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Final Report on the Controlled Cold Helium Spill Test in the LHC Tunnel at CERN

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The 27-km circumference LHC underground tunnel is a confined space in which the helium-cooled LHC magnets are installed. The vacuum enclosures of the superconducting magnets are protected by over-pressure safety relief devices that open whenever cold helium escapes either from the magnet cold enclosure or from the helium supply headers, into this vacuum enclosure. A 3-m long no stay zone around these devices is defined, based on scale model studies, protecting the personnel against cold burns or asphyxia caused by such an eventual helium release. Recently several simulation studies have been carried out modelling the propagation of the helium/air mixture along the tunnel resulting from the opening of such a safety device, releasing a helium flow in the range between 1 kg/s and 0.1 kg/s. To validate these different simulation studies, real life mock-up tests have been performed inside the LHC confined space, releasing helium flow rates of 1 kg/s, 0.3 kg/s and 0.1 kg/s. For each test, up to 1000 liters of liquid helium were released under standard operational tunnel conditions. The data recorded include oxygen concentration, temperature and flow speed measurements, and video footage permit to assess qualitatively the visibility. These measurements were made in the up- and downstream directions, with respect to the ventilation flow, of the spill point in the LHC tunnel.
This paper presents the experimental set-up under which these release tests were made, the effects of these releases on the atmospheric tunnel condition as a function of the release flow rate, and will discuss the modification to the personnel access conditions to the LHC tunnel that are presently implemented as a result of these tests.

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