



Australian Government

News Flash

ANSTO

1 June 2004

Big Benefits Likely from Stable Water Isotope Research



Australia's Murray-Darling basin

Climate forecasting is likely to be dramatically improved as a result of ground-breaking research carried out by ANSTO's Professor Ann Henderson-Sellers and UTS's¹ Dr Kendal McGuffie.

With evidence collected from the depths of South America's Amazon forest and Siberia's Lena River, through to Australia's Murray-Darling basin, Ann and Kendal have discovered that two rare water isotopes could be the key to accurately calculating evaporation and precipitation cycles in the world's major river basins.

"We believe this research is the missing link in climate change prediction, so we are terribly excited," Ann said. "It will eventually enable meteorologists to ensure greater accuracy in predictions of global and regional climate change."

Traditional climate forecasting methods currently use atmospheric and oceanic models based on total water movements. By following the paths of the two stable water isotopes, Ann and Kendal's work reveals exactly how all water moves through its various cycles.

"Nuclear scientists have been monitoring water isotopes since the 1960s, without really knowing how the data might be applied to improving climate forecasting,"

said Ann. "I have been fortunate enough to have this depth of information to draw upon and use in collaboration with our modelling results."

The two water isotopes are found in all types of water but only occur once in 500 molecules and once in 6500 molecules, and both are heavier than common water. The weight of these isotopes is the key, as they behave very differently from regular H₂O.

Following their paths can reveal exactly how all water moves through its various cycles and, importantly, allows different computer interpretations of all water exchanges to be validated and improved.

With samples from the Amazon, Ann and Kendal confirmed that greenhouse warming is overwhelming wet season moisture depletion resulting from deforestation. They also identified that increased fresh-water flows now affecting the polar oceans was instigated by the melting of permafrost underlying the soil in Siberia.

Looking to the future, salinity and total evaporation in Australia's Murray-Darling basin have been highlighted as research goals of a new ANSTO project.

Water shortages are seen as the climate challenge for this century. Current pressure on drinking and agricultural supplies worldwide will be exacerbated by climate fluctuation. "This novel stable water isotope research has a contribution to make to the goal of reducing uncertainty in these predictions," concluded Ann Henderson-Sellers.

The importance of Ann and Kendal's work has also been highlighted in a recent statement by former UN chief weapons inspector (and former IAEA² Director-General), Dr Hans Blix. "Global vulnerability to fluctuations in water supply arising from climate fluctuations are predicted to be a major trigger of future global conflicts", said Dr Blix, who believes that environmental global risks are of equal, if not greater, magnitude than the danger of terrorism.

¹ University of Technology, Sydney

² International Atomic Energy Agency



Philip Arthur with ARI's new camera

ARI Camera in Australian First

ANSTO Radiopharmaceuticals and Industrials (ARI) have developed a portable gamma radiography camera called Gamgen. The camera allows various industries, such as power stations and the oil industry, to take in situ radiographic images of key components to ensure the safety and efficiency of the plant.

ARI have used their experience and knowledge to ensure that the Gamgen is one of the safest gamma cameras on the world market. The stainless steel body is highly resistant to corrosion and is seal welded for strength. These high specifications make the Gamgen reliable and durable, as such cameras are often used in situations where water and sand can reduce their life.

The camera is designed to hold a wide range of highly radioactive sources such as Iridium-192, Ytterbium-169, Selenium-75, Cesium-137 or Cobalt-60, making it very versatile.

When an image is required, the operator places radiographic film around the part of the plant being examined and attaches specially designed cables to the camera to wind the source out. This allows the source to be exposed remotely and the radiograph to be taken. The resulting image shows any flaws or cracks, which can then be repaired or replaced.

Philip Arthur, ARI Industrials Manager, said producing this innovation in Australia raises ANSTO's credibility in the eyes of multi-national businesses.

"In the past, organisations have purchased the source from us, and the camera from the United States or Germany," he said. "We believe our camera is more reliable, and it makes ANSTO a one-stop shop for this product."

Research for Improved Disease Diagnosis

ANSTO's Suzanne Smith has been invited to travel to Cambridge University, UK to undertake further research into attaching isotopes to chemical agents that target particular organs or diseased cells for Positron Emission Tomography (PET). The research has the potential to develop new radiopharmaceuticals for diagnosis of disease and improve testing for new drugs.

PET gives much higher resolution images than the standard gamma cameras, and therefore can provide more accurate information for the diagnosis of disease.

Suzanne's trip has been funded by a grant from the Australian Academy of Science. Her host will be the PET Science Department, Wolfson Centre, Cambridge, and she has been invited to spend time at research institutions such as the Wolfson Imaging Centre and Paterson Cancer Institute in Manchester, Imperial College and Guy's and St Thomas Hospital in London and Oxford University.

"We have developed techniques that allow PET isotopes to be added as tags onto target agents for different diseases," says Suzanne. "The Cambridge group are looking at using copper-64, which has a much longer half-life than the PET isotopes currently in use, for imaging of breast cancer."

More Information

ANSTO has published its 50th Anniversary Booklet featuring stories and images about our past and current work. If you would like a copy of the booklet please contact Susan Cooper on (02) 9717 3626.

If you would like to receive online updates about ANSTO's science and technology please email enquiries@ansto.gov.au or call (02) 9717 3111.