NTEC
Nuclear Technology Education Consortium
Educating the nuclear workforce since 2005.

NTEC MSc in Nuclear Science and Technology

Dr Stuart Christie

NTEC Course Tutor

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Consortium started 2005

- Nuclear Technology Education Consortium
- 7 Universities and Educational Institutes working together to offer course units
- 16 course units, expanding to 19 in academic year 2024/25
- “Short-fat” module delivery
- Part-time or full-time study
- Postgraduate Certificate, Diploma or Masters Degree
- For full-time students we pay for you to attend course units which are held at the other Universities. You travel by train on the Sunday, stay in a hotel for 5 nights and there is a food allowance while you are there.

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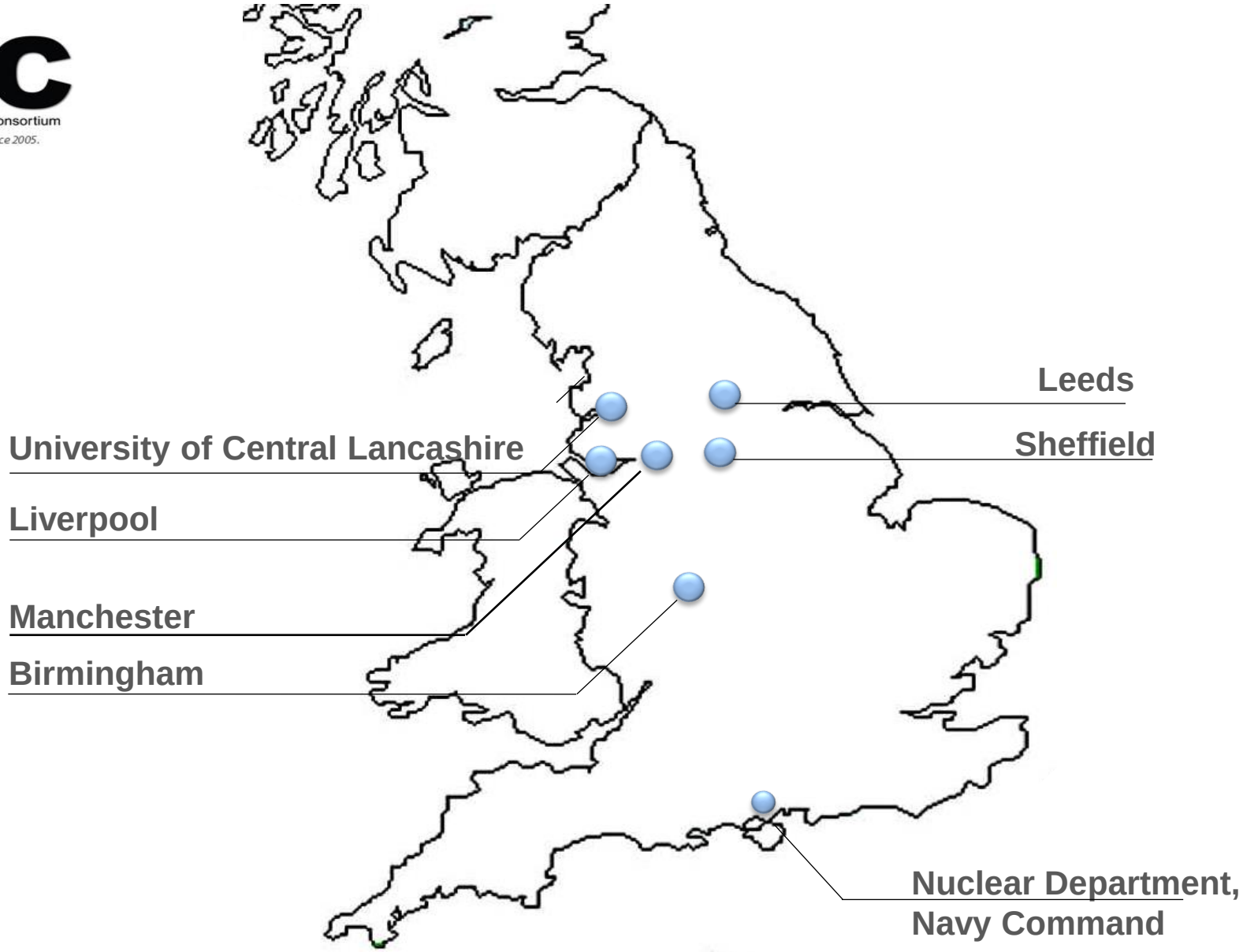


North of England

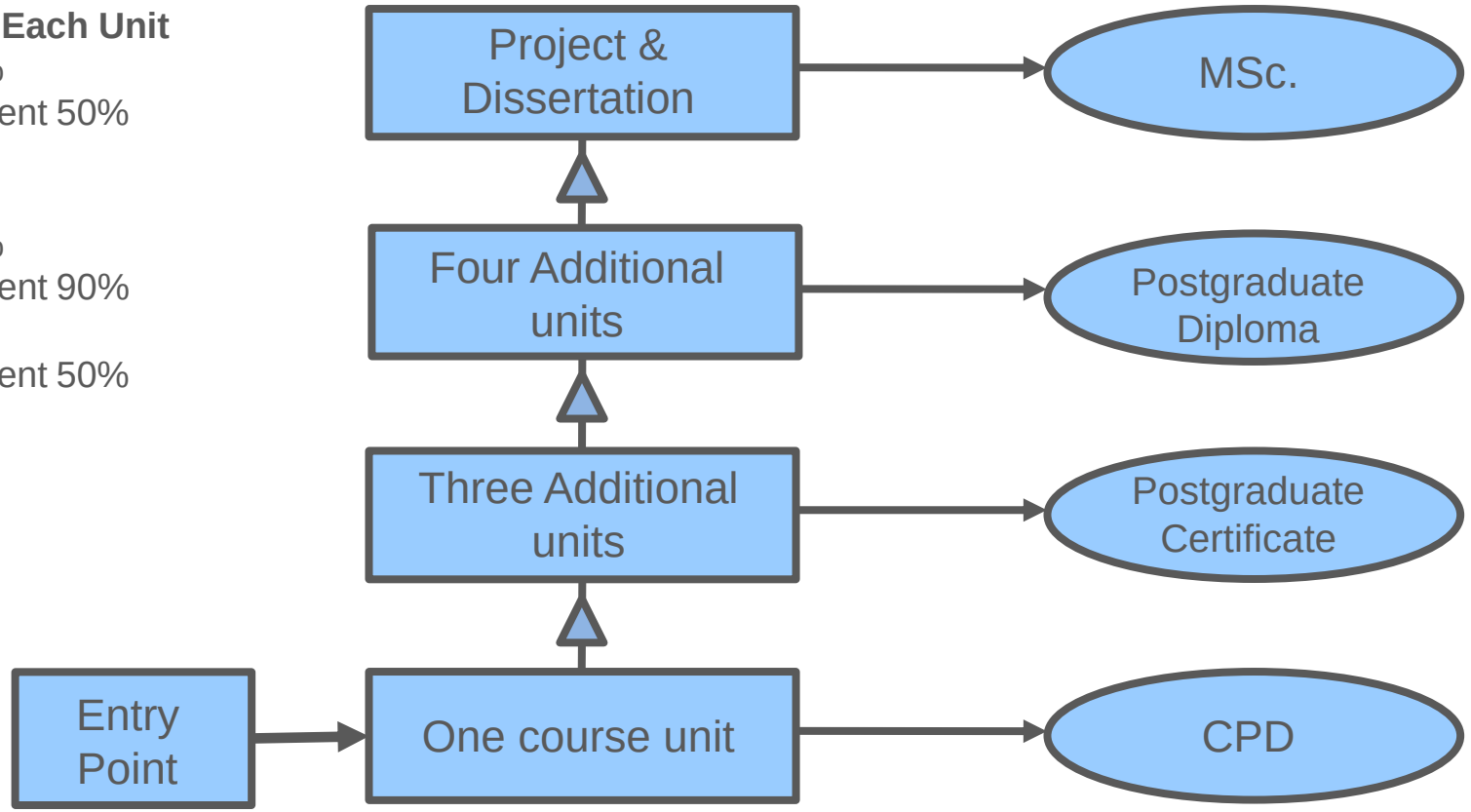
- Uranium **conversion and fuel manufacturing** in Springfields, Preston
- Uranium **enrichment** at Capenhurst, Chester
- **Nuclear reactors** at Heysham, Lancaster
- **Reprocessing and waste Management** at Sellafield, Cumbria
- **Geological disposal facility** in Cumbria?

Programme structure

Example Marking for Each Unit
- Pre-course work 10%
- Post-course assignment 50%
- Exam 40%

or
- Pre-course work 10%
- Post-course assignment 90%

or
- Post-course assignment 50%
- Exam 50%



MSc Nuclear Science and Technology
Full time: 12 months
Part time: 2 or 3 years

19 course units to choose from

35 hours at University
One week Monday - Friday
150 hours of study

NTEC unit list - Core and options

- Reactor Physics, Criticality & Design
- Nuclear Fuel Cycle
- ➢ Radiation & Radiological Protection
- Decommissioning, Radioactive Waste & Environmental Management
- Reactor Materials & Lifetime Behaviour
- Nuclear Safety Case Development
- Particle Engineering in the Nuclear Industry
- Policy, Regulation & Licensing
- ➢ Processing, Storage & Disposal of Nuclear Waste
- ➢ Radiation Shielding

- Reactor Thermal Hydraulics
- Criticality Safety Management
- Severe Accidents
- Chemical Aspects of Nuclear Technology
- Tritium & the Fusion Fuel Cycle
- Control and Instrumentation and Functional Safety
- Primary Circuit Materials and Manufacturing
- Management of the Decommissioning Process
- Experimental Reactor Physics

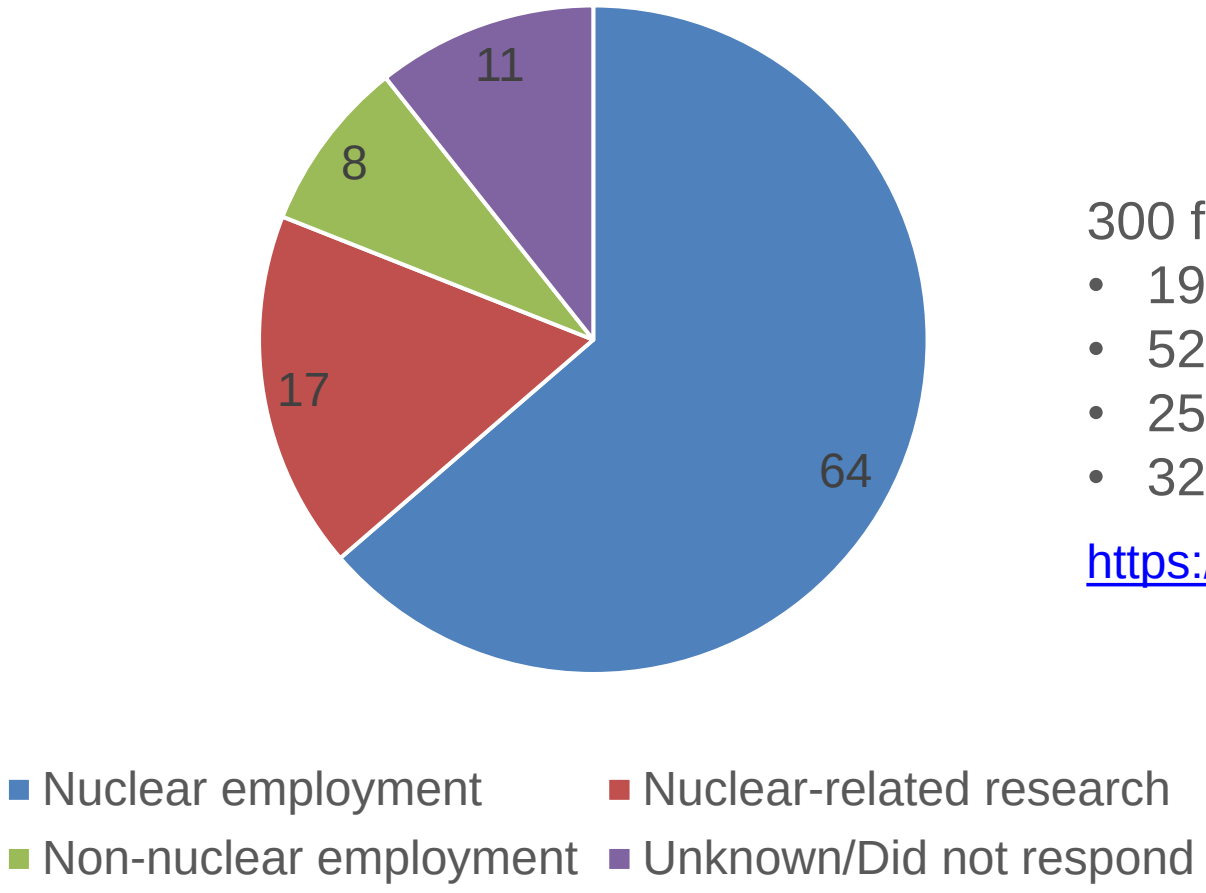
Taught week

- Course and unit schedules available at https://www.ntec.ac.uk/taught-programme/
- Monday usually 9 am start at delivering partner's institution unless otherwise stated
- Mixture of lectures, group exercises, presentation, lab work. Written course material is provided.
- Unit review after unit assessments

Partnership with Industry

- Course units designed in partnership with industry
- External Advisory Board
- Industry location for projects
- Short-fat delivery optimized for industry
- Industry lecturers support the programme
- Industry recruitment of NTEC students is the real test

Full-time student destinations



300 full time students;

- 191 Nuclear employment
- 52 Nuclear-related research
- 25 Non-nuclear employment
- 32 Unknown/Did not respond

https://www.ntec.ac.uk/student-destinations/

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NTEC unit summaries

Reactor Physics, Criticality & Design

- Reactor designs in the UK and worldwide
- Reactor accidents
- Reactor physics and criticality
- Time behaviour of the chain reaction
- Radiation transport

High Flux Reactor, World Nuclear News

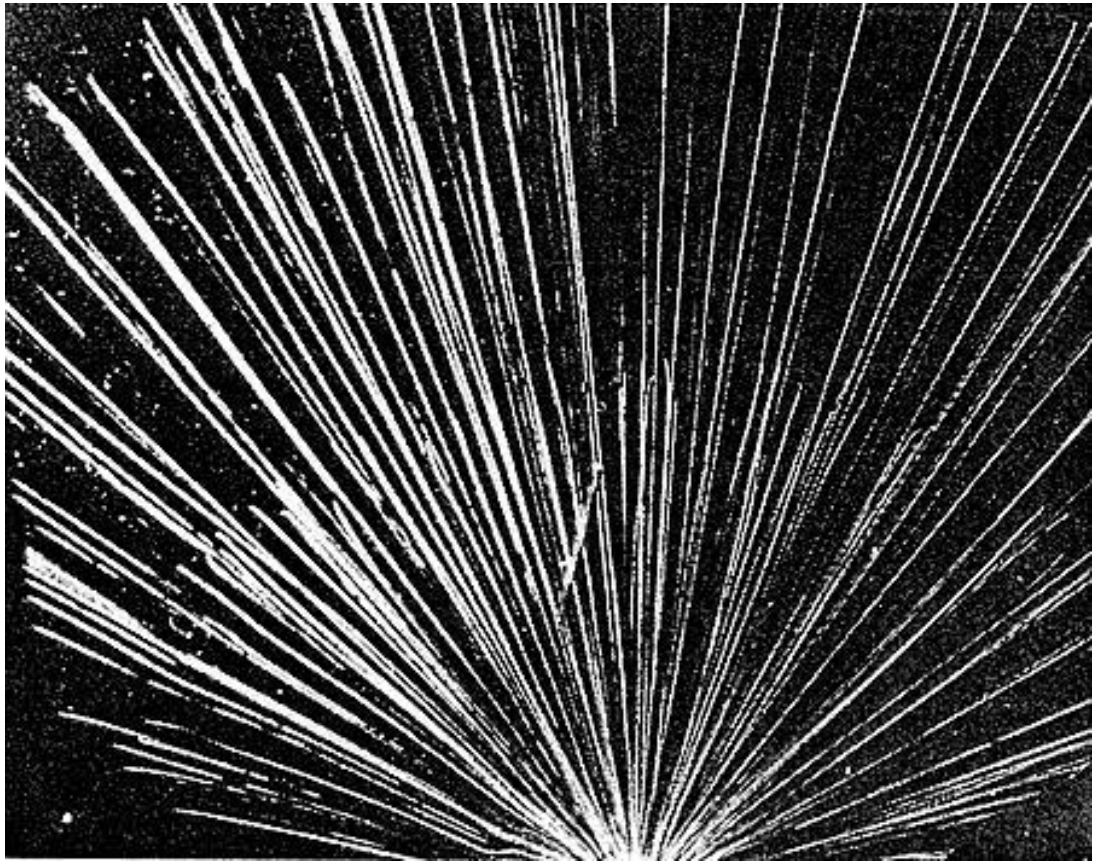
Nuclear Fuel Cycle

Uranium enrichment cascade, JNFL

- Mining and milling
- Enrichment
- Conversion
- Reprocessing
- Waste management

Radiation & Radiological Protection (Core)

- Nuclear and radiation physics
- Interaction of radiation with matter
- Radiation detection
- Biological effects of radiation
- Radiation safety



Alpha particle cloud chamber tracks, Institute of Physics

Decommissioning, Radioactive Waste and Environmental Management

Windscale pile filter decommissioning,
Nuclear Engineering International

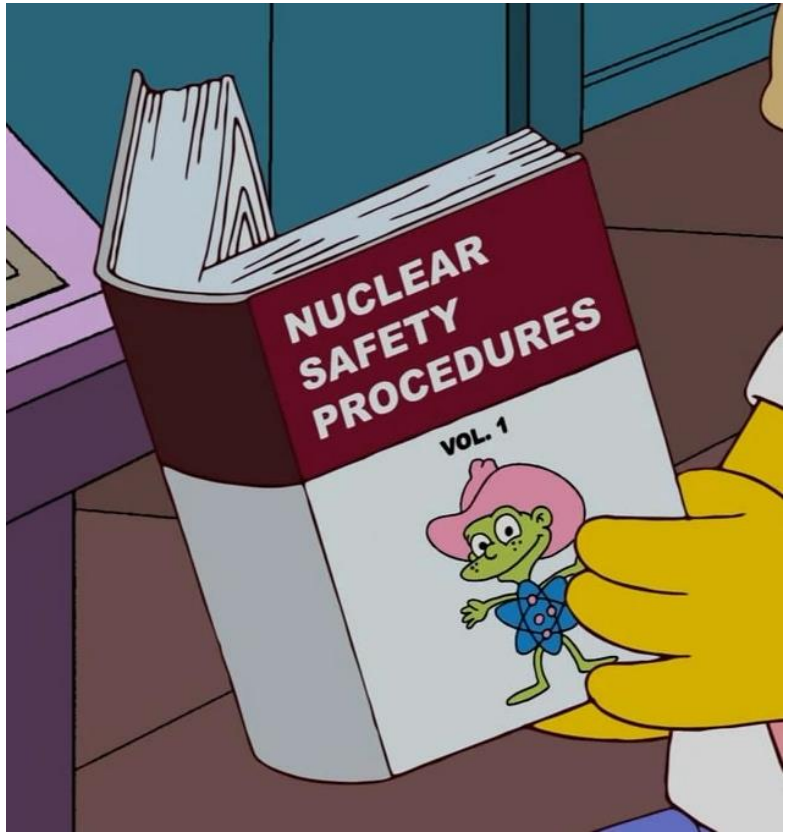
- Decommissioning of nuclear facilities
- Site remediation
- Policy, governance and socio-political issues
- Environmental safety cases
- Sustainable decommissioning

Reactor Materials & Lifetime Behaviour

- Materials science
- Corrosion
- Irradiation effects
- Structural integrity
- Nuclear materials
- Non-destructive evaluation

Nuclear fuel assembly, RIA Novosti

Nuclear Safety Case Development



Nuclear Safety Procedures, The Simpsons

- Purpose and scope of a nuclear safety case
- Nuclear safety justification principles
- Engineering substantiation
- Deterministic safety justification
- Probabilistic safety analysis

Particle Engineering in the Nuclear Industry

- Particle technology and the nuclear fuel cycle
- Suspension rheology and slurry flow
- Colloid science
- Legacy waste retrieval and storage
- Particle science for nuclear fuel manufacturing

Yellowcake, Kazatomprom

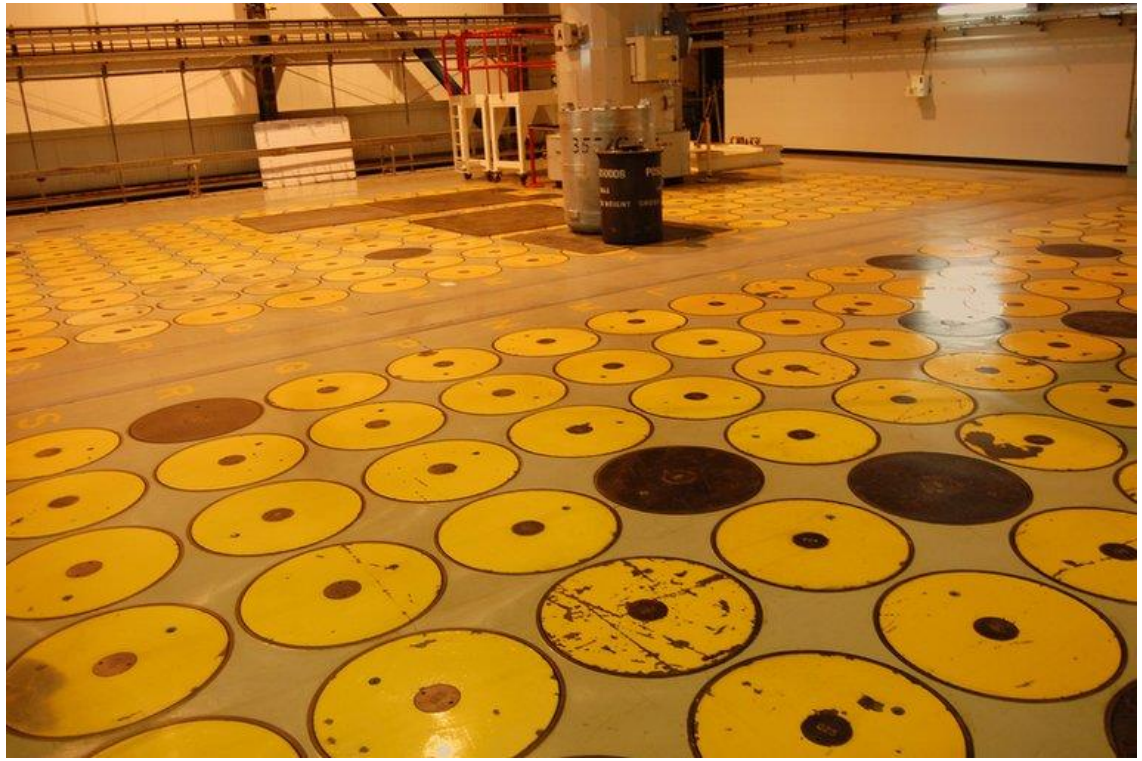
Policy, Regulation & Licensing

UK Parliamentary Group Nuclear Roadmap,
All-Party Parliamentary Group on Nuclear Energy

- Legal systems and nuclear law
- Regulatory framework
- Nuclear licensing
- Environmental permitting
- Radioactive waste policy

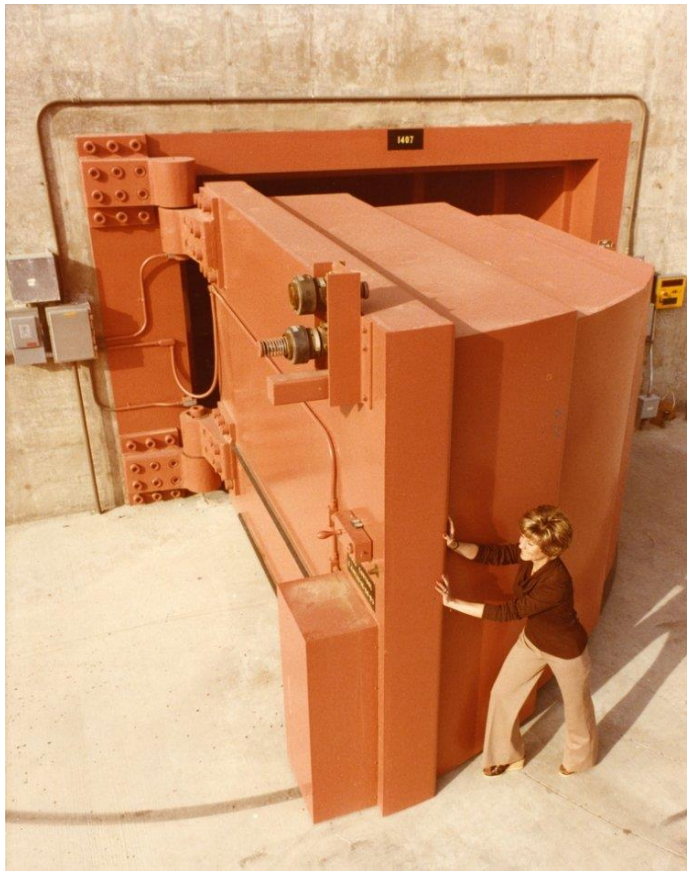
Processing, Storage & Disposal of Nuclear Waste (Core)

- Sources of radioactive waste
- Nuclear waste regulation
- Radioactive waste disposal materials and technologies
- Waste disposal concepts
- Geological repositories



High-level waste store at Sellafield, BBC

Radiation shielding (Core)

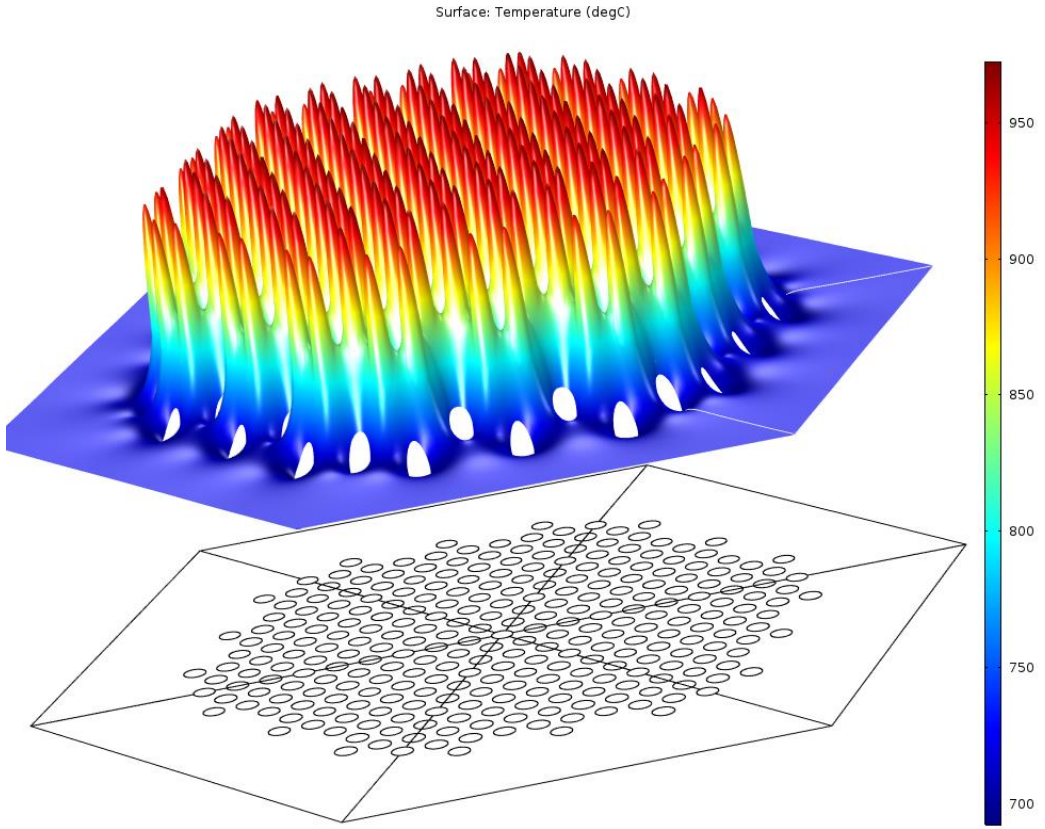


44 tonne door for neutron source shielding, Energy.gov

- Particle transport
- Principles of radiological protection
- Shielding methods
- Monte Carlo and deterministic modelling
- Radiation shielding design

Reactor thermal hydraulics

- Heat transfer in fuel elements
- Heat transfer by convection and boiling
- Hydraulics of reactor fuels and systems
- Thermal hydraulic design
- Steam and gas power cycles



Nuclear fuel assembly surface temperature model, Oak Ridge National Laboratory

Criticality safety management

Criticality safety experiment, Lawrence Livermore National Laboratory

- Physics of nuclear criticality
- Methods of criticality control
- Criticality accidents
- Criticality calculations
- Criticality safety assessment

Severe accidents

- Nuclear safety principles
- History of severe accidents
- Accident processes
- Nuclear regulations
- Radiological, societal and environmental consequences

Chornobyl, S. Christie

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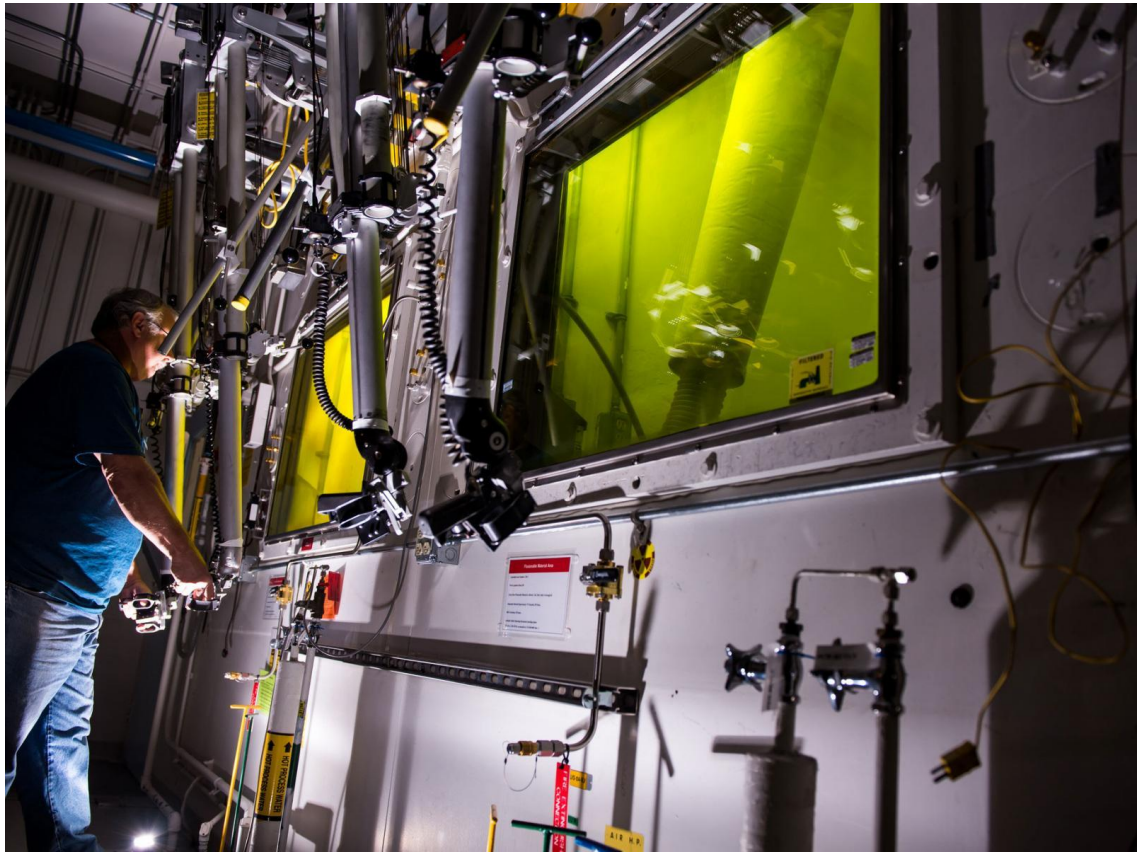
Chemical aspects of nuclear technology

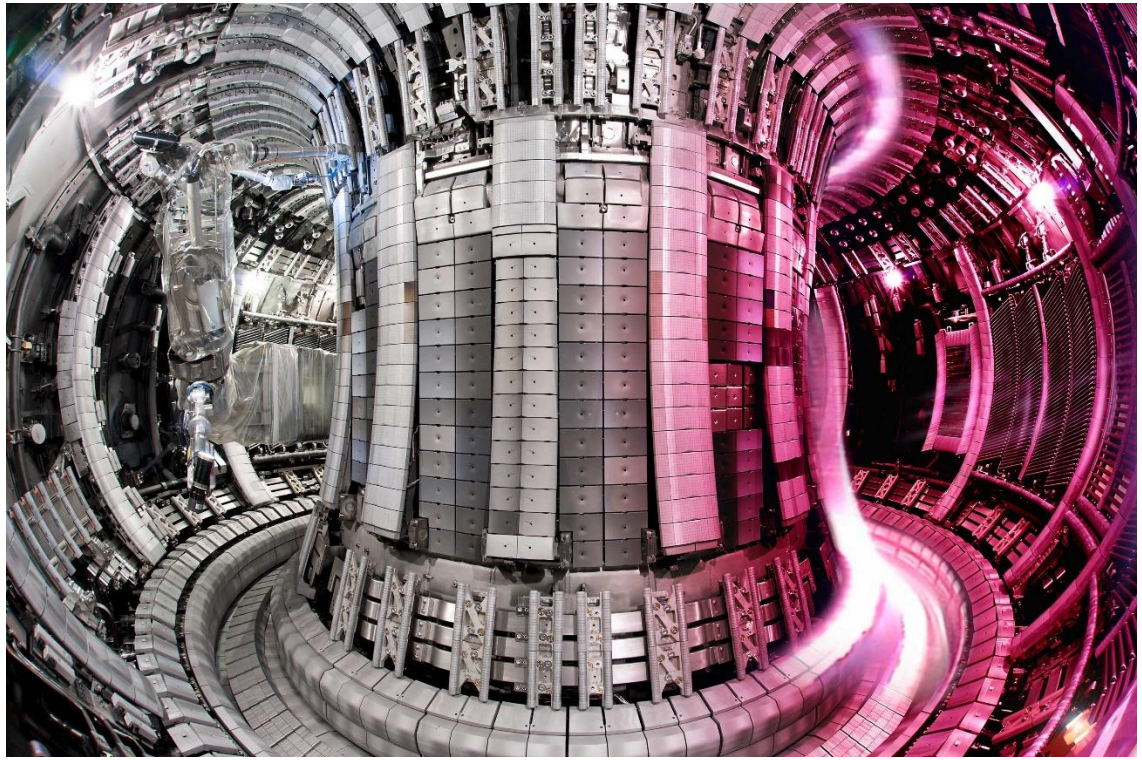


Shielded cells with remote manipulators,
Pacific Northwest National Laboratory

- Chemical and physical principles
- Nuclear fuel cycle chemistry
- Environmental radiochemistry
- Reactor coolant chemistry
- Analytical and forensic radiochemistry

Tritium & the Fusion Fuel Cycle

- Introduction to nuclear fusion
- Fuel storage and supply
- Isotope separation
- Tritium removal from water and waste forms
- Personal and environmental protection



JET: The Joint European Torus, CCFE

Control and Instrumentation and Functional Safety

Reactor control panel, IAEA

- Control and instrumentation (C&I) for nuclear facilities
- Design, verification and validation of C&I
- Safety justification and assessment
- Benefits and challenges of different approaches to C&I

Primary Circuit Materials and Manufacturing

- Welding processes used in nuclear manufacturing
- Welding metallurgy
- Residual stresses and distortion
- Near-net shape manufacturing
- Quality assurance, inspection, codes and standards
- Trends in manufacturing practice

Hinkley Point C reactor pressure vessel, EDF

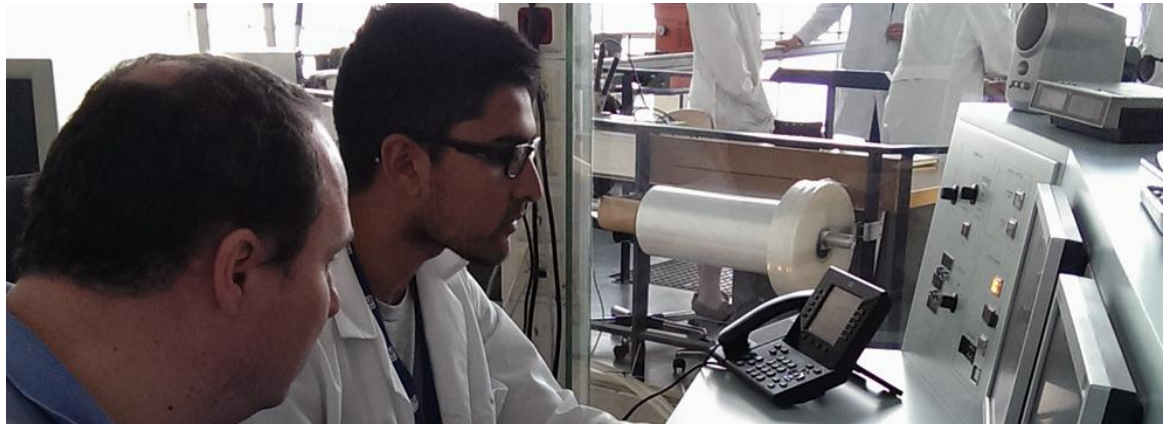
Management of the Decommissioning Process

Robots used for decommissioning at Sellafield, Nuclear Decommissioning Authority

- Policy and business objectives of decommissioning
- Hazard reduction and risk management
- Project planning processes
- Nuclear safety culture
- Waste classification and characterisation

Experimental reactor physics

- Neutron detection and measurement
- Reactivity measurements
- Control rod calibration
- Reactor behaviour and response
- Nuclear reactor operation



NTEC student operating TRIGA reactor in Vienna, NTEC

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Dissertation

- Summer(FT)/3rd year(PT) project working on a specific nuclear science and technology topic
- Industry and university based projects
  - Alternative waste encapsulation technologies
  - Application of machine learning to nuclear fuel studies
  - Space applications of nuclear technology
  - Neutronic analysis of nuclear reactor designs
  - Proton beam therapy modelling
  - Analysis of UK nuclear safeguards

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What would you like to discuss?