

NUCLEAR TECHNOLOGY EDUCATION CONSORTIUM

N12 REACTOR THERMAL HYDRAULICS

Summary

This module describes the thermal hydraulic processes involved in the transfer of power from the core to secondary systems of nuclear power plants. Fundamental calculations associated with these processes will be explained, examples set and results discussed.

On completion, students should have obtained:

- An understanding of the heat transfer mechanisms in reactor systems.
- An understanding of fluid flow mechanisms in reactor systems.
- An appreciation of the limits on safe power removal from reactor cores.
- An appreciation of computer codes used to assess limiting power.
- An understanding of the influence of power conversion methods on reactor design.
- The ability to perform basic calculations of thermal hydraulic quantities in core channels.

Syllabus

The module is split in two parts and comprises of the following topics:

- Introduction to Reactor Thermal Hydraulics.
- Heat transfer in fuel elements.
- Heat transfer by convection.
- Boiling heat transfer.
- Hydraulics of reactor system loops.
- Hydraulics of heated channels.
- Thermal hydraulic design.
- Steam and gas power cycles.

For the second part of the module the student will be working on an assignment. This will be to produce the first iteration of a Thermal Hydraulic design for a reactor plant required to supply 1000 MW electrical power, examining aspects such as choice of reactor type, power conversion efficiency, thermal limits on reactor core power, coolant circulation, and heat transfer from the primary circuit.