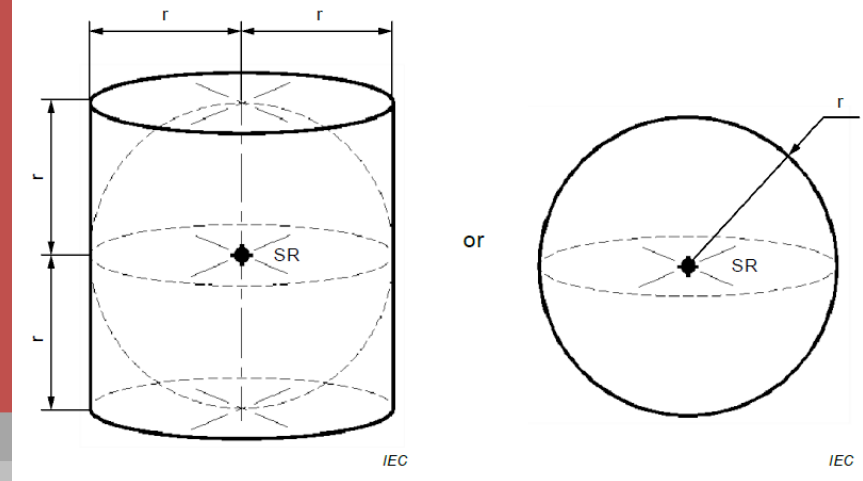
高压气体的释放源可能发生自稀释现象，区域的形状受释放速度的影响发生改变。 A high pressure gaseous release may be self-diluting with certain condition with the shape of the hazardous area influence by release velocity.



新版本的技术修订内容

释放形式

低压气体释放主要受密度和大气条件的影响。 Low pressure gas release influenced by material vapour density and atmospheric conditions.





新版本的技术修订内容

释放源的计算方法

气体或蒸气的释放速率

增加了流量因素的系数和二级释放源的通孔尺寸 (附录B) coefficient of discharge factor and hole cross sectional diameters for secondary grades of release

01

液体释放速率

增加了流量因素的系数用于确定蒸气池尺寸和释放速率。

02

03

蒸发池的释放速率

规定了蒸发池的蒸发速率，并新增了确定体积图表



新版本的技术修订内容

某一位置的区域划分

根据“释放等级”，“通风可用性”和区域内通风的“有效性”来确定室内和露天场所的区域

Zone classification based on the grade of release, availability of ventilation and the effectiveness of ventilation.

Grade of release	Effectiveness of Ventilation						
	High Dilution			Medium Dilution			Low Dilution
	Availability of ventilation						
	Good	Fair	Poor	Good	Fair	Poor	Good, fair or poor
Continuous	Non-hazardous (Zone 0 NE) ^a	Zone 2 (Zone 0 NE) ^a	Zone 1 (Zone 0 NE) ^a	Zone 0	Zone 0 + Zone 2	Zone 0 + Zone 1	Zone 0
Primary	Non-hazardous (Zone 1 NE) ^a	Zone 2 (Zone 1 NE) ^a	Zone 2 (Zone 1 NE) ^a	Zone 1	Zone 1 + Zone 2	Zone 1 + Zone 2	Zone 1 or zone 0 ^c
Secondary^b	Non-hazardous (Zone 2 NE) ^a	Non-hazardous (Zone 2 NE) ^a	Zone 2	Zone 2	Zone 2	Zone 2	Zone 1 and even Zone 0 ^c

^a Zone 0 NE, 1 NE or 2 NE indicates a theoretical zone which would be of negligible extent under normal conditions.

^b The zone 2 area created by a secondary grade of release may exceed that attributable to a primary or continuous grade of release; in this case, the greater distance should be taken.

^c Will be zone 0 if the ventilation is so weak and the release is such that in practice an explosive gas atmosphere exists virtually continuously (i.e. approaching a 'no ventilation' condition).

'+' signifies 'surrounded by'.

Availability of ventilation in naturally ventilated enclosed spaces shall never be considered as good.



新版本的技术修订内容

用稀释进行通风评估

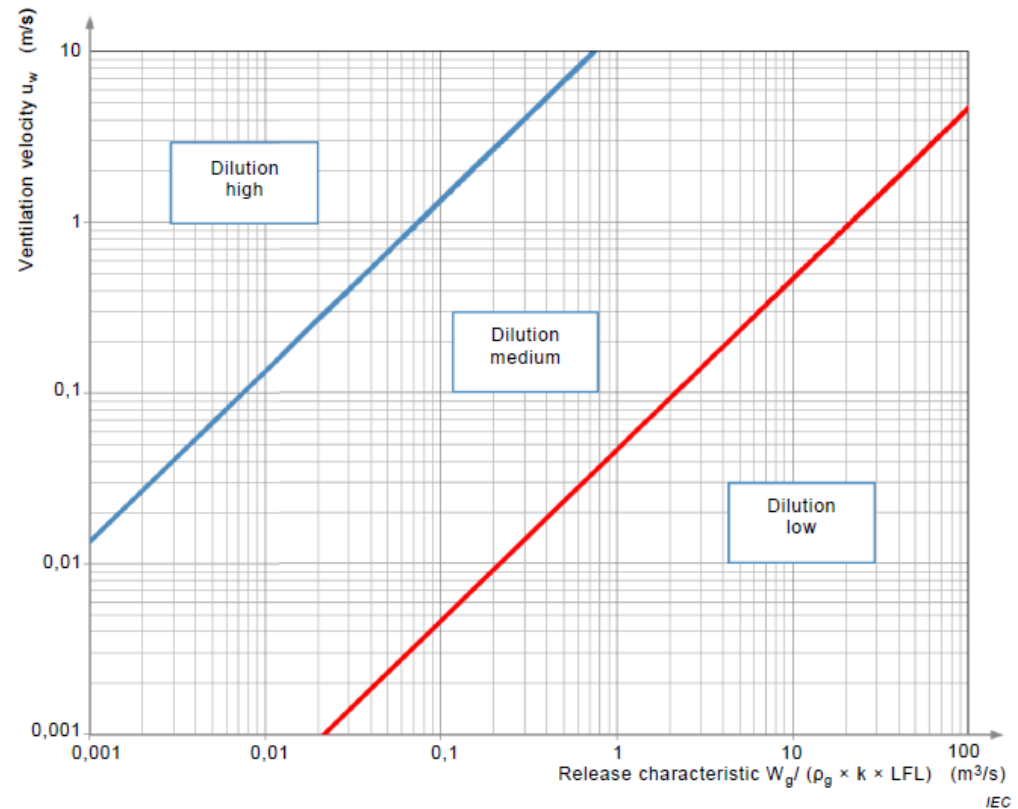
- 密闭区域 enclosed area——通风速率及背景浓度 ventilation velocity and background concentration
- 人工通风区域 artificially ventilated enclosures- 平均流速 average flow velocity caused by ventilation system
- 自然通风区域 naturally ventilated enclosures-热烟道效应及通风 a function of the thermal stack effect, wind effects or both



02 气体区域划分标准 新版本的技术修订内容

用稀释进行通风评估

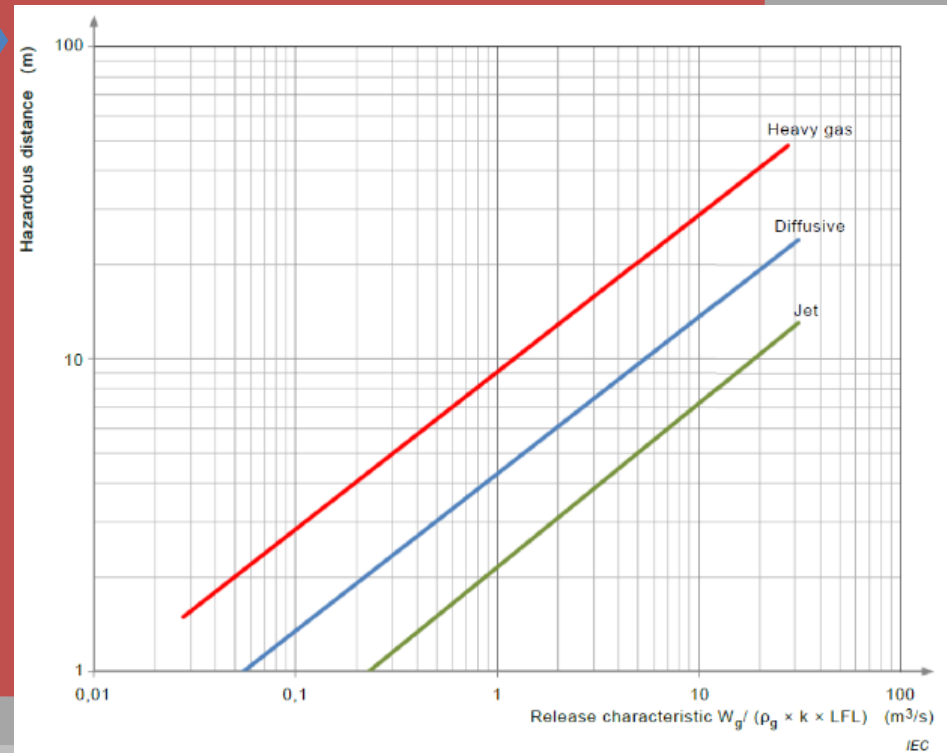
稀释是将释放稀释至安全水平的通风或大气条件
dilution is a measure of the ability of ventilation or atmospheric conditions to dilute a release to a safe level.



新版本的技术修订内容

评估危险场所的范围

根据释放类型确定危险区域的范围 extent of hazardous area based on the type and behavior of release.





新版本的技术修订内容

文档

文件化的设计信息包括：documented design information:

- 使用的信息来源（代码，国家标准或计算） sources of information used
- 气体蒸气扩散计算 gas dispersion calculation
- 考虑到建筑物通风位置的通风特性研究 study of ventilation characteristics
- 易燃材料的特性 properties of flammable materials
- 识别和标识释放源 identification and location of sources of release



02 气体区域划分标准 新版本的技术修订内容

文档

文件化的设计信息包括：documented design information:

区域划分文件还应包括区域类型和范围、气体组别，点燃温度和/或温度组别的计划，高程或三维模型等。

Plan, elevation or three dimensional models indicating the type and extend of zone, group classification, ignition temp. and/or temperature class.



02 气体区域划分标准 新版本的技术修订内容

示例

附录E示例：sample

泵应用在户外场所 pump application in open air

泵应用在封闭的场所 pump application within an enclosed location

处理容器在露天 process vessel in open air

控制阀处于拥堵位置 control valve in a congested location

封闭处理管道 process piping in an enclosed location

压缩机设施处理天然气 compressor facility handling natural gas



02 气体区域划分标准 新版本的技术修订内容

区域划分的程序

- 释放的特征 characteristics of release
- 场所特征 characteristics of location
- 释放影响 effects of release
- 区域划分 hazardous area classification



02 粉尘区域划分标准

粉尘场所

释放形成粉尘云，包括粉尘积聚或粉尘层。 Formation of a dust cloud from any source of release, including a layer or accumulation

释放形成粉尘层，不会产生粉尘云，但粉尘层因自燃、高温等发生点燃，成为点燃源。 Formation of dust layers, which are not likely to form a dust cloud, but may ignite due to self-heating or exposure to hot surface. The ignited layer may also be an ignition source.



02 粉尘区域划分标准

粉尘区域划分

粉尘区域评估与气体区域划分方法类同，但有特殊性： similar to flammable gas and vapour area classification, but

- 粉尘环境会出现粉尘层和粉尘云的不同情况； formulation of dust and layer
- 高浓度（爆炸上限）的粉尘层可能会形成爆炸性粉尘云环境； very high concentration may be explosive
- 并非所有的粉尘释放会形成粉尘危险环境； not every source of release produce explosive dust atmosphere.



02 粉尘区域划分标准

粉尘区域划分

粉尘区域评估与气体区域划分方法类同，但有特殊性 similar to flammable gas and vapour area classification, but :

- 粉尘云内的密度不是平均的， dust clouds are rarely of uniform density.
- 粉尘云不能采取通过通风措施来消除 dust not removed by mechanical extraction or ventilation;
- 稀释和少量释放也会形成爆炸粉尘层。



02 粉尘区域划分标准

粉尘场所

- 煤矿井下, underground mining areas,
- 不需要氧气会产生爆炸的粉尘, 自燃物质, 烟火、弹药等
dusts of explosives that do not require atmospheric oxygen for combustion, or to such as pyrophoric substances, propellants, pyrotechnics, munitions, peroxides, oxidizers, waterreactive elements or compounds, or other similar materials,
- 标准未规定的病变引起的灾难性故障 catastrophic failures which are beyond the concept of abnormality dealt with in this standard
- 粉尘释放的可燃性或毒性气体 any risk arising from an emission of flammable or toxic gas from the dust.



02 粉尘区域划分标准

影响粉尘区域划分的因素

- 粉尘燃烧特性 combustible or not
- 材料特性 Material characteristics
- 粉尘泄漏类型 Nature of dust releases
- 运行和维修程序，包括日常保养 Operational and maintenance regime procedures for the plant, including housekeeping.
- 其他设备与安全信息 Other equipment and safety information



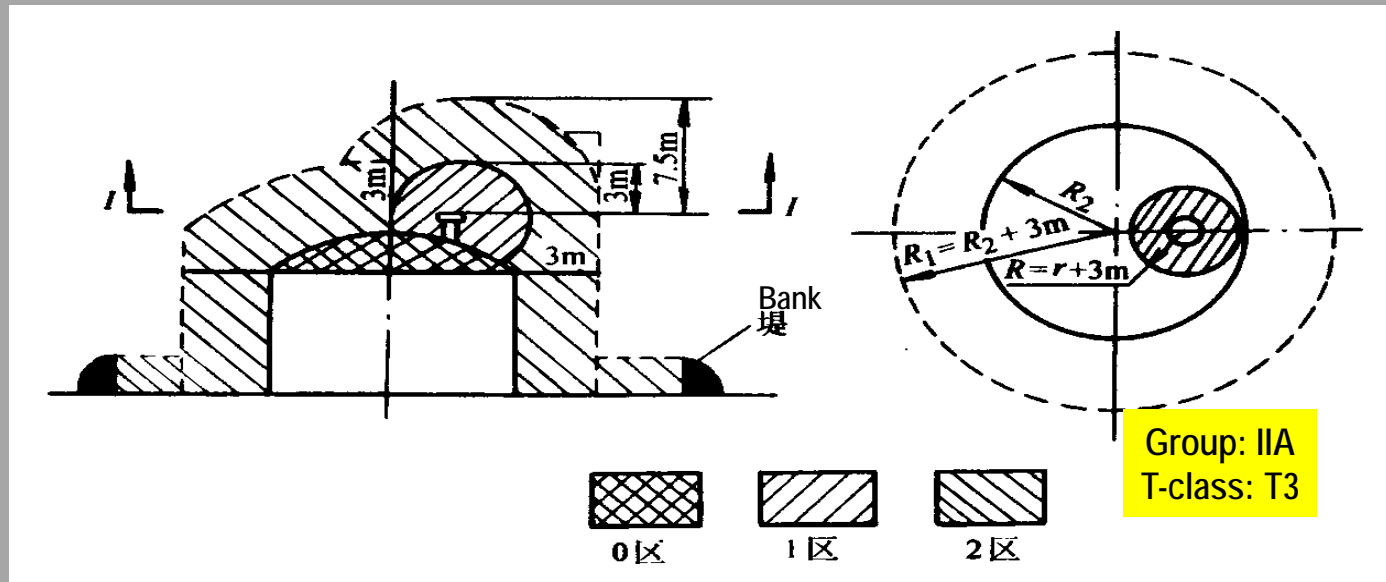
02 粉尘区域划分标准

粉尘区域划分的程序

1. 识别物料的燃烧特性及物料特征：尺寸、温度、粉尘层和粉尘云的最低点燃温度和导电性等 identify whether the material is combustible and, for the purpose of assessment of ignition sources, determine the material characteristics
2. 确定环境中使用的电气设备可能存在或产生释放源 identify items of equipment where explosive dust containment mixtures may be contained or sources of dust release can be present
3. 确定释放源出现粉尘爆炸性环境的可能性 determine the likelihood that dust will be released
4. 确定粉尘区域及边界（范围） identified and their extents boundaries

03 气体区域划分示例

- 典型的带有呼吸阀的露天汽油罐的危险区域划分示例。Area classification for a gasoline tank in open location.



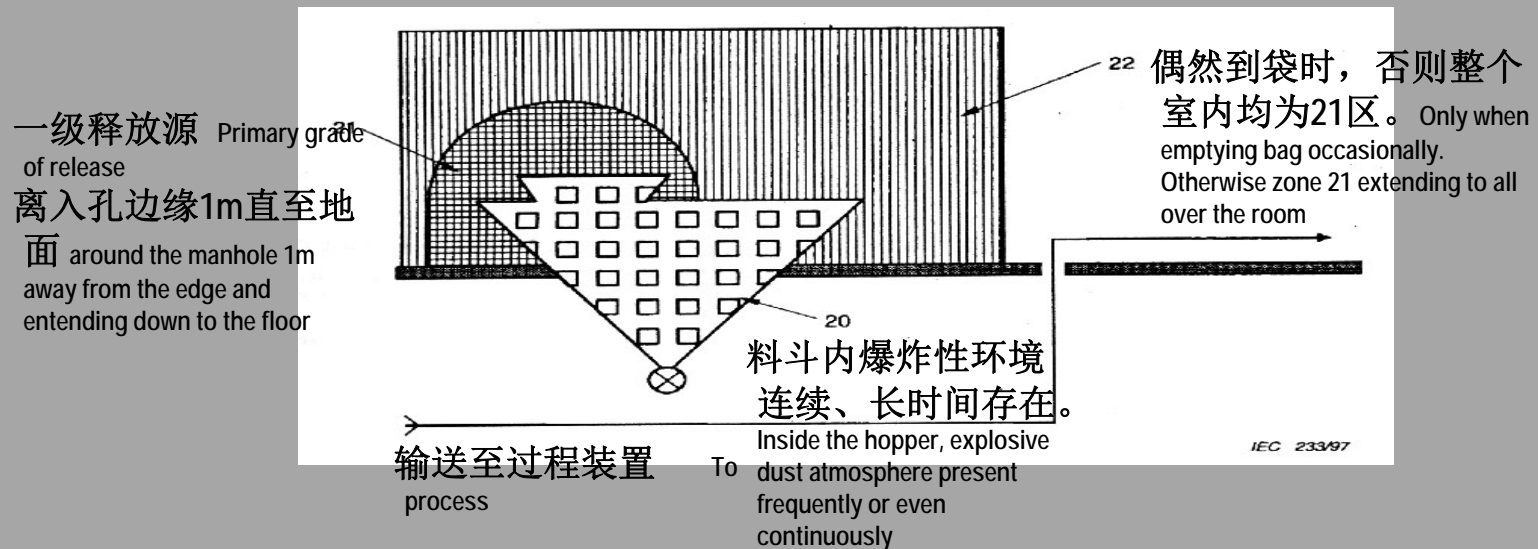
R—油罐半径 (m)

r—呼吸阀阀口半

03 粉尘区域划分示例

- 室内不带通风的投料站。 Bag emptying station within a building without exhaust ventilation.

本例子中，袋是手工倾倒在料斗中，并通过空气作用将物质传送至工厂的其他地方。漏斗总是充满的。
 In this example bags are manually emptied frequently into a hopper from which contents are conveyed pneumatically into some other part of the plant. Part of the hopper is always filled with product.





谢 谢 !

Thanks for your attention!