10 minutes with...

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Good morning Arul and thanks for talking to gasworld. What have we interrupted in your schedule today?
Thanks, I was expecting your call. Just now, I was looking at the latest news in energy to understand new requirements for energy standards. This is something I need to do every so often to keep up-to-date with industry.

How long has NPL been involved in developing energy gas standards?
NPL has produced natural gas reference standards for decades. These are used in the gas distribution networks to confirm the energy value of the fuel. More recently we have been involved in hydrogen, which became a mainstream activity about a decade ago. Now, we are also working on developing biomethane standards and increasingly becoming involved in the area of carbon capture and storage. The breadth of the energy standards has grown in response to the changing energy mix as our planet searches for sustainable ways to decarbonise.

How do biomethane reference materials differ from natural gas reference materials?
As an example, biomethane is sometimes produced from the digestion of wastewater. This can result in chemicals known as siloxanes being introduced into the gas network. Siloxanes can form silicon when combusted, for example, which could block the nozzles in your boiler and gas cooker.

What are the reasons for creating hydrogen purity standards for 'energy-hydrogen'?
The purity of hydrogen supplied for use in fuel cells or domestic appliances is important. It is essential that harmful impurities are monitored and avoided. For example, in vehicles the main issue is protection of the fuel cell which is very susceptible to degradation. For hydrogen which is injected into the gas grid, the concerns are different as domestic appliances are less sensitive to impurities.

What is the typical composition of an 'energy-hydrogen' reference material
NPL provide two types of reference materials for the two types of quality standards; hydrogen vehicles or domestic use. In each case, hydrogen is obviously the main component. In a cylinder gas mixture reference material, this is called the 'balance' gas. Other components are the impurities that could cause problems to the vehicle or appliance. For hydrogen vehicles, the standard contains 13 impurities in total and, for example, the mixture might be manufactured and certified to contain 4 parts-per-billion (ppb) of hydrogen sulfide and 300 parts-per-million (ppm) of nitrogen. We are still developing an appropriate quality documentary standard for hydrogen in the gas grid, but once this is written we will start providing the relevant reference materials.

What problems could these impurities cause if they flow through to a fuel cell?
Hydrogen sulfide would quickly poison the catalyst in the fuel cell, leading to irreversible damage. Nitrogen is an inert gas that could accumulate in the fuel cell and, over time, cause the car to lose power.

And what are the issues with hydrogen that is destined to be used as a heating energy vector in the natural gas grid?
As part of the BEIS funded Hy4Heat programme NPL, with DNV GL, developed a new draft standard for hydrogen quality based on existing global and national standards and feedback from the key stakeholders. Safety is a key factor, avoiding impurities that can degrade appliances and ensuring the properties of the gas are suitable for end-use operation. One of the most challenging decisions was a level for carbon monoxide; as the level must be a compromise between what the hydrogen producers can provide and what would be a safe level. The next step is for IGEM to review the standard for implementation in the UK.

Are the 'energy-hydrogen' standards harmonised at an international level?
Yes, there is an international standard known as ISO14687 which has been widely accepted; this includes separate specifications for hydrogen fuel cell vehicles and domestic appliances. NPL and 12 laboratories from Europe, the US and Japan engaged in a 'round-robin' testing programme against this standard. gw