Partner for Progress

Case Study

Hydrogen Safety Simulation with Helium

Hydrogen is strategically important in decarbonising the UK and contributing towards Net Zero. Replacing carbon-emitting natural gas with carbon-free hydrogen is a practical solution for reducing emissions.

Town gas (~50% hydrogen) was in general use across the UK before the 1960s and the gas industry achieved safe management of its distribution. After conversion of 13m households to natural gas in 1967-77 there was no significant change in accident rate. Fundamentally, distributed hydrogen can be as safe as any other flammable gas.

Contracting Client:
Cadent and all GDNOs

Location:
Cheltenham, UK

Sector:
Energy

Key Elements:

- ✓ Innovative approach
- ✓ Real life test scenario
- ✓ Invaluable knowledge gained

The Challenge

Demonstrating the safety of 100% hydrogen use is critical, in particular for domestic properties. We need to understand hydrogen characteristics fully and how it differs from natural gas, especially in escape scenarios.

As hydrogen is not widely available or in general domestic use, testing of its behaviour after an uncontrolled escape has been undertaken in a range of laboratory environments. These tests mimicked real-life scenarios and assessed measures required to minimise risks and impacts in the event of an escape.

As hydrogen is ~10 times lighter than natural gas, it tends to disperse upwards towards the ceiling of a room or the roof space of a building. While Kiwa Energy has completed extensive mathematical modelling, the effects of this buoyancy had never been explored in real occupied houses.

The Approach

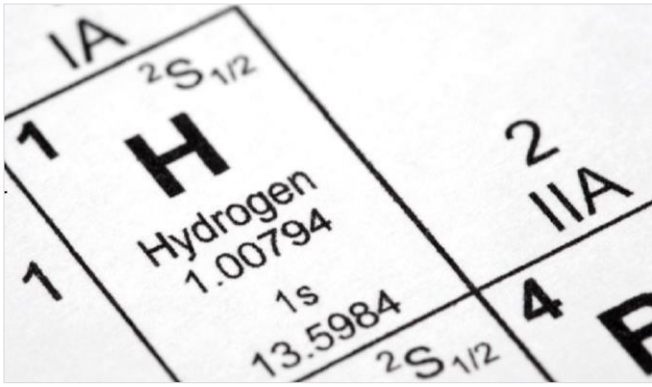
Helium has similar physical properties to hydrogen but does not burn, so it provides an effective means to model a hydrogen escape simulation. Its passage around a property can be scientifically monitored with sensors.

Kiwa has completed air tightness testing of an unexpected hydrogen escape on a number of houses (as required by Building Regulations) in the Cheltenham area and is now releasing helium into a sample of them. We are delighted that early results support our mathematical modelling.

The Outcome

The findings of this project provide invaluable data to inform standards, specifications and codes of practice all contributing to public safety.

- The concentration of hydrogen in a building during a gas escape from a broken pipe is about 2/3rds of that expected.
- The best location within the home for gas detectors has been investigated.
- The safety benefits of gas detectors have been numerically assessed.
- How best hydrogen could be vented from a house where an escape has occurred has also been explored.



Part of the global Kiwa organisation, Kiwa Energy is an established low carbon consultancy driving the transition a to Net Zero future using its expertise in renewables.