A new radionuclide waste assessment tool for the Nuclear Sector

Scientists at the University of Southampton’s Geosciences Advisory Unit, led by Professor Ian Croudace and Dr Phil Warwick, have developed a better and faster way to extract and measure volatile radioactive materials, specifically tritium and carbon-14, which contaminate parts of nuclear sites. The information gained helps sites that are decommissioning nuclear power stations to make appropriate decisions on the proper disposal of the radioactive waste materials. In some cases, with a simple remediation process, it is even possible to safely recycle some metal wastes. The new technique has been adopted by nuclear decommissioning companies and specialist laboratories in the UK and the international nuclear industry. In 10 years it is estimated that the Pyrolyser innovation will have generated £15-20m of turnover in the UK economy including ca. £2m in contract income for the university, with clear benefits to society in terms of jobs and reduced waste requiring special disposal.

Tritium and C-14 pose particular problems to decommissioning teams as they can be found in many places - metal, wood, concrete and insulation materials - throughout a nuclear site. Former methods of identifying and removing these volatile radionuclides were very inefficient. Samples were heated individually in a furnace; this process released the tritium and C-14 which was then collected and analysed so a decision could be reached on what to do with the rest of the material; expensive specialist processing or simple disposal or recycling.

In the UK alone, most Magnox nuclear power stations have reached the end of their working lives and need to be decommissioned safely; the last is scheduled to be closed in 2035. The National Audit Office estimates that the costs of decommissioning in the UK over the next 100 years could reach £100billion.

As policymakers debate how the country should generate power in future years and consider whether to embark on a major new nuclear energy programme, there is pressure to accelerate the current schedule of nuclear decommissioning.

The GAU at Southampton has extensive experience in waste characterisation linked to nuclear decommissioning, dating back to 2000. Its scientists have developed an innovative and rapid technique to extract tritium and C-14 from samples prior to their measurement. Each system, of which there can be several in use, is used to heat up to six samples at a time in an efficient and cost-effective furnace to release and trap volatile radionuclides.

Professor Croudace and colleague Dr Phil Warwick jointly developed their pioneering method in 2000 and it has continued to evolve to the present day; it is now in demand throughout the world as governments start to dismantle ageing power plants.

In the UK, the GAU has worked closely with the UK Atomic Energy Authority while it was involved in decommissioning its sites around the country. In one specific example, from 2003-2005, researchers found tritium was almost entirely confined to paint and surface corrosion layers in samples of contaminated steel at Winfrith in Dorset, a discovery that...
meant several hundred tonnes of reactor building steel could be safely recycled by simply removing the contaminated surface.

Magnox Ltd has praised the way Professor Croudace and his colleagues have shared their specific knowledge with companies and organisations in the analytical community and helped improve the confidence of industry regulators in this aspect of the decommissioning process.