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Area Classification

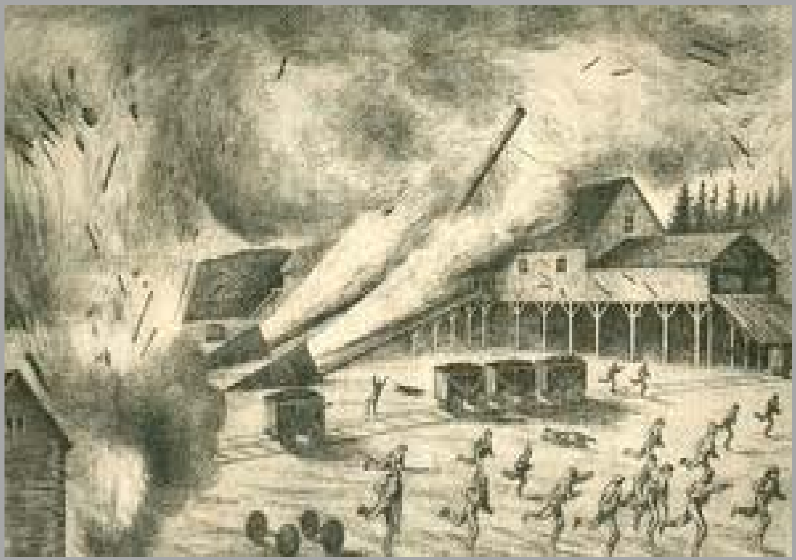
Why ? Where ? How ? Who ? When ?

Patrick Leroux
TOTAL

AREA CLASSIFICATION **Why ?** *A brief history of accidents*

Severe accidents in **coal mines** occurred through the world in the 19th and 20th century (thousands of casualties).

Causes : result of ignition of **Fire damp** by sparks (often generated by electrical apparatus) leading to those catastrophic accidents .



AREA CLASSIFICATION **Why ?** A *brief history of accidents*

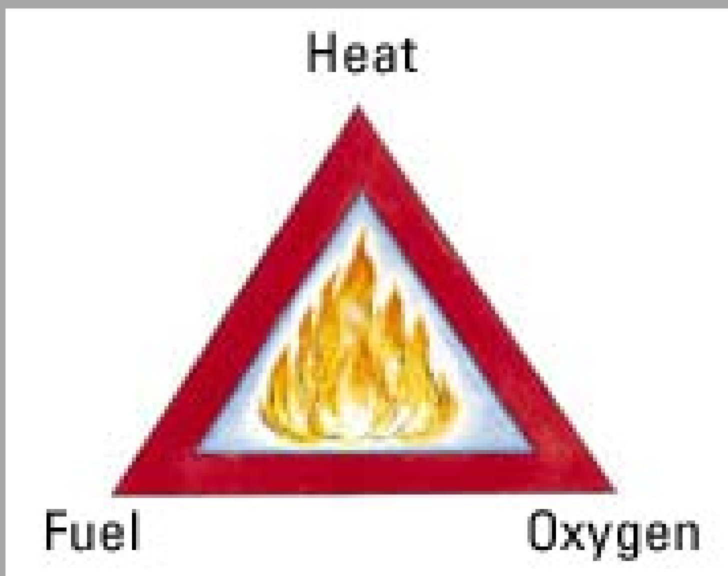
- Oil & gas and chemical industries also generated many accidents (**fire ,explosion**).
- Safety problems related to the design and use of electrical apparatus in hazardous areas have led the **Authorities**, at a very early stage to impose **very strict rules**.

AREA CLASSIFICATION

Why ?

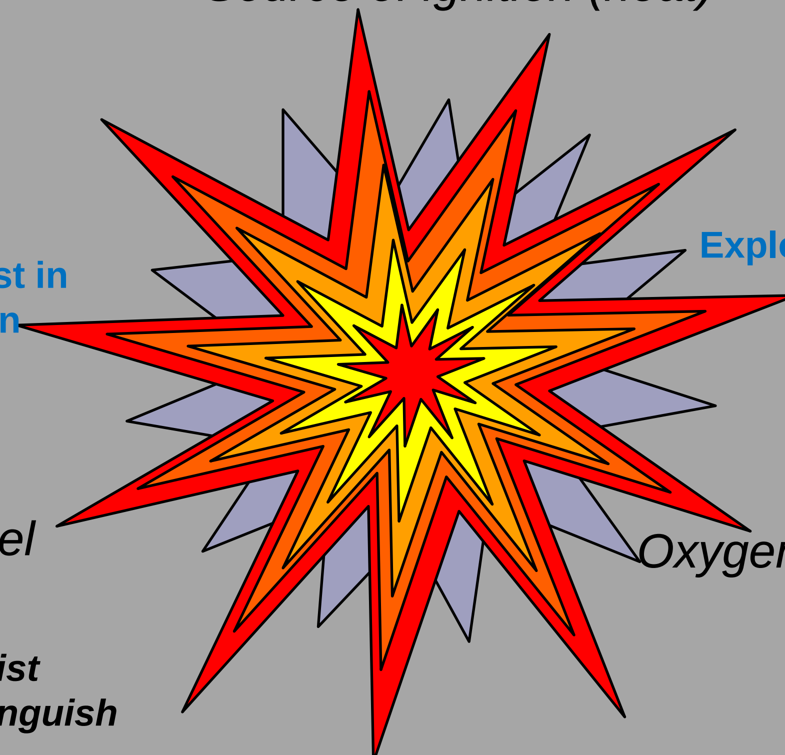
Fire , Explosion origin

FIRE TRIANGLE



-If any side of the triangle is missing , a fire cannot exist
-If any side of the triangle is removed, the fire will extinguish

HEXAGON EXPLOSION



Protection methods are based on the removal of one summit of the triangle/hexagon.

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AREA CLASSIFICATION

Why ? *Area classification objectives*

- **In a situation in which there may be an explosive (flammable) atmosphere , the following steps should be taken:**

a) eliminate the likelihood of an explosive gas atmosphere occurring around the source of ignition, or
b) eliminate the source of ignition.
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.

- **Area classification :** 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.

- Allows **preparation of safety procedures** for plant operation and maintenance.

- The area classification process **reduces the overall installation risk** level through design improvements.

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AREA CLASSIFICATION **Where ?** *Included as per IECEx*

- **Oil & gas production and processing plants :**
  -onshore
  -offshore : platforms, FPSO (Floating Production Storage Offloading vessels)
- **Oil and gas tankers, drilling ships**
- **Oil refineries**
- **Petrochemical and Chemical processing plants**
- **Gas pipelines and distribution centers**
- **Re-fuelling stations or petrol stations**

- **Underground coal mines**
- **Printing industries, paper and textiles**
- **Hospital operating theatres**
- **Surface coating industries**
- **Sewerage treatment plants**
- **Grain handling and storage and processing (flour-milling industry)**
- **Sugar refineries**
- **Light metal working, where metal dust and fine particles can appear**
- **Woodworking areas**

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AREA CLASSIFICATION

Where ?

Excluded as per IEC 60079-10-1

IEC 60079-10-1 **Classification of areas - Explosive gas atmospheres**

Standard intended to be applied where there may be an ignition hazard due to the presence of flammable gas or vapour, mixed with air under normal atmospheric conditions but **does not apply to** :

- mines susceptible to firedamp, but IEC 60079 series apply to mines (gas group I)
- processing and manufacture of explosives.
- areas where a hazard may arise due to the presence of combustible dusts or fibers (refer to IEC 61241-10 / IEC 60079-10-2).
- catastrophic failures which are beyond the concept of abnormality dealt with in this standard.
- rooms used for medical purposes.
- domestic premises.

➢ **This standard does not take into account the effects of consequential damage.**

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AREA CLASSIFICATION — How ? — *Rules*

Rules to be applied for area classification are divided into 2 categories :

REGULATIONS

- Published by the national legal Authorities.
- Application is mandatory. (**Law**)
- They vary from country to country.

STANDARDS

Published by a standardization committee ***(international/national/regional).***
Application is not mandatory but only if it has been enforced by law.
Standardization committees generally include representatives from :

* manufacturers,
* end users,
* safety agencies, certifying agencies
* utilities, etc.

- They publish a document (the « ***STANDARD*** ») which represents a **consensus** between all the parties and reflects the state of the art at a given time
- **Consensus does not imply unanimity !**

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AREA CLASSIFICATION **How ?** *Reference documents*

- Generally regulations give few details about on « How to achieve safety » but only aims are defined .

REGULATIONS

- International level ……………………… nothing so far ….but …. !
- Regional level (eg Europe)…………… 2 ATEX directives ***(1 for products , 1 for workers)***
- National level (eg USA)…………….… OSHA ,MOSHA , US Coast Guards

- Details are most of time found in Standards which can be of different types :

STANDARDS

International	**IEC 60 079 series**
European	CENELEC 60 079 series
National	USA : ANSI/API RP 505 (zone system)
	Russia : Gost R 51330-X-99 series

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AREA CLASSIFICATION **How ?** *Available IEC standards*

IEC 60 079 -10 Explosive atmospheres standard

Part 10-1: Classification of areas – Explosive gas atmospheres

Part 10-2: Classification of areas – Combustible dust atmospheres

Part 10-1 Introduction stipulates

In areas where dangerous quantities and concentrations of flammable gas, vapour or mist under normal atmospheric conditions may arise, **protective measures are to be applied in order to reduce the risk of fire and/or explosion.**

Part 10-1 scope stipulates :

For detailed recommendations regarding the extent of the hazardous areas in specific industries or applications, reference may be made to national or industry codes relating to those applications.

AREA CLASSIFICATION **How ?** *Codes*

CODE Example 1

Model CODE of safe practice Part IP 15 (UK)

*published by the Energy Institute (formerly **I**nstitute of **P**etroleum)*

Title : «Area Classification code for installations handling flammable fluids»

- The 3rd edition (2005) -143 pages- was prepared by about 15 major oil companies
- It is considered as a well established, internationally accepted code for classification of hazardous areas
- In the foreword, it is written:

"The information contained in this publication is provided for information only and while every reasonable care has been taken to ensure the accuracy of its contents, the EI cannot accept any responsibility for any actions taken, or not taken, on the basis of this information The EI shall not be liable …….."

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AREA CLASSIFICATION **How ?** *Codes*

CODE Example 2

The **European Commission** (publisher of the 2 ATEX directives) has also published a document titled :

"Non binding guide of good practice for implementing Directive n° 1999/92/EC" (User directive) which addresses area classification

The ATEX "User" directive is an 8 pages document (the law) but the non binding guide is a 65 pages document !

CODE Example 3

API RP 505 « Recommended Practice for classification of locations for Electrical Installations at Petroleum facilities classified as Class I, zone 0, zone1, zone2 »

Foreword states :

« API publications may be used by anyone desiring to do so. Every effort has been made by the Institute to assure the accuracy and reliability of the data contained in them ; however the Institute makes no warranty or guarantee in connection with this publication and expressly disclaims any liability or responsibility for loss or damage resulting from its use.

This standard is not intended to obviate the need for applying sound engineering judgement ... »

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AREA CLASSIFICATION **How ?** *Which code to select ?*

- Selection of a code to be applied (API,IP15,etc) for a project depends on a **Company decision** .
- The codes applied may depend on the type of facilities (offshore , refinery,….).
- **No code can be considered as the best one !**
- As an example consider **flanges/ valves**

Do they generate a zone or not ?

API RP 505	**IP 15**
UNCLASSIFIED	* 1st Edition= generates a zone 2 * 3rd Edition =unclassified except if there is a number of possible leak sources close together (typic>10),in this case….**Zone 2**

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AREA CLASSIFICATION How ? *Company specifications*

- Many oil companies have prepared their own documents sometimes called :

Company specifications

- These company specifications generally include :
  - references to specific regulations, standards and codes to be applied
  - requirements not included in regulations, standards and codes (coming from feedback and experience of the Operator) **and topics/situations not covered by standards/codes.**

Caution ! Above company requirements must not be in contradiction with regulations, standards and also preferably with codes !!

TOTAL, as many other Operators, has a set of Company Specifications named GS (general specifications) **:**
«Area Classification» is covered by the specifications published by the «Safety department»
«Electrical equipment for explosive atmospheres» is covered by the specification published by the «Electrical department» (GS ELE 079)

Other Operator's practices ?

- Most of European companies uses IP15 Code + amendments/supplements.
- American companies refer to API RP 505 (zone system), RP 500 (division system).
- **In conclusion,** each Company has its own rules (Company specifications) but they are based on common documents (codes) which have been amended/supplemented in a different manner.
- This means that it is unlikely that two individuals classifying the same location would arrive at the same or perhaps even similar area classification with only the general guidance of a code.

Hazardous area Zone (as per IEC60079-10-1)

Hazardous area (on account of explosive gas atmospheres) called "**hazardous locations**" in the US

An area (3-dimensional region or space) in which an explosive gas atmosphere is or may be expected to be present, in quantities such as to require special precautions for the construction, installation and use of equipment.

Hazardous areas are classified into 3 zones based upon the *frequency of the occurrence and duration* of an explosive gas atmosphere, as follows:

Zone 0

Area in which an explosive gas atmosphere is present continuously or for long periods or frequently.

Zone 1

Area in which an explosive gas atmosphere is likely to occur in normal operation occasionally.

Zone 2

Area in which an explosive gas atmosphere is not likely to occur in normal operation but, if it does occur, will persist for a short period only.

Non hazardous area (safe area)

A non hazardous area is an area in which an explosive atmosphere is not expected to be present.

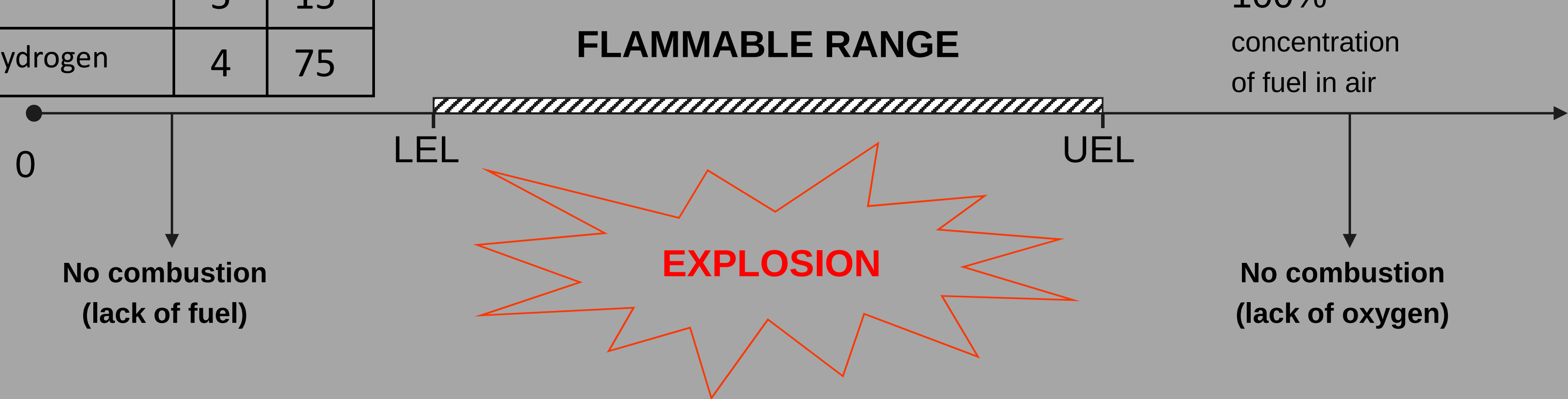
Lower, Upper Explosive (Flammable) limits

Combustion will only occur if the flammable mixture comprising fuel, in the form of a gas or vapour and air, is within certain limits. These limits are:

The **Lower Explosive Limit (LEL) sometimes called** Lower Flammability Limits **(LFL)**
The **Upper Explosive Limit (UEL)……………………** Upper Flammability Limits (**UFL**)

Vol % in air	LEL	UEL
methane	5	15
hydrogen	4	75

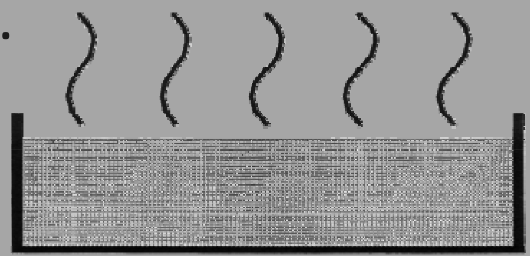
Between these limits is known as the FLAMMABLE RANGE



Flash point

- *Lowest temperature at which sufficient vapour is given off a liquid, to form a flammable mixture with air that can be ignited by an arc, spark, naked flame, etc*

FLASH POINT of a material gives an indication of how readily that material will ignite in normal ambient temperature.



Gasoline = - 45°C
Kerosene = + 38°C
Diesel fuel = + 55°C

- **Explosion of gas or vapour is possible when the ambient temperature becomes greater than the flash point of the flammable material.**
- **High flash point liquids are less hazardous than low flash point liquids.**
- **Practically liquids with flash point above 55°C are not liable to generate a hazardous area, unless they are likely to be submitted to a temperature above this flash point.**

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Normal Operation ?

Situation when the equipment is operating within its designed parameters,

- Normal operation includes ***start-up and shut-down*** conditions.

- ***Minor releases*** of flammable material may be part of normal operation.
  For example, releases from seals which rely on wetting by the fluid which is being pumped are considered to be minor releases.

- ***Failures*** (such as the breakdown of pump seals, flange gaskets or spillages caused by accidents) which require urgent repair or shut-down are not considered to be part of normal operation nor are they considered to be catastrophic.

- ***Catastrophic failures*** which are beyond the concept of abnormality are excluded (such as rupture of a process vessel or pipeline and events that are not predictable).

- In case of activities other than those of normal operation, e.g. commissioning or maintenance, **the area classification drawing may not be valid !**
  It is expected that this would be dealt with by a safe system of work (work permit).

Method for classification of hazardous areas

- **The basic elements for establishing the hazardous zone types are :**
  - *** Identification of the sources of release**
  - *** Determination of the grade of release**
  - *** Determination of the release rate, velocity, etc**
  - *** Determination of the type of area (openness)**
  - *** Degree and availability of ventilation**
  - *** Use of an appropriate code or calculations to determine the extent of zone**

Extent of zone : ***Distance in any direction from the source of release to the point where the gas/air mixture has been diluted by air to a value below the LEL.***

- The extent of the zone depends on the estimated or calculated distance over which an explosive atmosphere exists before it disperses to a concentration in air below its lower explosive limit with an appropriate safety factor.

- **Penetration of flammable gas into an area can be prevented by:**
  - **Physical barriers**
  - **Sufficient overpressure in the area relative to the adjacent hazardous areas**
  - **Purging the area with sufficient flow of fresh air**

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Sources and grades of release

Source of release

A point or location from which a gas, vapour, mist or liquid may be released into the atmosphere so that an explosive gas atmosphere could be formed.
A source of release may give rise to any one of these grades of release, or to a combination of more than one.

Grades of release

3 basic grades of release in order of decreasing frequency and likelihood of the explosive gas atmosphere being present may occur.

- **Continuous grade of release**

Release which is continuous or is expected to occur frequently or for long periods.

- **Primary grade of release**

Release which can be expected to occur periodically or occasionally during normal operation.

- **Secondary grade of release**

Release which is not expected to occur in normal operation and, if it does occur, is likely to do so only infrequently and for short periods.

GRADE OF RELEASE (+ VENTILATION) = ZONE 0, 1, 2

Relationship between grade of release and zone

Indications of the frequency of the occurrence and duration may be taken from codes relating to specific industries or applications.

Continuous grade release > 1 000 h
Primary grade of release 10 - 1 000 h
Secondary grade of release 1 - 10 h

This rule of thumb is derived from API RP 505 & IP 15

Grade of release is dependent solely on the frequency and duration of the release
Grade of release is independent of the rate and quantity of the release ,the degree of ventilation or characteristics of the fluid (although these factors determine the hazardous area dimensions)

In **"open air "** conditions there is a relationship between grade of release and zone to which it gives rise:

- **A continuous grade of release normally leads to a zone 0**
- **A primary grade to zone 1**
- **A secondary grade to zone 2**

However grade of release and zone are not synonymous !
Poor ventilation may result in a more stringent zone while with high ventilation the converse is true .

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Release rate

❖ Release rate

→The greater the release rate, the larger the extent of the zone.

Release rate depends on :

* geometry of the source of release **(open surface, leaking flange)**
* release velocity **(depending on process pressure …)**
* concentration **(release rate increases with concentration of flammable vapour or gas in the released mixture)**
* volatility of a flammable liquid
* liquid temperature

Release rate may be estimated using formulas given in IEC 60079-10-1: Annex A-informative

❖ Ventilation

→Size of a cloud mixture of flamable gas or vapour with air and the time for which it persists after release halts can be influenced by ventilation .

➢ Effectiveness of ventilation in controlling dispersion and persistence of the explosive atmosphere will depend upon :

Extent of zone

Ventilation

- Degree and availabilty of ventilation
- Design of the ventilation system

→Ex: ventilation may not be sufficient to prevent the formation of an explosive gas atmosphere but may be sufficient to avoid its persistence .

- Main types of ventilation
  - * natural ventilation (wind , temperature gradients,).
  - * artificial ventilation (fans).

- Degree of ventilation

  3 degrees of ventilation are recognised in IEC 60079-10-1:

- **High**: can reduce the concentration at the source of release virtually instantaneouly resulting in concentration below the LEL ;a zone of negligible extent (NE) results.
- **Medium**: can control the concentration.
- **Low** : cannot control the concentration whilst release is in progress or cannot prevent persistence.

Extent of zone

Ventilation

➢ Assessment of the required degree of ventilation requires the knowledge of the maximum release rate of gas or vapour at the source release either by :
verified experience-reasonable calculations-sound assumptions –available manufacturer's data

* Increased ventilation will normally reduce the extent of zone.
* Obstacles which impede the ventilation may increase the extent of zone .
* Some obstacles (walls ,ceillings ,dykes) may limit the extent of zone.

○ Availability of ventilation (**good,fair,poor**).

❖ LEL

The lower the LEL , the greater will be the extent .

❖ Relative density of gas/vapour released

- **a gas which is heavier than air may flow into areas below ground level (for example, pits or depressions) .**
- **a gas which is lighter than air may be retained at high level (for example, in a roof space).**

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Zone in relationship with grade of release & ventilation

Table B.1 – Influence of independent ventilation on type of zone

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

- **Extract of IEC 60 079-10-1 Annex B (informative) allows the determination of the type of zone from the degree and availability of ventilation and the grade of release .**

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Ventilation as per IP 15 CODE

Openness

An area can be classified in three categories with respect to confinement:

- An **open area** (basically no roof/ceiling, no walls and floor made of grating) .
- A **sheltered, partially enclosed, partially confined area** (various combinations of solid floor, ceiling and walls or equivalent obstructions to natural draft).
- An **enclosed area**(building rooms).

➢ **The extent of confinement governs the determination of the level of ventilation**.

Adequate/Inadequate ventilation

Adequate ventilation is defined as ventilation sufficient enough to prevent the accumulation of concentrations of flammable gas-air. This will normally be achieved by a uniform ventilation rate of at least **12 volumetric air changes per hour** with no stagnant areas.

Dilution ventilation

Dilution ventilation shall be sufficient to immediately bring the flammable gas concentration below **20% of the Lower Flammability Limit (LFL)** and keep it so all the time.

Ventilation as per IP 15 CODE

Ventilation assessment

A method allows to assess the type and degree of ventilation for each type of area (open, sheltered or enclosed). The level of ventilation available in a location shall be established in order to allow Zone classification.

Pressurization

Pressurization shall be provided to ensure the protection of a room or building:

- Containing *electrical equipment* or other potential sources of ignition and **located in a hazardous area** where flammable gases or vapours may enter (**over pressurisation**).
- Containing *sources of release* and **surrounding by a safe area** containing electrical equipment or other potential sources of ignition (**under pressurisation**) .

The difference in pressure to be maintained shall be **greater or equal to 25 Pa (0.25 mbar).**

Determination of the hazard radius

3 methods can be used :

- **Direct examples** limited to common facilities
- A **point source approach** for all situations
- A **risk based approach** for secondary grade release equipment or when the release rate is unknown (hole size and pressure)

- Hazard radius depend on :
  - **Grade of release - Fluid category- Release pressure- Hole release size**

- The hazard radius is not the result of a fully deterministic approach.

- It should be regarded as a standard to be used when no better method is available.

- It is not a substitute for good engineering judgment.

- The hazard radius does not take into consideration all the actual physical properties of the gas characteristics and conditions of release.
- Gas dispersion calculations using computer programs can be used (CFD, PHAST….)

Classification of petroleum (based on Flash Points FP) acc IP 15

CLASS = relates to FP & handling temperature

For flammable liquids , volatility determines the extent of rapid formation of any release

This classification is applicable for the Direct Examples method

8.1.1 Classification of petroleum fluids based on closed cup flash points (IP Code, Part 15)

CLASS	0	I	II	III
Fluid	LPG	Liquid hydrocarbon with $T_F < 21°C$	Liquid Hydrocarbon with $21°C \leq T_F < 55°C$ II(1): $T_H < T_F$ II(2): $T_H \geq T_F$	Liquid Hydrocarbon with $55°C \leq T_F < 100°C$ III(1): $T_H < T_F$ III(2): $T_H \geq T_F$

Where: T_F is the flash point of the fluid in °C.

T_H is the temperature at which the fluid is handled in °C.

CATEGORY= indicates to which extent a fluid on release can form a flammable mixture with air.

This is a determining factor in the calculation of the hazard radius

This classification is required for the Point Source approach method

Category	Definition
G(ii)	Refinery hydrogen
G(i)	A typical methane-rich natural gas.
A	Any flammable liquid that, on release, would vaporise rapidly or substantially. Includes LPG and lighter flammable liquids e.g. LNG. Also includes any flammable liquid at a temperature sufficient to produce, on release, more than 40% vol vaporisation with no heat input other than from the surroundings.
B	Any flammable liquid, not in Category A, but at a temperature sufficient for boiling to occur on release.
C	Any flammable liquid, not in Category A or B, but which can be at a temperature above its flash point or form a flammable mist or spray.

Determination of the hazard radius

❑ Direct examples

- **Many facilities of standard layout & design can be classified directly from typical examples.**
- **Codes include typical diagrams such as drilling, workover & wellhead sites, tank storage, road & rail car loading & unloading etc…**
- **However this approach should only be applied when the facility does not differ significantly from the direct examples in terms of layout, pressure, class of fluids, etc**
- **All the individual ancillary items (vents, drainage & sampling points, etc ..) associated with generic facilities but not shown on the diagrammatic examples should be assessed according to the point source approach.**

Determination of the hazard radius

❑ Point source approach

- Factors determining the extent of the hazardous area include the vaporising potential of the fluid release, the degree of ventilation and the rate or volume of the release .

- IP15 code provides typical hazard radii (R_1) for standard equipment in relationship with :
    - Fluid category – pressure (100 bar) – and diameter for drains & liquid sample points
    - Vent diameter & vent rate from tank vent for category C fluid
    - Etc….

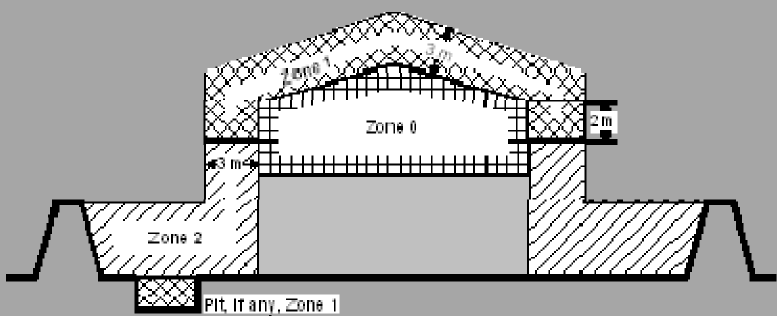
  All the hazard radii given in the tables are provided using the dispersion modelling published in IP calculations in support of IP 15.

- For process conditions which are different from the ones defined in the tables or for a more accurate value of hazard radius, then specific dispersion calculations using specific characteristics of the fluid and release rate (hole size and pressure) must be carried out .

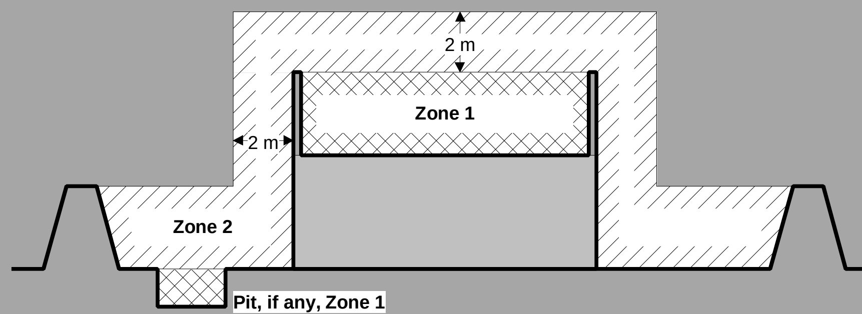
❑ Risk based approach

When release rate is unknown, this method proposes to determine an appropriate leak rate size to be used for a secondary release.

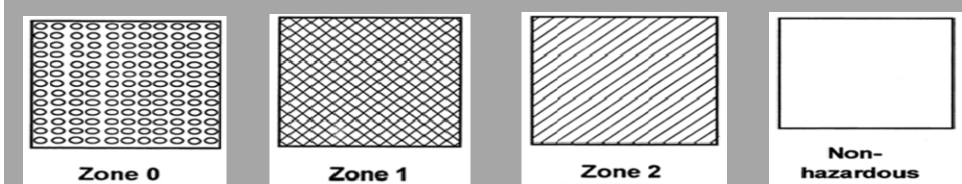
Hazardous area classification drawings extract of Total/EP GS SAF 216

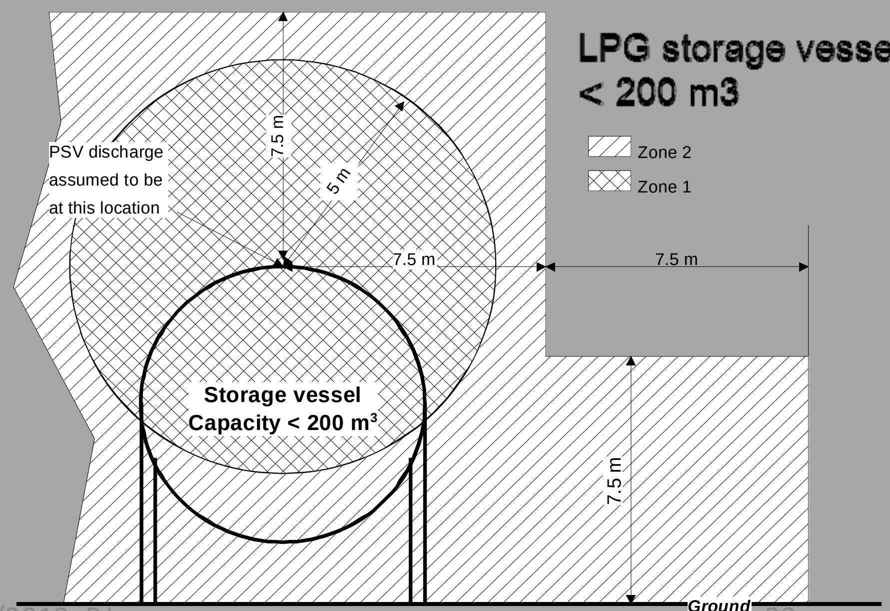


Fixed roof storage tank (Fluid class I, II (2) and III (2))



Floating roof storage tank (Fluid class I, II(2) or III(2))

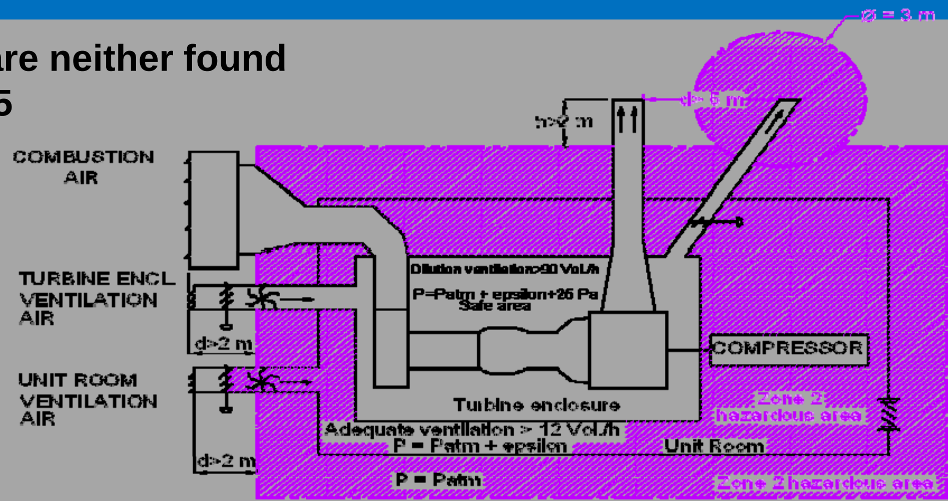




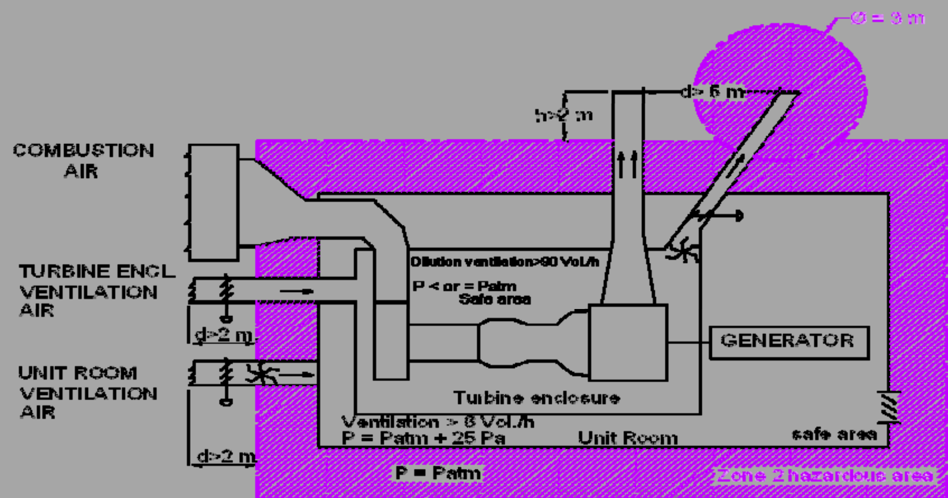
- ➢ Area classification documentation should include :
- **Standards & codes used**
- **Flammable material characteristics**
- **Dispersion calculations**
- **Ventilation calculations (for effectiveness ventilation proof)**
- **Gas group and temperature class.**
- **Extent of zone and sources of release**
- **Special considerations**

Hazardous area classification drawings extract **of Total/EP GS SAF 216**

Note: these 2 diagrams are neither found in IP15, nor in API RP 505



Turbine enclosure within a unit room in a hazardous area



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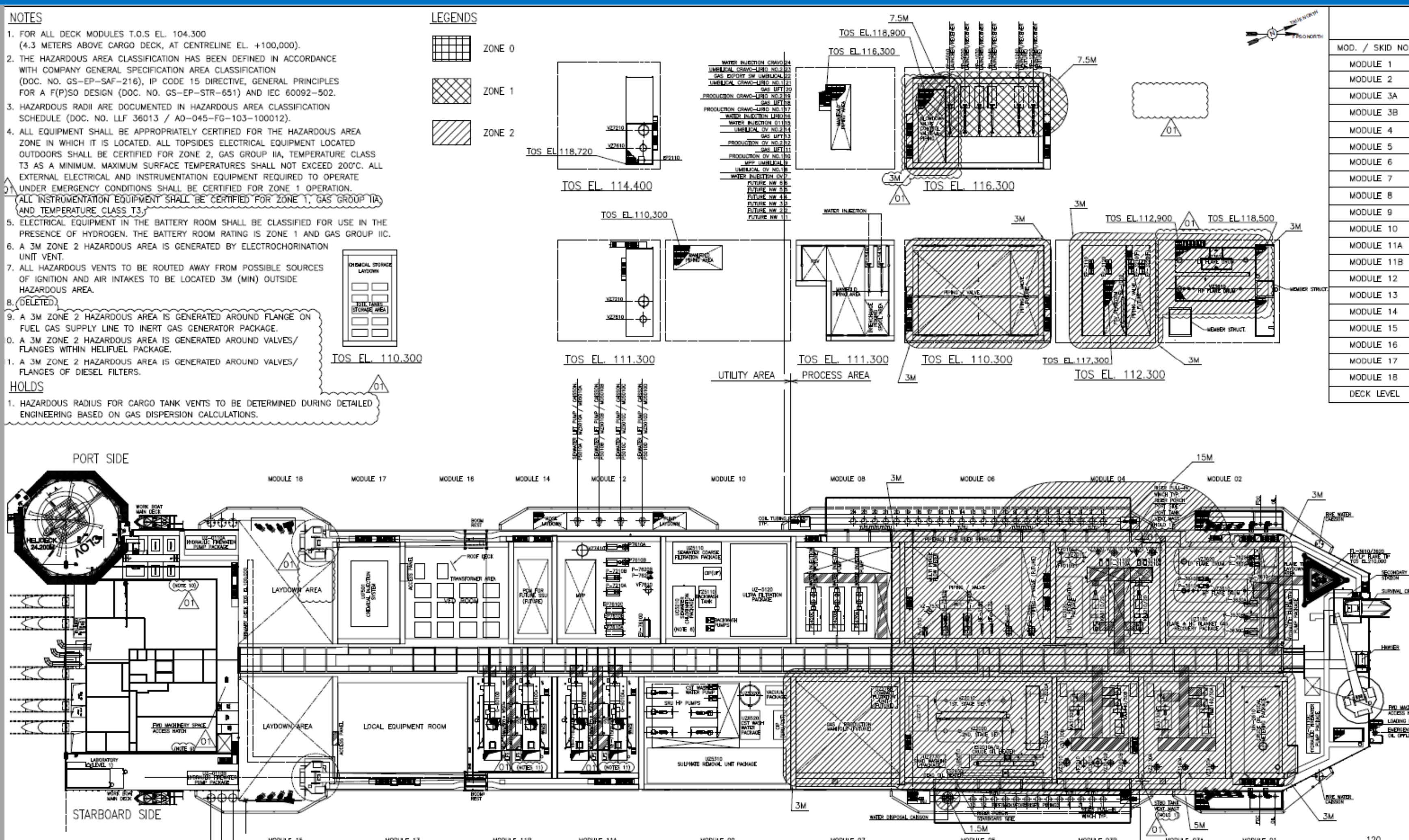
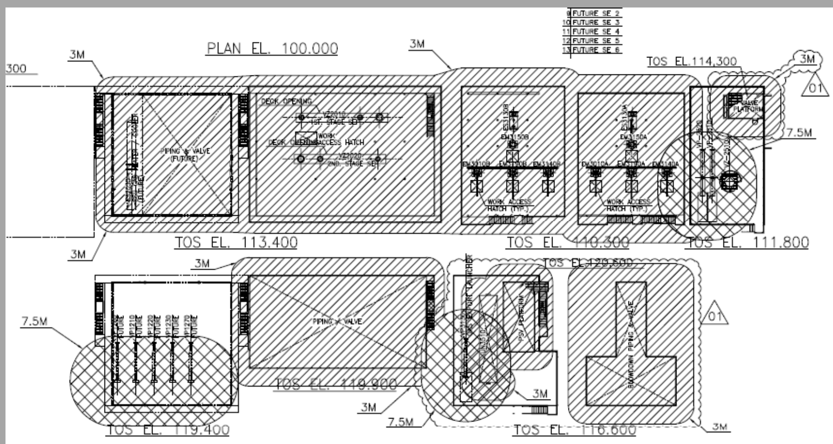
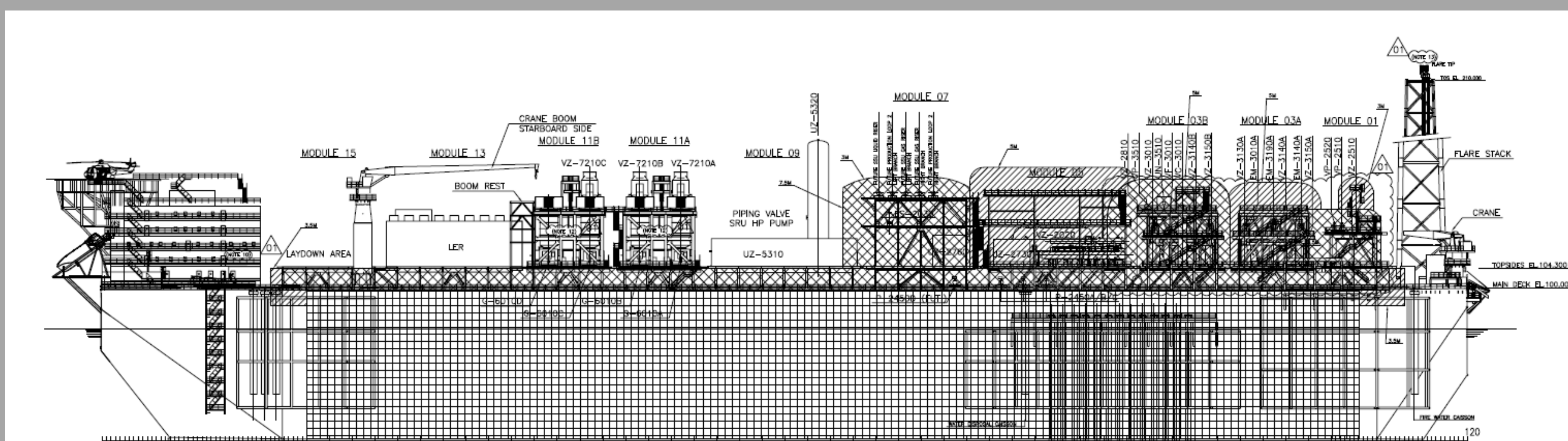
FPSO hazardous area classification drawing (typical)



FPSO hazardous area classification drawing (typical)





AREA CLASSIFICATION

Who ?

- By those who understand the relevance and significance of properties of flammable materials and who are familiar with the process and the equipment .
- Preferably there should be a multidisciplinary team (process, safety ,operation)

- At Total ,area classification is under the responsibility of the Safety department .

- In many companies area classification is carried out by the sole electrical engineer , but normally the latter has not the required competence to identify the sources and grade of release, to know the properties of flammable materials , etc…..which are far from the electrotechnical knowledge !

- The electrical engineer should not be the area classification designer !

- **The electrical engineer is the first user** of the hazardous area classification drawings with his colleague the Instrumentation engineer .
- Soon the mechanical (rotating equipment) engineer shall be also an user (this is already the case in Europe where the ATEX directive has included in its scope non electrical equipment).

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AREA CLASSIFICATION **When ?** *Schedule*

- **When the initial process and instrumentation PID and initial layout plans are available .**
- **Must be revised during the project phase and confirmed before plant start-up.**
- **The drawings should be kept up-to-date during the life of the plant to take into account:**
  - **New or modified equipment (frequent in offshore)**
  - **Changes in method or frequency of operations**
  - **Changes in installation protection**
  - **Experience in operation of the installation**
  - **Reclassification as a result of measurements in and around hazardous areas**

Yet experience has shown that updating of hazard. area classification drawings is an issue !

- **A survey was made in the US in the 90's with the American O&G and Petrochemical industries and revealed that relatively to area classification documents**
- ***20% of designers used just a text description !***
- ***20% failed to mention the gas group !***
- ***25% (only) included the recommended T rating (temperature class) for electrical equipment to be installed in the area !***
- **The reliability of these documents was assigned a rating of 6 (10 being the highest rating)**

CONCLUSION

- **Area classification is a complex exercise requiring an in depth knowledge of:**

- Regulations (Law) which are mandatory and vary from country to country.
- Applicable standards (choice to be made).
- Codes which shall be applied (choice to be made).
- Company Specifications which give the Company practices based on experience in addition to standards/codes.
- Benchmarking with other Operator 's practices .
- Updating of Company specifications (new regulations , standards/codes revision, feedback, etc …).

CONCLUSION

- **IEC 60079-10-1 is a standard in its evolutionary stage :**
  - As an example IEC 60 079 -10-1 is going to be revised in 2013.
  - **The current draft anticipates to delete all the drawings showing the extent of zone** !

- Considering that area classification is closely related to thermodynamics and fluid dynamics, the **ISO may be a more appropriate** environment for it to grow as opposed to IEC because electrical engineers have not usually the technical background (gas & physical properties,ventilation calculations, etc…).

- Area classification is definitively not the duty of a single person , just applying equations and finding typical diagrams as found in codes , but a multi-disciplinary job with people familiar with the processes & equipment and operation of the plant.

- Although many codes have typical figures to orient the shape of the foreseen explosive atmosphere, **such figures are not universally applicable** because for each facility there are many factors that affect the extent of zone .

CONCLUSION

- Preparation of hazardous area classification drawings may have an impact on the plot plan involving sometimes modifications of the general arrangement drawings (eg relocation of a substation to avoid to be located in a hazardous area)during the design phase.

- **Careful checking of Ex equipment** installed in hazardous areas must be done all along the project phase from Basic Engineering to commissionning (due to modifications) and an **ultimate check** during the pre-commissionning .

- **Updating of hazardous area drawings** must be carried out every time modifications or expansion are brought to the plant (frequent in offshore) with relevant modifications of Ex equipment .

- Experience has shown that often these updating are not properly done !

- **Training of Operators** :safety, electrical, instrumentation, telecom, and rotating equipment engineers/technicians **(today for ATEX in Europe, tomorrow for IECEx)** is a **MUST**

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Area classification

Thanks for your attention !

Any Question ?