Risk Analysis for Hydrogen Refueling Stations

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ABSTRACT

Hydrogen refueling stations (HRS) do not have significant environmental impacts, but it is important to study their safety risks, especially considering nearby populations and potential interference with adjacent activities. The objective of this work is to conduct an analysis of the key safety issues of a typical HRS, utilizing on-site electrolysis production for refueling a fleet of up to 10 heavy-duty fuel cell vehicles.

For this analysis, the characteristics and dimensions outlined in the Verne project were considered, along with its location in the Capurro industrial hub near the Teja refinery. The methodology involved a literature review that encompassed standards such as ISO 19880-1:2020 and NFPA2, as well as risk assessment studies available in peer-reviewed articles, focusing on HRSs with similar characteristics to those proposed in this project. Additionally, risk analysis performed for hydrogen storage facilities, with similar capacities, at la Teja Refinery were taken into consideration.

Based on this analysis, it can be concluded that the risk distances reported in these publications, both for individual risk (10^{-6} per year, or one event every 1,000,000 years) and harm effect distance, would remain entirely within a radius of approximately 50 meters centered around the HRS. Therefore, considering the proposed location of the project in Capurro, nearby populations and the Teja refinery would not be affected. Additionally, the capacity of the HRS does not appear to have a significant influence on the safety distances.

Compared to other fuels, the safety distances for hydrogen refueling stations are similar to those for gasoline refueling stations. The results presented in this work are significant for a better understanding of the risks associated with HRSs, which is a fundamental step towards the acceptance of these new technologies.