The technology could be used to detect leaks from gas lines

Sounds like a plan

Hydrophones could be used to identify gas bubbles

BY SAM SHEAD

Scientists at Southampton University are employing hydrophones to monitor leaks from underwater gas pipelines.

Those working on the project claim that changes in acoustic signals could be used in the future to detect leaks from underwater pipelines and natural methane gas leaks from the seabed.

The technique relies on a network of hydrophones that are able to detect bubbles in the ocean.

Prof Tim Leighton, lead researcher at Southampton, said: 'If you listen to the sounds of bubbles being generated, and specifically the amplitude and frequency, you can determine the number and size of the bubbles being generated.

'We're interested in important scenarios where gas escapes from the seabed and is injected into the water column. The first is the rupture of gas pipelines set up by the petrochemical industry. Oil companies are continually monitoring the pressure at various points in the pipe to try and work out if any gas is going missing.

'Petrochemical companies would like to be able to detect any leaks and triangulate their location at a much earlier stage because little leaks can rapidly grow into big leaks.'

The hydrophones, which Leighton said can be bought for £10,000, are distributed across the seabed. Once in position, they can listen passively over several square kilometres and send an alarm if a leak is detected.

It is hoped that the technology will enable teams to remotely monitor — and possibly limit — the release of gases from the seabed into the atmosphere.

In addition to monitoring ruptured gas pipelines, the hydrophones could also be used to detect leaks from disused oil wells being employed to store carbon dioxide, as well as naturally occurring methane gas leaks.

'The UK seabed capacity for carbon storage is estimated to equate to 100 years of the current power sector output, and this is probably why the government has invested £1bn into developing the technology,' said Leighton.

Naturally occurring methane gas leaks are potentially devastating, because every molecule of methane contributes 20 times more to the greenhouse effect than a carbon dioxide molecule.

Leighton added: 'If we could find the methane and collect it, then it's a good source of fuel. A hydrophone could tell you if a natural gas leak increases in intensity and you could then potentially tap it off.'

Researchers go with the flow

Technology developed at Sheffield University is expected to enable engineers to monitor, in real time, how the rheology of liquids change during production processes.

'Companies that make liquid products need to know how the liquids will behave in different circumstances, because these different behaviours can affect the texture, the taste or even the smell of a product,' said Dr Julia Rees from the Department of Applied Mathematics.

The Sheffield research team has now developed a way of predicting these changes using a non-invasive sensor system that the liquid flows through. The sensor feeds information back through an electronic device that calculates a range of likely behaviours.

Gut feeling is to create logic gates

Chemical-stimulated components could be used to build tiny computers

BY SAM SHEAD

Researchers at Imperial College London have shown that it is possible to build some basic components used in digital devices out of gut bacteria and DNA.

The team reprogrammed E.coli bacteria with modified DNA to perform the same switching-on and -off process as logic gates more commonly found in computers and microprocessors.

The researchers believe these biological logic gates, which operate when stimulated by chemicals, could one day be used as the building blocks for tiny biological computers.

Prof Martin Buck said: 'We've been trying to establish a switching system using sensitive and robust biological components, which effectively allows us to generate the AND and NOT gate. We took the genetic components from one bacterium and controlled the expression of them very tightly so that the overall system was dependent on both these genetic systems firing at the right time.'

Imperial's biological logic gates can be fitted together to make more advanced versions

Biological logic gates have been demonstrated before, but the modularity of Imperial's concept means that they can be fitted together to make more advanced versions, which could pave the way for more complex biological processors in future.

Although still a long way off, the team believes its biological logic gates could one day form the building blocks in microscopic biological computers. The team said that devices may include sensors that swim inside arteries, detecting the build-up of harmful plague and rapidly delivering medications to the affected zone.

Buck added that one of the main issues at present is that the description of the parts isn't sufficiently elaborated, which means they can't be mixed together straight off the shelf. 'The components need to be characterised according to the context they are to be used in,' he said.