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NEW AREA CLASSIFICATION GUIDELINES

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Abstract - In 1991, the American Petroleum Institute (API) merged their three area classification documents (RP500A for refineries, RP500B for production and drilling facilities, and RP500C for transportation/pipeline facilities) into one document, RP500 [1]. A common general section was supplemented with three other sections for specific recommendations for the three sectors of the industry, but, for all practical purposes, the RP was composed of the three previous recommended practices bound in a single cover. In 1997, API created RP505 [2], *Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Zone 0, Zone 1, and Zone 2*, which will serve the petroleum industry essentially as an supplement to both ISA 12.24.01 (IEC 79-10 Mod) [3] and National Electrical Code (NEC) [4] Article 505. RP500, which underwent significant changes in 1997, is presently referenced by Article 500 of the NEC; it is proposed that the 1999 NEC will reference RP505. This paper provides a brief overview of the two new recommended practices, but primarily emphasizes the substantive changes and additions to RP500 and the portions of RP505 with the highest impact on the industry.

Index Terms - Area classification; hazardous (classified) locations; API RP500; API RP505

I. Introduction

The United States National Electrical Code (NEC) and the Canadian Electrical Code (CEC) [5] both provide special rules for installing electrical equipment in hazardous (classified) locations. Hazardous (classified) locations are those locations where fire or explosion hazards may exist due to flammable gases or vapors, flammable liquids, combustible dust, or easily ignitible fibers or flyings. Only Class I materials (gases and vapors) are within the scope of RP500 and RP505. Both the NEC and the CEC further provide guidelines for dividing such locations into "Divisions" and "Zones", designating the probability that flammable materials will be present. However, the guidelines are quite general, and it is unlikely that two individuals "classifying" the same location would arrive at the same, or perhaps even similar, area classifications with only the general guidance of the two Codes.

The customary means of documenting the classification of a location is with an *area classification drawing.* Typically, area classification drawings are plan views of locations depicting the major process equipment and components (i.e., *sources of release*) that could allow the release of flammable gases or vapors, flammable liquids, combustible dust, or easily ignitible fibers or flyings to the atmosphere. Also shown are the boundaries of the various area classifications and other information (i.e., information on ventilation) necessary to properly classify a location or to design, install, inspect, maintain, or operate electrical equipment at the location. At times, elevations or sections are provided where different classifications apply at different elevations.

Area classification drawings should include, as a minimum, for all areas that are classified: (1) the Class, (2) either the Division or the Zone, and (3) the gas or gas group(s), the combustible dust or dust group(s), or the ignitible fiber or flying, as applicable. In addition, it may be desirable to include either the maximum safe operating temperature or the maximum operating temperature range of electrical equipment permissible in the area.

To promote uniformity of area classification drawings for petroleum facilities, the API developed the recommended practices RP500, *Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Division 1 and Division 2*, and RP505, *Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Zone 0, Zone 1, and Zone 2*. In 1997, RP500 was totally revised – organized into ISO format and expanded significantly. Many of the recommended classifications for equipment common to all three petroleum sectors were normalized and added to a new common section. Numerous substantive changes were made, and several new appendices were added. The scope of RP500 was limited to those petroleum facility locations classified as Class I, Division 1 and Division 2.

Also, in 1997, API created a totally new recommended practice, RP505, to supplement the new (1996) NEC Article 505, with a scope limited to those petroleum facility locations classified as Class I, Zone 0, Zone 1, and Zone 2. Efforts were made to coordinate with the work of ISA's SP12 committee, who concurrently normalized IEC 79-10, the IEC standard that addresses the zone area classification scheme in general. RP505 also supplements and complements material currently proposed for the 1998 CEC (and likely adopted by the time of the release and presentation of this paper). The new material provides allowance of area classification schemes using the international "Zone" (versus Division) scheme of area classification. This scheme is optional in the United States, but is proposed as mandatory for new facilities in Canada.

This paper provides a brief overview of the two new recommended practices, including outlines of the tables of content, but primarily emphasizes the substantive changes and additions to RP500 and the portions of RP505 with the highest impact on the industry. It is assumed that the reader is reasonably familiar with the contents of the NEC and the CEC and this paper will not provide significant tutorial of that information. In a similar manner, it is assumed that the reader is capable of using the text and figures of RP500 and RP505 to classify most locations, so the paper is not intended to address many specific classifications, but rather to point out the changes, to give the logic behind the criteria, and to explain the sections that may be misunderstood.

II. Underlying Reasons for the Revision of RP 500 and the Creation of RP505

In addition to RP500 nearing the end of its five year ANSI cycle life, numerous situations common to petroleum operations were not addressed by the First Edition of RP500, issued in 1991, which combined previously separate documents RP500A, 500B, and 500C, covering refining, producing and drilling, and transporting (pipeline) facilities, respectively. Facilities not addressed in previous editions include offshore United States Coast Guard (USCG) regulated facilities, paint storage areas, and locations containing batteries. Also, it had been agreed when the first edition of RP500 was created that the second edition would attempt to normalize some of the equivalent situations in all three type facilities – for example, certain storage tanks and vents from buildings that are classified within. Most important, however, the inclusion of the zone method of area classification had been added to the NEC (and was proposed for the CEC), and there was no industry standard providing guidance for the classification of petroleum facilities into zones. After much deliberation, it was decided to issue two separate documents, both in the ISO format – RP500 addressing areas classified as Division 1 and 2 and RP505 addressing areas classified as Zone 0, Zone 1, and Zone 2.

Consideration was given to the adoption and normalization (i.e., adding national deviations) of IEC 79-10, but it was decided that the normalization task should be undertaken by a more diverse group than an industry-specific group like the API, so the work was relegated to ISA, who prepared ISA RP12.24.01 (IEC 79-10 Mod). It was decided that API RP505 should supplement and serve as an appendix to ISA RP12.24.01 (IEC 79-10 Mod) solely for the petroleum industry. Such practice is suggested by IEC 79-10.

RP505 was created using, as a basis for a start, many existing standards, recommended practices, and other documents – including API RP500, ISA RP12.24.01 (IEC 79-10 Mod), NFPA 497 [6], *Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas*, and the Institute of Petroleum document IP 15 [7], *Area Classification Code for Petroleum Installations.*

An attempt was made to be as harmonious as possible with the requirements of the NEC (considering proposed changes likely to be incorporated into Article 505 in the 1999 Edition), germane United States Coast Guard requirements, and certain relevant ISO and IEC documents.

Definitions were added to RP500, and previously included definitions were updated to agree with other documents from which they had been extracted. New sections were added for USCG-regulated offshore facilities, such as Tension Leg Platforms (TLPs) and Mobile Offshore Drilling Units (MODUs). Additionally, a new *Annex D, An Alternate Method for Area Classification*, was added, which it is envisioned will eventually lead to the preparation of area classification drawings using computer modeling. Because of the large volume of material in Appendix D, the information found in it will be covered for the most part by a separate IEEE-PCIC paper.

Substantive changes were made to the sections on unclassified locations that deal with open flame sources, gas detector systems, and ventilation criteria. These changes were reflected in RP505 as well as RP500 and will be addressed in more detail below. Also, often misunderstood "transition zones", required by NEC Articles 500 and 505, but not by IEC 79-10, will be discussed.

Following precedence set by the NEC, both RP505 and ISA RP12.24.01 (IEC 79-10 Mod) add the term *Class I* before Zone 0, Zone 1, and Zone 2, although international standards (e.g., IEC 79-10) typically do not use the term. It was considered that the addition of the term would make the transition from Divisions to Zones easier in North America, where those using the Division system for a long period of time were accustomed to the Class designating the type of ignitible material present – Class I for gases and vapors, Class II for combustible dusts, and Class III for easily ignitible fibers and flyings.

RP500 and RP505 provide appendices presenting recommended designations for identifying Divisions 1 and 2 locations and Zones 0, 1, and 2 locations, respectively, on area classification drawings. These recommended designations are consistent, for the most part, with industry practice in North America for designating Divisions and with the recommendations of IEC 79-10 for designating Zones. The members of the RP500 and RP505 task forces had seen widespread inconsistencies in designations – ranging from the typical Division 2 designation of diagonal lines drawn with both positive slopes and negative slopes to a potpourri of symbols for Zone 0.

There have been suggestions and innuendoes that one of the driving forces of the users' community to introduce the Zone System in North America was to convert many existing Division 1 locations to Zone 2 locations. The authors compared the recommendations of RP500 and RP505 and found no evidence to support such claims. In fact, in every case, analogous Division 2 locations were defined as Zone 2 locations; the two appear to be synonymous.

After the Zone 0 locations were identified, the balance of the formerly designated Division 1 locations were delineated as Zone 1 locations. It is pointed out that there are very few Zone 0 locations in the petroleum industry, and most of these are inside atmospheric storage containment and process systems or in the immediate proximity to vents, where there is little need for electrical equipment. Electrical equipment in these locations usually is instrumentation or measurement equipment, which normally can be intrinsically safe. Much of the reduction in Zone 0 locations can be accredited to increased efforts by operators to reduce both normal and abnormal discharge of products into the atmosphere – some voluntary and some because of legislation. Some say, partly tongue-in-cheek and partly factual, that it will be illegal in the near future to have Division 1 locations due to more rigorous environmental laws.

III. Common Equipment

Recommendations for the classification of areas surrounding storage tanks; tank cars and tank trucks; vents, relief valves, and rupture disks; marine terminals handling flammable liquids; hydrocarbon-fueled prime movers; batteries; and flammable and combustible paint products – storage and usage areas; were normalized and placed in a common section in the Second Edition of RP500 and also in RP505. More detail on these subjects is given below, but it is noted that RP500 and RP505 have created consistency of dimensions on certain of the recommended drawings, through consensus, that some standards have not been able to accomplish.

A. Storage Tanks

Recommendations for the classification of areas surrounding both fixed roof and floating roof storage tanks found in the previous edition in the refining, transportation, and production sections were normalized and moved to this section.

B. Tank Cars and Tank Trucks

Recommendations for the classification of areas surrounding tank cars and tank trucks found in the previous edition both in the refining section and in the transportation section were normalized and moved to this section.

C. Vents and Relief Valves

Recommendations for the classification of areas surrounding vents and relief valves found in the previous edition in the refining, transportation, and production sections were normalized and moved to this section.

The section on vents and relief valves includes the areas adjacent to process equipment vents; vents from instruments and control devices utilizing flammable gas for control; atmospheric vents (e.g., building ridge vents, building roof vents, and atmospheric tank vents); and relief valve and rupture disk discharge points.

The reader is cautioned that the section on process equipment and instrument and control device vent sources cited are based on there being **continuous** *grades of release*. If the grade of release is not continuous, good engineering judgment normally would dictate a lesser degree of hazard – for example, Zone 1 instead of Zone 0. More information on g*rades of release* can be found in ISA RP12.24.01 (IEC 79-10 Mod) and Appendix F of RP505.

Inference to atmospheric vents from classified buildings and other enclosed areas was made in the previous edition of RP500, but specific recommendations are now given in both RP500 and RP505. The areas around atmospheric vents from Class I, Division 1, Zone 1, Division 2, and Zone 2 areas are shown below in **Figs. 1, 2, 3, and 4**, extracted from API RP500 and RP505.

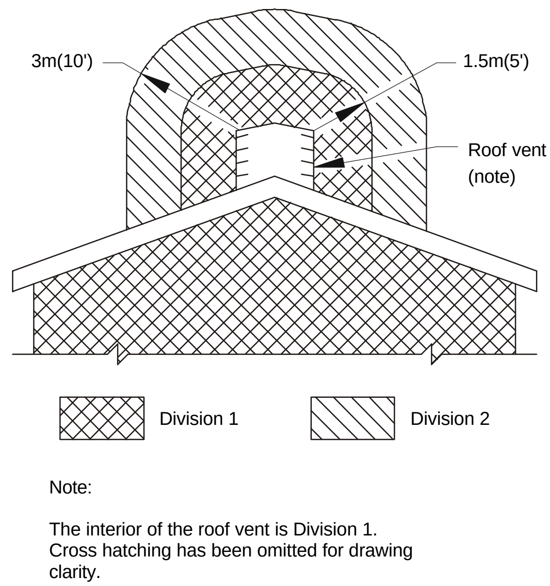

Fig. 1 Atmospheric Vent From a Division 1 Area

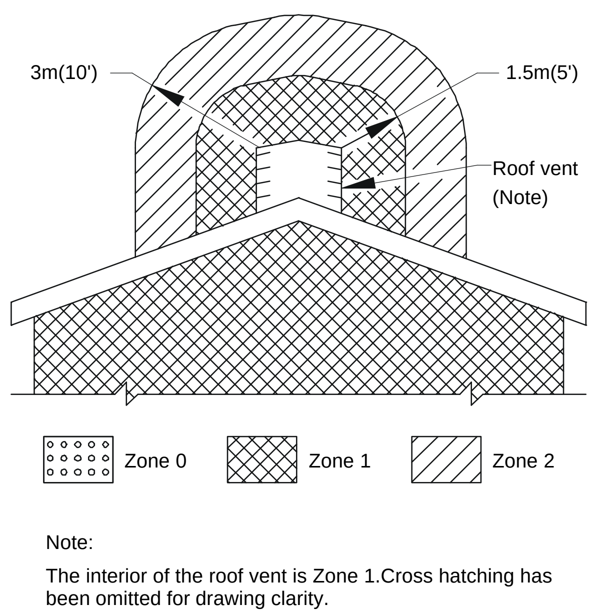

Fig. 2 Atmospheric Vent From a Zone 1 Area

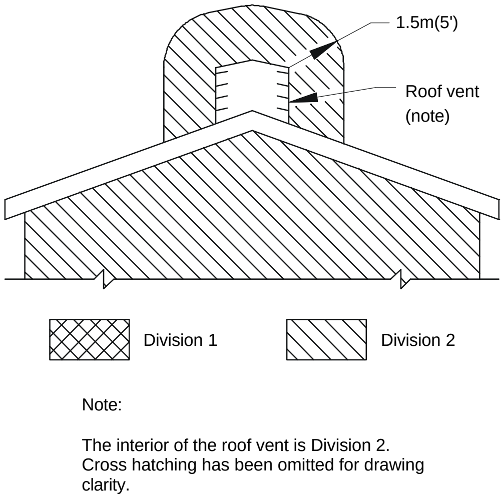

Fig. 3 Atmospheric Vent From a Division 2 Area

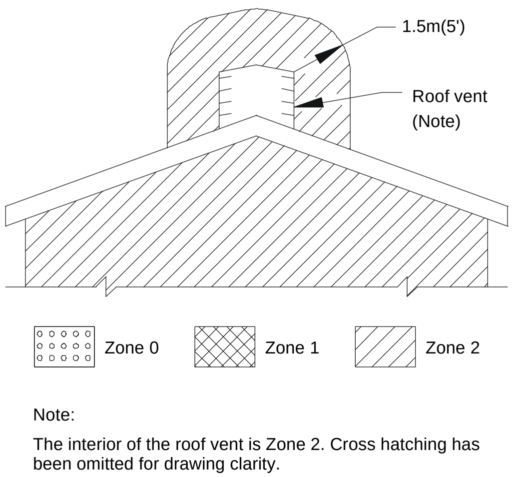

Fig. 4 Atmospheric Vent From a Zone 2 Area

D. Marine Terminal Handling Flammable Liquids

Recommendations for the classification of areas surrounding marine terminals handling flammable liquids found in the previous edition of both in the refining section and in the transportation section were normalized and moved to the common section.

E. Hydrocarbon-fueled Prime Movers

Recommendations for the classification of areas surrounding hydrocarbon-fueled prime movers found in the previous edition in the production section were slightly edited and moved to this section.

The reader is advised that the referenced standard, NFPA 37 [8], on which part of this section was based, was changed between the approval of RP500 and the writing of RP505, eliminating the former limitation of 7500 HP of its scope. Therefore, the 7500 HP limitation imposed by RP500 is not referenced in RP505.

F. Batteries

The section on batteries probably was the most difficult of all new sections to write as there is a minimum of literature available specifically devoted to the classification of locations containing batteries. No significant information was found in national or international standards. USCG regulations do have some guidance, and this information was reviewed and used as much as practical. The section presents guidelines for classifying locations where batteries are installed. Areas classified solely because they contain batteries are classified because of hydrogen evolution from the batteries, and, therefore, require a Group B (or Group IIC for the zone system) designation.

Areas containing non-rechargeable batteries do not require area classification solely due to the presence of the batteries. Also, enclosed areas containing rechargeable batteries that (1) have no vents, (2) are of the nickel-cadmium or nickel-hydride type, (3) have a total volume less than one-hundredth of the free volume of the enclosed area, and (4) have a capacity not exceeding 1.5 ampere-hours at a one hour discharge rate, do not require area classification solely due to the presence of the batteries.   For the purpose of area classification, battery vents include relief devices, such as valves that open to the atmosphere, as found in valve-regulated lead acid (VRLA) batteries.

The section differentiates between enclosed and non-enclosed areas; batteries that have vents and those that do not; and batteries that have a charging system that is designed to prevent inadvertent overcharging and those that do not. Particular attention is given to batteries installed in "battery boxes" and the venting methods of such boxes.

It is recommended that ventilation rates to achieve adequate ventilation be based on the maximum hydrogen evolution rate for the applicable batteries. The maximum hydrogen evolution rate for lead antimony batteries should be considered as 0.000269 cubic feet per minute per charging ampere per cell at 25^{o}C, with the maximum charging current available from the battery charger applied into a fully charged battery. The maximum hydrogen evolution rate for other types of batteries (e.g., lead calcium and nickel cadmium) should be obtained for the condition when the maximum charging current available from the battery charger is applied into a fully charged battery. It is cautioned that a Division 1 or Zone 0 classification normally would prohibit the installation of batteries in an area.

G. Flammable and Combustible Paint Products – Storage and Usage Areas

The section on flammable and combustible paint products addresses only the electrical classification of locations where flammable and combustible paint products (for example, paints, lacquers, and paint solvents) are stored or used. It does not address safe practices for the storage or use of these products, a subject outside the scope of both RP500 and RP505. Likewise, the section does not cover rooms and other areas specifically intended for spray painting and similar operations where flammable and combustible paint products are regularly or frequently applied during normal operations in the room or area. These areas are not unique to petroleum facilities and are adequately addressed in Article 516 of the NEC, to which the reader should refer. Also, due to the wide variety of conditions and application methods encountered, the section does not cover painting *operations*, which are not unique to petroleum facilities.

The section is divided into two main parts: (1) Storage Areas, non-enclosed and enclosed areas (e.g., rooms, cabinets, and lockers) where flammable and combustible paint products are stored, and (2) Usage Areas, areas where flammable and combustible paint products are used. “Used” is defined as operations such as cleaning paint brushes with flammable solvents and mixing paint with solvents where volatile gases or vapors will be given off to the atmosphere. Also included as “usage areas” are areas where cleaning rags containing solvents or open containers of paint products are present. The storage area sub-section does *not* cover areas where paint brushes are cleaned with flammable solvents, paint is mixed with solvents, and other similar operations or areas where cleaning rags containing solvents, open containers of paint products, and similar materials are present.

Nonenclosed and enclosed, adequately ventilated and inadequately ventilated, areas where flammable and combustible paint products are stored in sealed containers (original containers or equivalent) are unclassified. Adequately ventilated enclosed areas where flammable and combustible paint products are used are unclassified if the quantities of open containers of paint are 20 liters (five gallons) or less or if the quantities of open containers of solvent are four liters (one gallon) or less. Adequately ventilated enclosed areas where only combustible paint products are used are unclassified if the temperature is below their flashpoints.

IV. Unclassified Locations

Both RP500 and RP505 recommend that certain locations be unclassified *regardless of the ventilation rate* since the occurrence of flammable gas or vapor liberation from some apparatus is so infrequent. Examples of such locations include the following:

(a) Locations where flammable substances are contained in all-welded closed piping systems without valves, flanges or similar devices, or continuous metallic tubing without valves, fittings, flanges, or similar devices, and

(b) Locations where flammable liquids, gases or vapors are transported or stored in certain containers or vessels (primarily those approved to meet specific NFPA and Department of Transportation regulations specifying containers for flammable liquids and gases).

Unfortunately, a number of people have misunderstood this recommendation and have believed that the converse of (a) and the converse of (b) were applicable. This is *not* the intention of RP500. Areas containing piping and tubing systems *with* flanges do not *necessarily* require classification. One must consider the ventilation and other criteria to determine if areas adjacent to such systems should be classified.

Additionally, it is recommended that adequately ventilated locations surrounding equipment that has continuous flame sources (e.g., unprotected fired vessels and flare tips) need not be classified solely by reason of the fuel gas being considered as a source of release. This is a change from previous editions. In previous editions, wording was "stronger", basically stating that areas surrounding continuous or intermittent flame sources need not be classified. Questions arose: How far from the flame source was included in "the surrounding area"? Was it intended to include sources other than the fuel gas? What about equipment that might allow flammable fuel to be released to the atmosphere during purge cycles? The previous wording seemed to allow abuse of the intention: to allow ordinary equipment to be installed in locations that already had a source of ignition. Therefore, the wording was changed to clarify the original intent. It is noted that it may be prudent to classify portions of these locations. For example, electrical equipment may be exposed to flammable gas during a purge cycle of a fired heater or furnace. Also, it is noted that the lack of classification around unprotected fired vessels and flare tips does not imply the safe placement of fired vessels and flare tips in the proximity of other sources of release, because unprotected fired vessels and flare tips are themselves sources of ignition. The decision of whether or not it is safe to install unprotected fired vessels or flare tips at specific locations is outside the scopes of RP500 and RP505.

The practice of not classifying locations where non-electrical ignition sources (e.g., the open flame of an unprotected fired vessel or flare tip) exist has been utilized in previous issues of RP 500. It is recommended that the application of this practice be limited to unprotected fired vessels or flare tips and that the resulting unclassified locations be restricted to their immediate vicinity. Electrical equipment located in these unclassified locations typically is de-energized for the majority of the time that the flame source is not present.

Although from a practical view, when an open flame is present a spark from electrical equipment in the immediate area of the flame would not likely be the initiator of combustion, the location of sources of ignition is not a criteria for the classification of locations. Classification is, by definition, based on the likelihood of the presence of flammable mixtures. It is not the intent of RP500 or RP505 to recommend the creation of an unclassified location in which one can locate general purpose electrical devices that are not directly associated with the combustion or ignition systems of unprotected fired vessels or flare tips.

V. Combustible Gas Detector Systems

The concept of using combustible gas detectors essentially as a protection technique, or to reduce the degree of classification, was introduced in RP500B several editions ago. Areas not containing a source can be considered unclassified rather than Division 2, and certain areas normally otherwise classified as Division 1 can be classified as Division 2, provided all criteria specified are met. The concept was carried forth from RP500B into RP500, but was modified in the Second Edition. In the First Edition of RP500, sensing a gas concentration of 40 percent lower flammable limit (LFL), maximum, or a gas detector system malfunction was required to both activate an alarm (audible or visual, or both, as most appropriate for the area) and to initiate automatic disconnection of power from all electrical devices in the area that were not suitable for *Division 1*. In the Second Edition, automatic disconnection of power from all electrical devices in the area is required for all devices not suitable for *Division 2*. Redundant or duplicate components (such as sensors) still may be installed to avoid disconnecting electrical power when single component malfunctions are indicated. It is cautioned that when automatic shutdown could introduce additional or increased hazard, automatic shutdown should not be provided, and this method of area reduction may not be feasible. This concept was extended to RP505, allowing areas normally classified as Zone 1 to be classified as Zone 2 and areas not containing a source to be considered unclassified if the criteria specified are met.

VI. Ventilation Criteria

Ventilation is a prime factor in determining area classification. Most methods used to determine whether or not ventilation is adequate involve determining the minimum ventilation rate at which flammable mixtures are maintained below 25% of their LFL, based to a large extent on recommendations in NFPA 30 [9], *Flammable and Combustible Liquids Code.* RP 500 and 505 allow these conventional methods as well, but also provide mathematical equations and means that one can use to determine whether or not an enclosed area is adequately ventilated by natural or artificial means. Methodology developed for fugitive emissions by an earlier RP500B task force was incorporated into NFPA 30.

Additionally, certain buildings or other enclosed or partially enclosed areas can be considered adequately ventilated because of their construction characteristics if (a) for flammable liquids with heavier-than-air vapors, ventilation is arranged to ventilate all areas (particularly floor areas) where flammable vapors might collect; and, (b) for lighter-than-air gases, roof or wall openings are arranged to ventilate all areas (particularly ceiling areas) where gases might collect and also the buildings comply with any one of the three following criteria:

1. A building or area having a roof or ceiling with walls comprising 50 percent or less vertical wall area of the total wall area possible is considered to be adequately ventilated (regardless of the type of floor).
2. A building or area is considered to be adequately ventilated provided it has neither a floor (for example, the floor is grating) nor a roof or ceiling.
3. A building or area is considered to be adequately ventilated provided it is without a roof or ceiling, and provided that there are no walls for a minimum of 25% of its perimeter. This criteria was rewritten for the Second Edition of RP 500 and for RP505 to clarify the intent of the original document.

In the United States ventilation is divided into two categories, *adequate* and *inadequate*, with no "gray" area between. In international standards, ventilation rates typically are divided into three categories – defined by ISA RP12.24.01 (IEC 79-10 Mod) as h*igh ventilation, medium ventilation,* and *low ventilation.*

High ventilation is defined as the ventilation rate that can reduce the concentration at the source of release virtually instantaneously, resulting in a concentration below the lower flammable/explosive limit. A zone of small (even negligible) extent results. *Medium ventilation* can control the concentration, resulting in a stable situation in which the concentration beyond the zone boundary is below the LFL during the period of time in which the release is in progress and where the flammable/explosive atmosphere does not persist unduly after release has stopped. *Low ventilation* cannot control the concentration during the period of time in which the release is in progress; neither can it prevent undue persistence of a flammable atmosphere after release has stopped.

Ironically perhaps, the latest edition of RP500B, before it was merged into RP500, recommended three ventilation rates – adequate, limited, and inadequate, with *limited ventilation* defined as an intermediate ventilation rate between *adequate* and *inadequate*. The former term *limited ventilation* fairly well fits the term *medium ventilation*; perhaps later versions of RP500 and other standards such as NFPA 30 will revert to the three-level ventilation rates.

The two-level ventilation rates matches well the Division classification scheme – two ventilation rates and two divisions dividing hazardous (classified) locations. The three-level ventilation rates matches well the Zone classification scheme – three ventilation rates and three zones dividing hazardous (classified) locations. In fact, for continuous releases, although no firm recommendations are made, a low ventilation rate normally leads to a Class I, Zone 0 or Zone 1 designation ; a medium ventilation rate to a Class I, Zone 1 or Zone 2 designation; and a high ventilation rate to a Class I, Zone 2 or unclassified designation, dependent to a large extent on the rate of release, or potential rate of release, of the source.

VII. Transition Zones

A Division 2 “transition zone” normally is required by the NEC between a Division 1 location and an unclassified location. In a similar manner, a Zone 1 transition zone normally is required between a Zone 0 location and a Zone 2 location, and a Zone 2 transition zone normally is required between a Zone 1 location and an unclassified location. A vaportight barrier can be used, however, to prevent gas and vapor from spreading, and in most cases, can alleviate the need for a transition zone. Also, adequate positive-pressure ventilation from a source of clean air and effective safeguards against ventilation failure can be used to eliminate the transition zone. It is noted that IEC 79-10 does not require transition zones. That is, a Zone 0 or Zone 1 location can abut an unclassified location, or a Zone 0 location can abut a Zone 2 location. This is a major deviation between ISA RP12.24.01 (IEC 79-10) and IEC 79-10.

VIII. Grades of Release

One of the criteria used internationally in determining the classification of locations is the "grade of release" concept of IEC 79-10 [10]. Table 1, based on concepts from IEC 79-10 and IP-15, and extracted from RP505, relates grades of release to the time that flammable mixtures are present, and, thus, indirectly to which areas should be classified as Zone 0, Zone1, and Zone 2. A similar thought process could be used for Divisions 1 and 2.

TABLE I

THE RELATIONSHIP BETWEEN GRADE OF RELEASE AND THE PRESENCE OF FLAMMABLE MIXTURES

Grade of Release	Flammable Mixture Present
Continuous	1000 or more hours / year
Primary	10 < hours/ year < 1000
Secondary	less than 10 hours / year

Continuous grades of release normally lead to a Zone 0 classification. Primary grades of release normally lead to a Zone 1 classification. Secondary grades of release normally lead to a Zone 2 classification. However, it should be noted that the terms "Grade of Release" and "Zone" are **not** synonymous. Although continuous, primary, and secondary grade releases normally will result in Zones 0, 1, and 2 classifications, respectively, this is not always true. For example, poor ventilation may result in a more stringent classification while, with high ventilation provisions, the converse will be true. Also, some sources may be considered to have a dual grade of release with a small continuous or primary grade and a larger secondary grade.

IX. Time Criteria for Area Classification

Although there is no firm rule relating the time that flammable mixtures occur in Zone 0, Zone 1, and Zone 2 , and unclassified locations, many use the rule-of-thumb shown in Table 2, extracted from API RP505.

TABLE 2

THE TYPICAL RELATIONSHIP BETWEEN ZONE CLASSIFICATION AND THE PRESENCE OF FLAMMABLE MIXTURES

Zone	Flammable Mixture Present
0	1000 or more hours / year (10%)
1	10 < hours / year < 1000 (0.1% - 10%)
2	1 < hour / year < 10 (0.01% - 0.1%)
Unclassified	Less than 1 hour / year (0.01%)

The same criteria often are used for Divisions, specifying Division 1 for locations where flammable mixtures are present for periods of time greater than 10 hours per year and Division 2 for locations where flammable mixtures are present for more than one , but less than 10, hours per year.

X. Conclusions

API RP500 and RP505 offer those in the petroleum industry an opportunity to standardize area classification drawings – both for drawings using the Division method of area classification and for drawings using the Zone method of area classification. Good engineering judgment must be used with RP500 and RP505 as with all recommended practices, but guidelines provided should minimize differences of classifications by qualified individuals classifying the same or similar locations. Individuals in other industries should also be able to use some of the concepts set forth by the new recommended practices.

The audience of users of the API area classification recommendations has been expanded through the addition of sections on operations not included before and offshore facilities excluded in the past edition of RP500, and also through the issuance of RP505 that provides guidance to those using the zone method of area classification. Although international harmonization has not been fully achieved, the new documents, particularly RP505, offer a start towards that long term goal.

References

[1] API RP500 1997, *Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Division 1 and Division 2* : API

[2] API RP505 1997, *Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Zone 0, Zone 1, and Zone 2* : API

[3] ISA-RP12.24.01 (IEC 79-10 Mod) 1998, *Recommended Practice for Classification of Locations for Electrical Installations Classified as Class I, Zone 0, Zone 1, or Zone 2* : ISA

[4] NFPA 70, 1996, *National Electrical Code*: NFPA

[5] CSA C22.1-1998, *Canadian Electrical Code-Part I*: CSA

[6] NFPA 497 1997, *Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas* : NFPA

[7] Institute of Petroleum (Great Britain), *Area Classification Code for Petroleum Installations, Part 15*

8] NFPA 37 1994, *Standard for the Installation and Use of Stationary Combustion Engines and Turbines* : NFPA

[9] NFPA 30 1996, *Flammable and Combustible Liquids Code* : NFPA

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