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INTRODUCTION

1.1 Background

With the rapid growth of the petroleum industry, the risk associated with the processing, handling and storage of highly flammable gases, vapors and liquids has increased tremendously. It is often necessary to use electricity in some form or the other in such high risk locations and consequently the need to assess and classify these hazardous areas assume great importance. When the electrical equipment is to be installed in or around a hazardous area, it is frequently possible by taking care in the layout of the installations to locate much of the equipment in less hazardous or non-hazardous area and thus reduce the number of special equipment required. Alternatively, they should be designed, installed and maintained in accordance with measures recommended for the area in which the apparatus is located.

1.2 Need for Area Classification

Hazardous areas are classified to assist selection of electrical equipment which will be safe as well as cost effective. While classifying an area, the probability of release or flammable liquids or vapors in sufficient quantity to constitute an explosive or ignitable mixture must be considered. The question of whether such release is likely to occur during normal operation, or only as a result of an unusual occurrence or abnormal conditions, must also be determined.

1.0 SCOPE

This standard is applicable to classification of hazardous areas for electrical installations in onshore processing, storage and transportation facilities handling flammable liquids, vapors or gases including gas / oil gathering and processing stations but excluding drilling rigs and wellhead installations.

2.0 DEFINITION

3.1 Adequately Ventilated

Adequately ventilated is defined as a ventilation (Natural or Artificial) which is sufficient to prevent the accumulation of significant quantities of vapor air mixtures in concentration above 25% of their Lower Explosive (Flammable) Limit (LEL).

3.2 Flash Point

The minimum temperature at which the liquid gives so much vapor that this vapor, when mixed with air, forms an ignitable mixture and gives a momentary flash on application of a small pilot flame under specified conditions of test.

3.3 Ignition Temperature

The lowest temperature at which ignition occurs in a mixture of explosive gas and air.

3.4 Hazardous Area

An area shall be deemed to be a hazardous area, where:

i) Petroleum having flash point below 65 ℃ or any flammable gas or vapor in a concentration capable of ignition is likely to be present.
ii) Petroleum or any flammable liquid having flash point above 65℃ is likely to be refined, blended, handled or stored at or above its flash point.

3.5 Hazardous (Flammable) Atmosphere

An atmosphere containing any flammable gas or vapor in a concentration capable of ignition.

3.6 Source of Release

A source of release is a point or location from which gases, vapor, mist or liquid may be released into the atmosphere so that a hazardous atmosphere could be formed.

3.7 Flammable Substance

i) Flammable Gas or Vapor which, when mixed with air in certain proportions will form a hazardous atmosphere.
ii) Flammable Liquid - A liquid capable of producing a flammable vapor, gas or mist under any foreseeable operating conditions.
iii) Flammable Mist - Droplets of flammable liquid, dispersed in air, so as to form a hazardous atmosphere.

3.8 Temperature Class

A system of classification by which an electrical apparatus is assigned to temperature classes according to its maximum surface temperature.

3.9 Ignition Source

Source of ignition is any electrical installation operating at energy levels sufficient to release incendiary energy.

Note: In any installation irrespective of size, there may be numerous sources of ignition apart from those associated with electrical sources. Precautions may be necessary to ensure safety but guidance in this aspect is outside the scope of this standard.

3.10 Normal Operations

Normal operation of a plant or installation includes start-up and shut down operations.

3.11 Incendiary Energy

Hot particle energy sufficient to ignite a specific ignitable mixture.

3.12 Protected Fired Vessel

Any fired vessel that is provided with equipment (such as flame arrestors, forced draft burners with safety controls and spark arrestors) designed to eliminate the air intake and exhaust as sources of ignition.

3.13 Pressurized Room

A room which has been made safe by pressurising or purging with a plenum of safe atmosphere by maintaining a minimum of 25 Pa overpressure than that of surrounding atmosphere with all door and windows closed.

3.0 CLASSIFICATION OF PRODUCTS

4.1 General

Three basic conditions must be satisfied for the occurrence of fire or explosion as indicated below:

i) A flammable gas or vapor must be present.
ii) It must be mixed with air or oxygen in the proportions required to produce a flammable or ignitable mixture.
iii) There must be an ignition source of this mixture. The potential source of ignition is electrical installation operating at energy level sufficient to release incendiary energy.

While analysing any potential hazard of the quantity of the substance that might be liberated, detailed consideration must be given its physical characteristics and the natural tendency of vapours to disperse in the atmosphere.

4.2 Flammable Substances and Vapor

The potential release of which must be considered in area classification for electrical installations, include flammable gases, liquefied petroleum gases (LPG) and vapors of flammable liquids.

4.2.1 Flammable Gases

Flammable gases commonly encountered include methane and its mixture with small quantities of low-molecular weight hydrocarbons.

These gases are generally lighter than air. Hydrogen because of its unique properties shall be given special consideration. Flammable gases released from an opening of given size will dissipate rapidly because of their low relative density and will not usually affect as wide an area as the liquefied petroleum gases.

4.2.2 Liquefied Petroleum Gas

Liquefied Petroleum gases include propanes, propylenes, butanes, butylenes and their mixtures having relative densities from 1.5 to approximately 2.0 times more than that of air. Vapor pressure of these gases exceeds 2.81 kg/cm^2 at 37.8 ℃. These gases in their liquefied state are highly volatile and have low boiling temperature so that they readily pick up heat creating large volumes of vapor. They should be treated very conservatively in considering the extent of areas affected, since the heavy vapors travel along the ground for long distances if air currents do not assist diffusion.

4.2.3 Flammable Liquids

Flammable liquids vary in volatility and have a flash point below 93 ℃. These are divided into three classes as follows on the basis of volatility:

CLASS A : Flammable liquids having flash point below 23 ℃.
CLASS B : Flammable liquids having flash point 23 ℃ and above but below 65 ℃.
CLASS C : Flammable liquids having flash point 65 ℃ & above but below 93 ℃.

The saturated vapors of these flammable liquids at atmospheric pressure and ambient temperature are generally heavier than that of air and tend to settle at lower levels.

Class A liquids may produce large volumes of vapor when released in appreciable quantities to the open.

Class B liquids are heavier and less volatile than Class A but flash point is at or slightly below normal ambient air temperatures. At normal storage temperatures such liquids release vapor slowly and are hazardous only near the surface of the liquid. At elevated temperatures Class B liquids approach the characteristics of Class A liquids in respect of vapour release.

Class C liquids include a broad range from cleaner's solvent to heavy fuel oil in commercial grades. The degree of hazard is low because the rate of vapor release is nil at normal ambient temperatures of handling and storage. When vapors from heated Class C products in process area released to the atmosphere, the chance of ignition by electrical equipment is not as great as in

case of Class A or Class B liquids because vapours either condense rapidly or ignite spontaneously.

Normally Class A and Class B liquids will produce vapors considered to be in flammable range for electrical design purposes. Class C liquids should be considered as producing flammable vapours when handled, processed or stored under such conditions that the temperature of the liquid, when released to the atmosphere, would exceed its flash point.

4.3 Gas Groups (Apparatus Group)

All gases normally encountered in industry are categorised into Group-I and Group-II gases.

Group-I gases are those which are found in the coal mining industry and are not covered in this standard.

Group-II gases have been further subdivided into three main representative subgroups namely Group-IIA, Group-IIB, and Group-IIC in the increasing order of their explosiveness. The gas assigned for each of these subgroups being propane, ethylene and hydrogen respectively. It should be noted that apparatus subgrouping is normally applied specifically to the technique of flame proof enclosure and to the limiting energy levels of the intrinsic safety type of protection. Apparatus certified for a particular subgroup may be used with gases allocated to a lower subgroup subject to consideration of temperature classification. A table having the properties of a few flammable gases, vapors and liquids and apparatus subgroup is attached in Annexure-I.