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Dimensioning hazardous areas in a crude oil pump facility by computational fluid dynamics and by recommended practice guidelines for classifying locations: A comparison

Accidents related to oil and gas plants are a concern because despite having intermediate frequency of occurrence, the consequences are severe, with intermediate fatality potential and high potential of economic losses. One of the issues noted to this risk is related with electrical facilities and equipment with components operating with flammable products, which can act as source of ignition, generating severe accidents. So, an appropriate hazardous area definition is necessary to avoid these types of accidents in places with explosive atmospheres. This study aims to define a hazardous area of a crude oil pump facility through numeric simulation with computational fluid dynamics (CFD), and compare the results to the recommended practice guidelines used to define the hazardous areas. These guidelines used as reference to define hazardous areas are the NFPA 497 and API 505. For the computational fluid dynamics, the CFD package from Ansys was employed. The comparison of the hazardous areas results based on the guidelines overestimate these areas when compared to the CFD results. It may be concluded that the guidelines are conservative criteria, so the standards are sufficiently safe. Nevertheless, the use of CFD may support projects as an auxiliary tool of risk analysis.

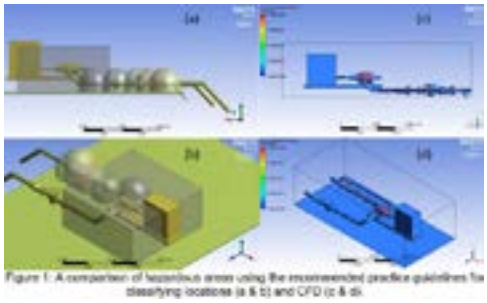

Figure 1: A comparison of hazardous areas using the recommended practice guidelines for classifying locations (a & b) and CFD (c & d).

Recent Publications

1. Bozek A, Anhalt J and Chin J (2015) The use of infrared emission detection and fugitive emission quantification technologies as a basis for hazardous area classification design. IEEE Transactions on Industry Applications. 51(1):142-147.
2. Nagaosa R S (2014) A new numerical formulation of gas leakage and spread into a residential space in terms of hazard analysis. Journal of Hazardous Materials. 271:266-274.
3. Gomes E G, Medronho R A and Alves J V B (2014) Gas detector placement in petroleum process unit using computational fluid dynamics. International Journal of Modeling and Simulation for the Petroleum Industry. 8:17-24.
4. Zhu Y et al. (2015) Analysis and assessment of the Qingdao crude oil vapor explosion accident: lessons learnt. Journal of Loss Prevention in the Process Industries. 33:289-303.

Biography

Prof. Ricardo A. Medronho is a full professor at the Chem. Eng. Dept. of the Federal Univ. of Rio de Janeiro. He is a specialist in CFD applied to the oil and gas industry and has supervised more than 50 MSc and DSc students.

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