Preliminary analysis of gas release and dispersion behaviour relevant to the use of hydrogen in the natural gas distribution network

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There is significant interest in using hydrogen in gas appliances in residential, commercial and industrial buildings, as a means of reducing carbon dioxide emissions and meeting the Net Zero 2050 targets. Several ongoing projects are investigating the feasibility of supplying either a 20% hydrogen blend or 100% hydrogen to properties using the existing natural gas distribution network or a new purpose-built network (e.g. HyDeploy, H21, H100). Risk assessment is an important aspect of these projects. One significant part of the risk assessment concerns leak rates and gas dispersion behaviour.

The aim of this talk is to present a preliminary analysis of leak rates and dispersion behaviour of hydrogen-methane blends (with up to 100% hydrogen), using established empirical correlations taken from the literature. The ratio of hydrogen to natural gas leak rates is first presented, across a range of pressures, using equations for choked, subsonic, turbulent and laminar flow. The resulting behaviour of free jets and buoyant plumes in air is then discussed in terms of the change in extent of the flammable cloud for hydrogen (and hydrogen blends) as compared to methane. Finally, a case study is presented involving a UK gas engineering procedure, IGE/UP/1, that deals with strength testing, tightness testing and direct purging of industrial and commercial gas installations. The implications of switching from natural gas to hydrogen on this procedure are discussed.

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