Title: Thermal Modelling of Spent Fuel Drying

Type of award  PhD Research Studentship

Department  Fluid and Dynamics, Mechanical Engineering

Scholarship Details  Enhanced stipend up to £17,000 p.a. subject to eligibility criteria and award

Duration  3.5 years

Eligibility  Home/EU

Start Date  From January 2021

PhD Topic Background/Description

The UK has a substantial inventory of used nuclear fuel, which has been discharged from nuclear reactors and is being stored, awaiting eventual disposal. This highly radioactive “spent” fuel is currently stored in purpose-built water-filled ponds. However, as an alternative to pond storage, the owner of the fuel (the UK Nuclear Decommissioning Authority, NDA) wishes to investigate if it could instead be transferred into dry storage canisters. This option would require the fuel to be retrieved from the water ponds and subsequently dried. Fuel drying is necessary because dry storage canisters have very stringent limits on the amount of residual water that is permitted.

Drying of spent fuel is the subject of this PhD. Spent fuel drying is a challenging, many-variable thermodynamic problem. The NDA has already invested in laboratory-scale R&D on fuel drying, using non-radioactive simulant materials. To complement the experimental R&D, and to better inform NDA’s decision-making on fuel drying, modelling and simulation is required.

This project will develop and demonstrate models for spent fuel drying and construct a statistical framework for estimates of drying performance. We will derive suitable models for vapour flow across the humidity range. The fuel drying model will include variables such as gas flow, humidity, spent fuel decay heat, thermal conductivity of the spent fuel and cladding materials. Lattice-Boltzmann and Monte-Carlo techniques will be used to represent the statistical mechanics. To develop a useful tool at the larger scale, we will develop a more conventional Eulerian CFD model that tracks fluxes of probability density functions of water vapour.
**Candidate Requirements**
Applicants must hold/achieve a minimum of a master’s degree (or international equivalent) in Physics, Engineering or Mathematical Sciences. Applicants without a master's qualification may be considered on an exceptional basis, provided they hold a first-class undergraduate degree. Please note, acceptance will also depend on evidence of readiness to pursue a research degree.

If English is not your first language, you need to meet this profile level:

**Profile E**
Further information about English language requirements and profile levels.

**Basic skills and knowledge required**
Interest and experience in fluid mechanics modelling and simulation.

**Informal enquiries**
Please email Dr Andrew Lawrie (Andrew.Lawrie@bristol.ac.uk)

For general enquiries, please email came-pgr-admissions@bristol.ac.uk

**Application Details**
To apply for this studentship submit a PhD application using our [online application system](http://www.bristol.ac.uk/pg-howtoapply)

Please ensure that in the Funding section you tick “I would like to be considered for a funding award from the Mechanical Engineering Department” and specify the title of the scholarship in the “other” box below with the name of the supervisor.

**Closing date for applications:** 15 May 2021

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