EngWorks Inc.
1620 49th Avenue SW
Calgary, Alberta,
Canada T2T 2T7
Phone: 403.287-2579
Fax:1-877-811-0806
www.EngWorks.ca

Process Building Hazardous Area Classification Assessment Overview

The Canadian Electrical Code (CEC) mandates hazardous locations be classified according to the nature of the hazard. This requires process buildings handling flammable materials to be classified to facilitate the selection of electrical and instrumentation equipment and to determine the appropriate wiring methods in accordance with the relevant sections of the Canadian Electrical Code. The hazardous area classification will also influence OH&S work procedures with respect to hot work permitting requirements and worker safety. Appendix L of the CEC provides guidelines on documenting a hazardous area classification. The documentation is considered "relied upon information" by engineers, installers and safety codes inspectors and as such must be issued under a professional engineering seal in the jurisdiction where the building is to be installed.

All new facilities are required to use the "Zone" method of classification. If a building is to be installed in a "Division" classified facility constructed prior to 1998, the "Division" classification may be maintained for a new building addition. It is frequently requested that process buildings handling flammable fluids be classified Zone 2 or Class I, Division 2 to avoid the extensive use of explosion-proof equipment and wiring methods. To do so, a building ventilation assessment must be performed to ensure that the probability of a flammable atmosphere is "not likely to exist under normal operation and if it does occur, persists for a short time only" consistent with the definition of a Zone 2 (Class I, Division 2) classification as defined by the CEC.

There are two ways of performing a ventilation assessment for a Zone 2 or Class Division 2 enclosed area. The first method is often termed a "fugitive emission calculation" where the ventilation rate is determined based on the average theoretical leakage rates of all piping and instrumentation components enclosed by the building. The method is described in Appendix B of API RP 500 and API RP 505. The emission factors used are based on data collected by the EPA prior to 1990 for the purposes of estimating fugitive emissions for environmental compliance. The data was never intended to be used for area classification purposes and was adopted at the time only because there was no other suitable method available for estimating fugitive emissions. The method requires that all potential leak components in a process skid be counted and an emission factor applied without regard to the pressure, temperature and volatility of the flammable material being handled. It is labour intensive, inaccurate and often results in a poor ventilation design especially when dealing highly volatile flammable materials such as propane and butane. It is not suitable for naturally ventilated building designs.

The second method of determining ventilation requirements for a Zone 2 (Class I Division 2) classification is using the methods described in Annex C of IEC 60079-10-1 Ed. 2.0 published in 2015. The IEC method is based on the assessment of a single, most probable release point in the process adjusted for temperature, pressure and volatility. This may be gaseous release from a flange or a pool of flammable material collecting adjacent a leak source. The assessment method more closely resembles what is observed in most operating facilities where the majority of process equipment is tight with only a very small percentage of components that leak. The IEC method allow the ventilation design assessment of both mechanically and naturally ventilated buildings and results in appropriate design ventilation rates that more accurately reflect the true nature of the hazard.

EngWorks uses the IEC assessment method to determine the appropriate ventilation design for buildings requiring a Zone 2 (Class I, Division 2) hazardous area classification design. Following is a list of information required to perform the assessment:

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Information Requirements

1) Provide a brief description of the process:

2) LSD and description of the final location of the building/facility:

3) PFD or P&ID of the process:

4) Information related to all flammable/combustible materials handled by the process:
   a) Material balance worksheet or gas/liquid analysis that lists the flammable material mixture compositions, pressures and temperatures handled by the process. If this is unavailable then an MSDS sheet combined with the following information will suffice:
      i) Pressure the materials are handled at:
      ii) Temperature the materials are handled at:

5) Physical layout of the building/facility
   a) Layout plan of the building showing locations of process equipment.
   b) Building fabrication plan showing location of doors, window and equipment ventilation openings. This information is usually provided by the building vendor.

6) Project minimum and maximum ambient design temperatures:

7) Interior building design maintain temperature:

8) Maximum expected interior building temperature:

9) Existing hazardous area classification for the end use facility?
   a) Date of last revision:
   b) Confirmation of the preference for a Division or Zone method of classification:

10) Indicate if the building is to be mechanically or naturally ventilated:

11) Indicate if the building will incorporate gas detection:
   a) State LFL alarm and shutdown setpoints and control actions:

12) Is the facility manned 24hrs/day, 8hrs/day or unmanned:
   a) Does the facility incorporate remote monitoring or an alarm call out system?
   b) What is the expected response time to an alarm call-out?

13) If requested, provide an ACAD or PDF layout drawing suitable for overlaying the hazardous area classification design.

Deliverables

Deliverables from the Hazardous Area Classification Design assessment will consist of a PEng. Certified report defining the hazardous area classification in accordance with Appendix L of the CEC. The report will contain a sketch drawing suitable for incorporation into the overall hazardous area classification design for the facility as well as conditions of use to ensure the integrity of the defined classification.