How Do We Define Hazardous Areas?

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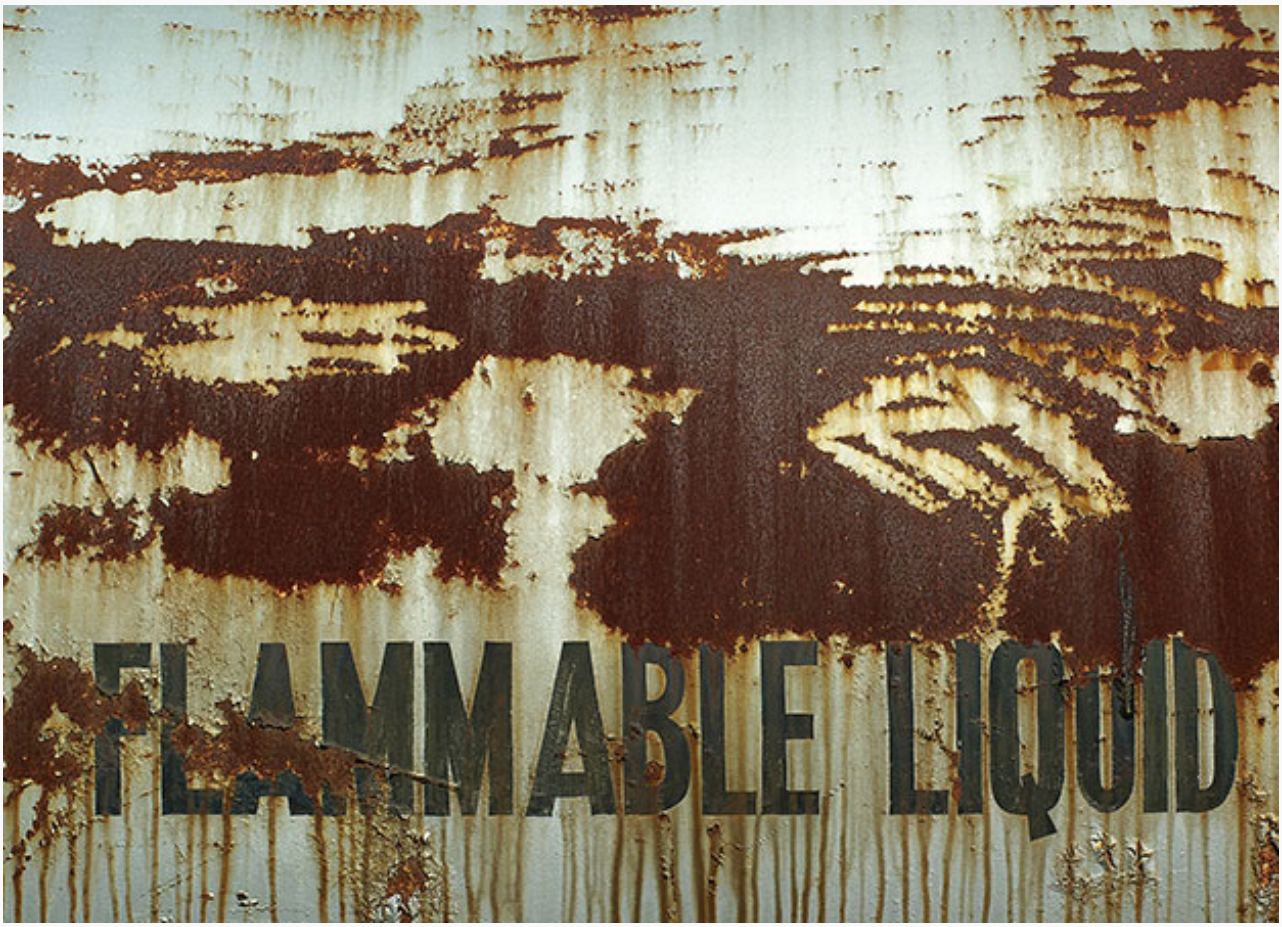


How Do We Define Hazardous Areas? (On photo: Flammable liquid warning)

What is the hazardous area?

The first requirement is to know what a hazardous area is. The principal factors relevant to the classifications of a hazardous area are the nature of the gases or dust present in the potentially explosive atmosphere and the likelihood of that atmosphere being present.

The concept of '***zone classification***' has been developed to summarize these factors. The nature of the atmosphere is characterized by the chemical composition of the gas or dust and its auto-ignition temperature.

The notions of '***gas grouping***' and '***temperature classification***' have been developed to formalize this.

Before looking in more detail at these definitions, it is instructive to consider how explosions occur.

A useful concept is that of the 'hazard triangle', ***Figure 1***.

The three sides of the triangle represent ***fuel***, ***oxygen*** and a ***source of ignition***, all of which are required to create an explosion. The fuel considered here is a flammable gas, vapour or liquid although dust may also be a potential fuel.

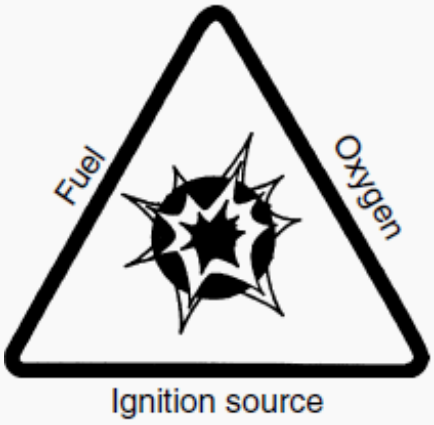
Oxygen is present in air at a concentration of approximately 21%. The ignition source could be a spark or a high temperature.

If the ***potentially flammable atmosphere*** is ***between the upper and lower flammable limits*** for the particular

material and an ignition source is introduced then it will explode or burn. Obviously if any side of the hazardous triangle can be removed then a ***fire* or explosion hazard cannot exist**.

Given that a hazardous area may contain fuel and oxygen, the basis for preventing explosion is ensuring that any ignition source is either eliminated or else does not come into contact with the fuel-oxygen mixture.

If there is any possibility of oxygen enrichment, i.e. above 20% by volume, then special consideration is necessary to ensure safety.



The Hazard Triangle

Zone classification

Table 1 shows the ***IEC 79-10 zone classification*** used in Europe and most other parts of the world. The British Standard ***BS 5345 Part 2*** will become obsolete and replaced by ***BS/EN/IEC 60079-10***.

The table also indicates which types of explosion protection are suitable for use within each zone. These explosion protection concepts are described later in the chapter.

	Suitable protection
Zone 0	
Areas in which hazardous explosive gas atmospheres are present constantly or for long periods, for example in pipes or containers	Ex 'ia' Ex 's' (where specially certified Zone 0)
Zone 1	
Areas in which hazardous explosive gas atmospheres are occasionally present, for example in areas close to pipes or draining stations	Ex 'd'; Ex 'ib'; Ex 'p'; Ex 'e'; Ex 's'; Ex 'o'; Ex 'q'; Ex 'm'; Equipment suitable for Zone 0
Zone 2	
Areas in which hazardous explosive gas atmospheres are rare or only exist for a short time, for example areas close to Zones 0 and 1	Ex 'N'/Ex 'n'; Equipment suitable for Zones 1 and 0

Table 1 - IEC 79 classification of hazardous area zones

The American system of hazardous area classification is structured in a different way, ***according to the National Electrical Code – NEC***.

In brief, hazardous locations are classified as either Class 1 '***Division 1***', where ignitable concentrations of flammable gases or vapours may be present during normal operation, or '***Division 2***', where flammable gases or vapours occur in ignitable concentrations only in the event of an accident or a failure of a ventilation system.

Class II and ***Class III Divisions 1*** and ***2*** relate to ***combustible dust and fibres***. The 1999 edition of the National Electric Code (NEC) introduced ***for the first time*** in the USA the zone classification concept as an alternative to the class and division definitions of hazardous locations, e.g. Class 1 Zones 0, 1 and 2 for gases and vapour.

In the UK, the Factories Act states that where there is a risk of a flammable dust cloud, explosion protection and measures to reduce the risk of ignition will be required.

The ATEX Directive legally requires dust hazards to be considered and classified as either Zone 20, 21 or 22.

Gas grouping and temperature classification

Different gases require different amounts of energy (*by hot surface or spark*) to ignite them and the two concepts of gas grouping and temperature classification are used in Europe to classify electrical apparatus according to its suitability for use with explosive atmospheres of particular gases.

Table 2 lists common industrial gases in their appropriate gas groups:

Gas group I is reserved for ***equipment suitable for use in coal mines***.

Gas group II which contains gases found in other industrial applications – is subdivided IIA, IIB, or IIC according to the relative flammability of the ***most explosive mixture of the gas with air***.

Table 3 defines ***each temperature class*** according to the maximum allowed apparatus surface temperature exposed to the surrounding atmosphere, and indicates common gases for which these classifications are appropriate.

Group		*Representative gases*
I	(MINING)	Methane
IIA	SURFACE INDUSTRIES	Acetone, ethane, ethyl acetate, ammonia, benzol, acetic acid, carbon monoxide, methanol, propane, toluene, ethyl alcohol, l-amyl acetate, N-hexane, N-butane, N-butyl alcohol, petrol, diesel, aviation fuel, heating oils, acetaldehyde, ethyl ether
IIB		Town gas, ethylene (ethene)
IIC		Hydrogen, acetylene (ethyne), hydrogen disulphide

Table 2 - CENELEC/IEC gas grouping

North American practice defines hazardous materials in classes.
Flammable gases and vapours are ***Class 1 materials***, combustible dusts are ***Class 2 materials*** and 'flyings' (*such as sawdust*) are ***Class 3 materials***.

Class 1 is subdivided into four groups depending on flammability:

- A (e.g. acetylene),
- B (e.g. hydrogen),
- C (e.g. ethylene) and
- D (e.g. propane, methane)

Note that when compared with the IEC gas groupings, the subgroup letters are in opposite order of flammability.

Class	*Highest permissible surface temperature* (°C)	*Representative gases*
T1	450	Acetone, ethane, ethyl acetate, ammonia, benzol, acetic acid, carbon monoxide, methanol, propane, toluene, town gas, hydrogen
T2	300	Ethyl alcohol, amyl acetate, N-hexane, N-butane, N-butyl alcohol, ethylene
T3	200	Petrol, diesel, aviation fuel, heating oils
T4	135	Acetaldehyde, ethyl ether
T5	100	
T6	85	Carbon disulphide

Table 3 - CENELEC/IEC temperature classification

North American temperature classification is similar to IEC standards, but further subdivides the classes to give more specific temperature data.

Resource: *Newnes Electrical Pocket Book (Get it from Amazon)*

Source: http://electrical-engineering-portal.com/how-do-we-define-hazardous-areas