

Oxygen Deficiency Hazard Cryogenic Assessment

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At CERN, many different types of installations, such as small laboratories, experimental halls and accelerator tunnels, require the use of cryogenic liquids and gases, typically stored in cylinders, gas tanks, or Dewar vessels. Since a liquid cryogen can expand, the uncontrolled release into an enclosed space can easily cause an Oxygen Deficiency Hazard (ODH). In this paper a methodological approach for the evaluation of ODH is presented.

The starting point of the method is a simple estimation of oxygen level in the working environment after the complete release of all cryogenics, at room temperature and pressure. Then, in case the estimated oxygen level is less than 18 percent, a more detailed risk assessment is performed. The risk assessment includes credible release scenarios during normal operation (filling, steady-state) as well as during accidents/incidents (e.g. overpressure, mechanical impact, fire, etc.). The leakage rate of cryogenics is estimated for the release scenarios, using advanced modelling tools. A predictive model is used to estimate the indoor oxygen level as a function of time and to evaluate the necessity of preventive and/or protective measures. In addition, the time estimate to evacuate the zone is computed for the worst scenarios.

The proposed method is developed in order to bring a more proactive approach to the oxygen deficiency risk management at CERN and it is validated from a practical point of view with the presentation of a case study.

Keywords: Oxygen Deficiency Hazard, Risk assessment, Predictive model, Cryogenic liquids

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