



Australian Government



Nuclear-based science benefiting all Australians

Tim Payne – ANSTO chemist

Branch of chemistry: Dr Tim Payne has undertaken extensive research into the chemistry of environmental contaminants, focussing on the mobility of radionuclides in the geosphere. Tim provides technical advice to national and international organisations. He is also on the International Scientific Committee of the conference series on "Chemistry and Migration Behaviour of Actinides and Fission Products in the Geosphere".

Your work:

Environmental chemists play a key role in helping to find a solution to many environmental issues, including those associated with the environmental impact of waste disposal and the behaviour of contaminants. In this context, the environmental chemist often draws on information from other disciplines, including geology, soil science, physics, statistics, etc, as well as chemical sciences. However chemistry is a key knowledge component, since the problem can only be assessed if we understand the chemical behaviour of the contaminants.

Environmental chemistry utilises chemical concepts and principles from the main branches of chemistry, such as physical chemistry, inorganic chemistry, organic chemistry, and analytical chemistry. At ANSTO, radiochemists are particularly important. They understand the chemistry of radioactive materials, including those that are naturally present in the environment. The critical ability that an environmental chemist requires is to utilise and synthesise important concepts and information that are relevant to the environmental problem at hand.

One key chemical principle that is utilised is the concept of equilibrium chemistry. Often key processes can be formulated in terms of the critical chemical reactions. Many of these reactions occur at the soil-water interface, and these processes can be better understood if they are formulated as chemical reactions with associated equilibrium constants.

With whom do you collaborate in your collection and analysis of data?

Due to the complexity of environmental problems, a range of chemical expertise will be required. Collaboration is important as a single person will not usually have all the knowledge required to solve the problem. For example, consider a contamination problem such as a heavy metal in a river. The problem might be solved using:

- 1) An analytical chemist to identify and accurately measure the contamination
- 2) An ecotoxicologist to advise on the risks to biota (eg fish and other river life)
- 3) An environmental chemist to try to determine the mechanisms of environmental dispersion and possibly the source of the contaminant
- 4) A chemical engineer to recommend the appropriate water treatment plant to prevent further contamination

Real-world environmental problems always involve many branches of science, particularly chemical sciences. For this reason collaboration is a critical component of any successful research project.