Applications are invited for a research studentship in the field of chemistry modelling and analysis, leading to the award of a PhD degree. The post is supported by a bursary and fees (at EPSRC rates, with industrial augmentation) provided by EPSRC and the National Nuclear Laboratory. The studentship is for three years from October 2016. It is open to UK and EU candidates meeting the Research Council criterion of having been resident in the UK for the previous three years, but funding could also be available for highly qualified EU candidates who do not meet this three year requirement.

The coolant in a PWR is water at ~155b, ~300C, containing dissolved ionic and molecular species and suspended particulates. Some of these are deliberately added, whilst others are the result of corrosion of the alloys used to construct the primary circuit. There is a tendency for some of these materials to leave solution, and to form a solid deposit on the surface of the fuel cladding, particularly where boiling occurs on the cladding. Such deposits, termed “crud”, have a variety of undesirable effects on the performance of the plant. The crud can completely change the mechanism of heat transfer from the fuel, and by the complex chemical processes occurring within the crud, can cause significant local changes to the neutron flux.

The reasons for the formation of crud, and even more, its thermal-hydraulic and neutronic effects once it has formed, are incompletely understood. The present objectives are to develop coupled thermal-hydraulic and chemical models of the crud-coolant system, to help to build an understanding of the underlying phenomena, and to gain greater insights into the effect of crud on plant performance, and to help guide remedial measures. The various dissolved species are carried in solution through the existing porous crud. As they are transported, very high concentrations (perhaps some tens of times the concentrations in the bulk coolant) of dissolved species can be formed, and consequently the interactions between these various solutes are very important, and need to be incorporated into the models.

The work is a collaboration between the National Nuclear Laboratory, at Culham in Oxfordshire, and the Mechanical Engineering Department of Imperial College. NNL are world leaders in understanding the complex chemistry of water reactor coolants and crud, and Imperial will bring nuclear engineering and numerical and computational modelling skills. The intention is to develop computational advection-diffusion models of the processes. The work will build upon earlier work (see Haq et al., Nuclear Engineering & Design 241, 2011, p155), advancing it in particular by incorporating better modelling of the interaction between the several important species.

You will need to have an interest in the associated chemistry, and an ability to acquire knowledge in that area, coupled with an ability to describe the relevant processes mathematically, and to be able to convert these descriptions into a discreet form, and to write code to implement such a solution. As noted, the work actually does build upon existing research in this area, so there is a considerable body of this analysis and software already developed; the basic framework exists, but the complex chemical interactions now need to be developed and incorporated.

You will be an enthusiastic and self-motivated person who meets the academic requirements for enrolment for the PhD degree at Imperial College London. A wide range of first degree background could be suitable, for example Chemistry, Chemical or Mechanical Engineering, Materials Science, Physics or Mathematics. Most important is an enquiring and rigorous approach to research, together with a strong intellect. Good team-working and communication skills are essential.

In the first instance, interested applicants should send a curriculum vitae to Dr S P Walker (s.p.walker@imperial.ac.uk). In due course candidates will be required to complete a formal electronic application to Imperial College London. For information on how to apply please go to: http://www3.imperial.ac.uk/mechanicalengineering/research/phdopportunities/.

Closing date: 31 July 2016

Committed to equality and valuing diversity. We are also an Athena Silver SWAN Award winner, a Stonewall Diversity Champion and a Stonewall Top 100 Employer 2010