



Monthly Bulletin

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ISSUE NO. 3

Why this bulletin?

In the present phase of advertising the ANNETTE Courses, in addition to a continuous update of the ANNETTE course page on the ENEN Website,

<http://www.enen.eu/en/projects/annette/annette-project-courses1.html>

we felt the need to advertise in a more effective way the next upcoming courses, in order to alert the prospective attendance. Sending a periodic reminder about courses to ENEN Members and selected Stakeholders, in fact, is considered a useful service. However, this bulletin may serve also as a means of communicating the progress of the project as a whole and the content of these first issues may indeed evolve. We hope that this initiative will be considered useful and may be liked by recipients, as a means to attract learners to nuclear matters, being one of our most important missions.

[Link to the course application page](#)

[Link for asking support for mobility to the ENEN+ project](#) (not assured)

COMING SOON COURSES

[Course on Human-Technology-Organisation/Human Factors for Nuclear Safety including Virtual Reality Resources as part of Safety Culture \(6 ECTS\)](#)

**IFE at Halden, Norway
(November 5, 2018, to
December 21st, 2018)**



UPPSALA
UNIVERSITET

COURSE PURPOSE

The purpose of the course is to provide participants with a capability to account for the importance of human factors in modern technical system design and operations as well as raising awareness of risks associated with the negligence of critical human-technology-organisation (MTO) interfaces.

The main part of the course focuses on basic and fundamental MTO knowledge, including issues, theories, principles and practices related to MTO, interaction and Human Factor (HF) aspects in nuclear engineering systems and environments. It describes prevention of accidents, safe operations, design and use of barriers, user-centred design and systems development. In addition, participants will learn about the use of virtual reality tools in HF design work focused on human potentials and limitations. The course will be held in English.

TARGET GROUP

The typical participants are working professionals within the nuclear field at nuclear power plants as well as within engineering companies and authorities.

LEARNING OUTCOMES

Skills

- Application of tools, methods and techniques to improve safety and productivity in work systems
- Ability to analyse the complexities of interaction between technology, humans and organisational processes

- Ability to integrate complex human and organisational aspects in the design and operation of engineering systems

Knowledge

- The Man-Technology-Organization (MTO) perspective, including how this is different from alternative perspectives and approaches
- The different technological perspectives on unwanted events, including central constructs like barriers, human error, and how organisational factors affect human performance
- The fundamentals of different methods for analysing events
- The user centred design, verification & validation, and human performance
- The most important human factors tools and how to use these in industry

PREREQUISITES

In order to benefit from this course, the participants should have at least 3 years of experience from working within the nuclear field. University studies are recommended. The participants must have his or her employer's approval to attend the course.

TEACHING INSTITUTE

Uppsala University in Sweden offers this course in collaboration with the Institute for Energy Technology (IFE) in Norway. The teaching will take place at the IFE premises in Halden, Norway, where participants will have access to HAMMLAB, which is a state-of-the-art, international centre for research into process control, human system interaction, and human performance in complex systems.

METHOD OF DELIVERY

All teaching will be conducted on site in Halden, Norway. A combination of theoretical and practical methods and techniques will be included in the course as well as Virtual reality (VR) solutions for training. Course literature will consist of study books and other reference materials, such as ISO and NUREG standards.

FINAL EXAMINATION

In order to complete the course and receive 6 ECTS credits, participants are obliged to actively attend all scheduled sessions and to fulfil each assignment given during the course.

COURSE DATES

The course runs from November 5 – December 21, 2018. The total study time for the course is five weeks, full time. The course begins with two weeks of individual studies with reading assignments. Then there is a week of campus-based lectures and training in Halden, Norway, followed by two weeks of individual studies, including a written assignment. The participants will also prepare and conduct a 30-minute presentation of the written assignment. This will be conducted via webbased media (Skype or similar).

November 5, 2018: Course begins

- *Nov 5-16:* Individual studies
- **Nov 19-23: Campus-based lectures and training in Halden, Norway**
- *Nov 26-Dec 5:* individual studies, written assignment
- *Dec 5:* Deadline for written assignment
- *Dec 12-21:* Individual presentations (via Skype or similar)

December 21, 2018: Course ends

COURSE FEE

The course is offered as part of the ANNETTE-project and there is no course fee for the participant. However, participants will need to pay for travel and accommodation as well as meals for the five campus days in Halden, Norway. It is important that the participant has received his or her employer's approval before applying to the course.

APPLY HERE

In order to apply for this course, please use the application form on the ENEN website here: <http://www.enen.eu/en/projects/annette/eoi1.html>

Please enter **Human-Technology-Organisation/Human Factors for Nuclear Safety** as the course name and **Uppsala University** as the course provider.

Last day for application is September 28, 2018.

CONTACT

For questions and further information, please contact:

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**INTER-SEMESTER
COURSE ON "NUCLEAR
FUEL FROM CRADLE TO
GRAVE"
(ECTS ASSIGNMENT
DONE BY INDIVIDUAL
UNIVERSITIES)**

**KIT (from 8th October
until 12th October 2018)**



KIT
Karlsruher Institut für Technologie



Nuclear Fuel from Cradle to Grave

COURSE PURPOSE

The inter-semester course is designed in order to provide high-level understanding of the essential steps of the nuclear fuel cycle, i.e. the front end, the in-reactor behavior of the nuclear fuel, and the back-end of the fuel cycle.

The front-end of the nuclear fuel cycle focusses on uranium exploration and mining, uranium enrichment and different paths for fuel fabrication.

The behavior of nuclear fuel in the reactor spans over reactor normal operation up to accidental conditions. Relevant data for predictive analysis and safety implementation are the thermo-physical and chemical properties as well as the microstructural changes of the nuclear fuel during fission reaction. Emphasis is put on the impact on the fuel properties of activation and fission product and the radiation damages.

The different options to implement the back-end of the nuclear fuel cycle include on one end the direct disposal of the spent nuclear fuel considering it as waste, and on the other end the full recycling of the spent nuclear fuel. Finally, the generated high level waste at the back end needs to be handled in a proper manner and related issues are at the focus of the back-end of the fuel cycle.

The inter-semester course addresses also practical aspects related to operational radiation protection issues throughout the nuclear fuel cycle and hands-on training in the laboratories of KIT and JRC Karlsruhe site.

TARGET GROUP

Graduate and PhD students, post-docs and professionals. The course is limited to 15 participants.

LEARNING OUTCOMES

Skills

- Fuel fabrication starting from Uranium mining
- In reactor fuel behaviour under normal and accidental conditions
- Differences of the various back-end of the fuel cycle options
- Challenges and risks of the full recycling of the spent nuclear fuel.
- Understand operational radiation protection

Knowledge

- Uranium exploration, mining and enrichment technologies
- Materials science and chemistry background for nuclear fuel behaviour description
- Methods for the characterisation of ceramic materials
- Reprocessing chemistry
- Aging mechanism during long-term storage of nuclear fuel

PREREQUISITES

Before attending this inter-semester course, participants are encouraged to follow the MOOC 'understanding nuclear energy'. Registration to the edX platform for this MOOC is free of charge. (<https://www.edx.org/course/understanding-nuclear-energy-delftx-nuclear01x-0>).

TEACHING INSTITUTE

The Karlsruhe Institute of Technology in collaboration of the European Commission Joint Research Centre Karlsruhe site offers this course. Both are located at the KIT campus north in Karlsruhe, Germany. The teaching will take place at the Institute for Waste Disposal (INE) of the KIT.

METHOD OF DELIVERY

All teaching will be conducted on the KIT campus north, Karlsruhe Germany. The course is a combination of class-room teaching and hands-on training. The hands-on training are performed at the nuclear laboratories of KIT-INE (exercises in glove-boxes) and those of JRC (high-end instrumentation for fuel properties measurements and manipulator exercise for handling in hot cells). Moreover, a visit of the KIT medical monitoring and decontamination facility is also included.

FINAL EXAMINATION

In order to complete the course and receive ECTS credits, participants are obliged to actively attend all scheduled sessions and to fulfil at the end of the course a written test.

COURSE DATES

The course will be held **from 8th October until 12th October 2018.**

COURSE FEE

The course is offered as part of the ANNETTE-project and there is no course fee for the participant. However, participants will need to pay for travel and accommodation as well as meals for the five campus days in Karlsruhe, Germany.

Grants to cover travelling and accommodation costs can be requested by applying not later than July 31st, 2018, to the ENEN + Mobility scheme:
<https://plus.enen.eu/call-for-mobility-grants/>

APPLY HERE

In order to apply for this course, please send an e-mail to annette2018@ine.kit.edu indicating your Name, Institution, Address, e-mail address, phone and if you are student or professional.

To complete the application it is also mandatory to use the application form on the ENEN website here: <http://www.enen.eu/en/projects/annette/eoi1.html>

Please enter **Nuclear Fuel from Cradle to Grave** as the course name and **KIT and JRC** as the course provider.

Last day for application is September 15, 2018.

CONTACT

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N06: REACTOR MATERIALS & LIFETIME BEHAVIOUR

**Manchester
(8th - 12th October 2018)**



The University of Manchester

N06: Reactor Materials & Lifetime Behaviour

Summary

This module describes the science and engineering of reactor materials, and the factors that influence the lifetime of these materials, including corrosion, environmentally-assisted fracture, and irradiation embrittlement. Other topics covered in this module include fracture mechanics and structural integrity, non-destructive evaluation techniques, as well as plant monitoring and lifetime issues. Also considered are materials specifications and fabrication processes for materials used in nuclear power systems.

On completion, students should be able to:

Have an understanding/appreciation of the materials science structure/property relationships of key reactor materials, and how these are affected by corrosion and the environment (Light Water Reactors, AGRs).

An understanding of the methods of structural integrity assessment of reactor pressure vessels.

The ability to perform basic structural integrity assessment using the R6 code. An appreciation of the methods of non-destructive testing and plant monitoring with real-life examples.

An appreciation of the factors which limit the lifetime of reactor components, such as radiation damage and stress corrosion cracking.

An appreciation of the specifications and methods of material fabrication/joining for reliable performance in nuclear power system environments.

**N09: POLICY,
REGULATION AND
LICENSING**

**Manchester
(22nd - 26th October
2018)**

Syllabus

Materials Science and Engineering
Structure and Properties of Metals and Alloys used in Reactor Systems
Corrosion
Graphite
Mechanics and Lifetime
Fracture Mechanics
Non-Destructive Testing and Plant Monitoring
Lifetime Issues including Radiation Damage
Materials Specification and Fabrication for high reliability in nuclear power systems

The lectures will be supplemented by a Structural Integrity Assessment Tutorial and a Materials Evaluation and Analysis Session. The Structural Integrity Tutorial will include worked examples and problems. The Materials Evaluation and Analysis Session will include demonstrations of fractographic characterisation and microstructural analysis using scanning electron microscopy and energy dispersive x-ray spectroscopy, as well as a tour of the advanced analytical microscopy facilities and environmental testing facilities for nuclear materials research.



The University of Manchester

N09: Policy, Regulation and Licensing

Summary

The nuclear industry is one of the most heavily regulated industries in the UK. Regulatory issues necessarily impact upon the development of national policy in environmental and energy areas. This module covers the international and national legal frameworks for nuclear power and radioactive waste management including licensing issues covered by the Nuclear Installations Act, discharge authorisations under the Environmental Permitting (England and Wales) Regulations 2010 and planning for new build. The roles of the various regulatory bodies and other players are discussed. The module also addresses the role of the decommissioning of nuclear facilities and UK radioactive waste management policies and national strategies. Students are introduced to basic legal principles as applied in the nuclear sector and are shown how to read case law and apply their knowledge to legal problems

On completion, students should be able to:

- explain the policy context in which the nuclear industry operates.
- list key legal instruments and explain why they have been made.
- explain the principles guiding regulation in the nuclear industry and comment on the way that they are used.
- describe clearly the governing bodies, nationally and internationally, responsible for formulating policy, promulgating laws and regulations and enforcing them
- explain clearly the responsibility of the employer and the individual in respect of ensuring nuclear safety.
- identify the legislation applicable to the student's organisation, and how this is applied.

Syllabus

Introduction to legal systems
Working with statutes and case law
Nuclear law
The regulatory framework and institutional arrangements including public bodies involved in determining nuclear policy and regulating the industry at international, European and national levels and the context in which they work.
Nuclear Industry Policy and Regulation.
Energy Act 2008 and new build.
Nuclear licensing and delicensing under the Nuclear Installations Act.

**COURSE ON
RADON AND ITS
RADIOLOGICAL IMPACT**
IFIN – HH
(22 - 24 October 2018)

Safety assessment, plant justification, engineering substantiation, competency standards.
Environmental Permitting Regulations 2010 and the National Strategy for Radioactive Discharges 2001 – 2020.
Nuclear liabilities under international and national law.
Radioactive waste management – legacy waste and new build waste
UK Radioactive Waste Policy – the MRWS process.

Method of Delivery

One week of lectures and tutorials at University of Manchester



COURSE ON RADON AND ITS RADIOLOGICAL IMPACT

Course Outline and Content

The course is aimed to provide advanced knowledge of radon origin and its spread in environment, in terms of their radiological impact, and to develop the skills for performing the measurements of radon and progeny concentrations in different places. The content of the course will offer the theoretical and practical understanding of the regulatory requirements in the existing exposure situations involving radon exposure.

The programme is addressed to:

Radiation Protection Officers having responsibilities in NPP operation or radioactive waste management, in uranium mining, uranium processing, fuel fabrication; Professionals of Public Health Service (physicists, chemists); Professionals of Environment Monitoring and to those who are interested in continuous professional development in order to cover present needs in different sectors of nuclear energy and ionizing radiation applications.

The course is structured as follows:

Unit 1 – Radiological characterisation of radon (1 ECTS)

Unit 2 – Regulatory control on exposure to indoor radon in dwellings and workplaces (1 ECTS)

Detailed Learning Outcomes are reported at this [link](#)

Requested Background:

The learner is assumed to have basic knowledge of Physics, Engineering (EQF Level 6).

Lecturer:

Mrs. Maria Sahagia, PhD

“Horia Hulubei” National Institute for Physics and Nuclear Engineering (IFIN – HH)

Nuclear Training Centre

30 Reactorului, RO-077125, Bucharest-Magurele, Romania

Method of Delivery:

The teaching activities and practical sessions will be organized at IFIN-HH as a CPD training programme (3 days).

Final Examination: written test

Maximum number of ANNETTE participants: 6

Date of delivery: 22 - 24 October 2018

**SINGLE AND TWO-PHASE
THERMAL-HYDRAULICS -**
for nuclear applications

(e-learning, ready at
end of July 2018 - mid
August 2018)



SINGLE AND TWO-PHASE THERMAL-HYDRAULICS

Course Outline and Content

The course is aimed to provide basic and advanced concepts about single and two-phase fluid-dynamic and thermal-hydraulics, enabling the learner to

understand relevant phenomena of interest for nuclear reactor analysis and to apply them to classical problems. The content is conceived to progress from single to two-phase physical background, to quantitative analysis, also proposing exercises to be performed either manually or with the aid of computer programming.

The course is made of the following units (6 ECTS):

- Unit 1: Fluids and Balance Equations
- Unit 2: Laminar Flow, Navier-Stokes Equations and Boundary Layer Phenomena
- Unit 3: Heat Transfer in Laminar Flow
- Unit 4: Momentum and Heat Transfer in Turbulent Flow
- Unit 5a: Natural Circulation in Single-Phase Flow
- Unit 5b: Notes on Compressible Single-Phase Flow
- Unit 5c: More on Turbulence
- Unit 6: Two-Phase Flow: General Definitions, Flow Regime Maps and Balance Equations
- Unit 7: Pressure Drops and Heat Transfer in Two-Phase Flow
- Unit 8: Some Specific Phenomena in Two-Phase Flow: Critical Flow, Flooding and Boiling Channel Instabilities

5 Units of Exercises (under preparation)

Detailed Learning Outcomes are reported at this [link](#)

Requested Background

The learner is assumed to have basic knowledge of Mathematics, Physics, Applied Thermodynamics and basic programming skills at least at a level of BSc in Physics or Engineering (EQF Level 6).

Teacher

Prof. Walter Ambrosini ([see the CV](#))
Università di Pisa
Dipartimento di Ingegneria Civile e Industriale
Largo Lucio Lazzarino, 2
I-56216 PISA

Method of Delivery

Asynchronous e-learning.

The course material is available after application at

<http://elearn.ing.unipi.it/course/index.php?categoryid=329>

Lecture written and video Material is already online. Exercises are being prepared. A provisional userid can be provided to anybody interested in having a look.

Final Examination

Mainly oral, with proposed application problems. Modalities to be determined.

**NEW NAME AND DATES
FOR A HIGH QUALITY
SCHOOL**

**FRAMATOME
Professional School
(FPS) at KIT**



Courses Offered by the FRAMATOME Professional School (FPS) at KIT for ANNETTE

- [Reactor Exercises](#) (on agreement: 4th quarter of 2018)
- [Design Basis Accidents for Light Water Reactors and Numerical Simulation Tools](#) (April 2019)
- [Computational fluid dynamics with OpenFoam](#) (November 2018)
- [Design of Pipelines against Earthquake Loads](#) (on demand)

AN EXTENDED OFFER BY FPS@KIT FOR ANNETTE (TENS OF PLACES)

- Flow and heat transfer in reactor core - (24.09. - 27.09.2018) ([link](#));
- Monte Carlo criticality and shielding calculations (12.11. - 16.11.2018) ([link](#));
- Coupled Neutron Kinetics /Thermal Hydraulic Codes for Safety Assessment of Nuclear Power Plants (10.12. - 14.12.2018) ([link](#));
- Technology and Management of the Decommissioning of Nuclear Facilities (10.09. - 14.09.2018) ([link](#));

[For a general description of course conditions, look at this link](#)

MOOC (Massive Open Online Course)

[Introducing safety culture and its application to the nuclear field](#) **30 h**

This MOOC is conceived as a first contact with the safety culture in all areas to continue, then, deepening in more specific concepts in the nuclear field. In order to establish a good safety culture and nuclear safety culture, aligned leadership is necessary. All these aspects will be worked in a dynamic, different and participative way, in which collaborative learning will be a key aspect.

At the end of the MOOC, the participants will be able to understand and explain the aspects related to human behavior and its management to achieve a strong safety culture. These general concepts will be focused to the nuclear industry and its differentiating characteristics.

MOOC Structure

The MOOC structure includes **four independent** NOOCs (Nano Open Online Courses) available in [OPEN UNED platform](#).

Planned start date: October 15th 2018

For more information about each NOOC and pre-inscription, click in each NOOC title.

[NOOC I. What is Safety Culture? 10h.](#)

The concept of safety culture is an absolutely necessary issue, when it comes to recognize and manage risks.

There are many definitions for culture, and along this Nano-MOOC we will explain the common and most important features that support a strong safety culture. We will enhance our learning experience by showing industry experiences, and also engaging activities will be proposed to reach a complete understanding of what is safety culture.

[NOOC II. Understanding Nuclear Safety Culture. 10h](#)

We could say that the nuclear industry, together with other high hazard industries such as aeronautical or petrochemical, is the paradigm of safety. In this case, we will explore all the specific aspects of the nuclear sector related to safety culture. Based on operational experience and real cases, we will explore those aspects that make it different from other industries with high safety requirements.

[NOOC III. Developing leadership for safety. 5h](#)

People should be involved in safety. That could be achieved by promoting a healthy safety environment and helping all the workers to make safety culture as their own; however, they also need to know how to work during emergencies. Leaders play a key role in this process, so it is important to understand what is expected from the leadership under emergencies, and how to work on the different skills to be ready when they are needed.

[NOOC IV. Refreshing Nuclear Basics. 5h](#)

Nuclear power generation has special features, to know them and to remember the related physics, chemistry and engineering fundamentals is absolutely necessary to improve our knowledge in nuclear safety culture.

[General information about the MOOC in the Blog INOOC \(Innovative Nuclear Open Online Culture\)](#)

Contact

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**European Nuclear
Education Network
Association**



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FOR GENERAL INFO:

Web page of ANNETTE Courses
<http://www.enen.eu/en/projects/annette/annette-project-courses1.html>
Web page for course application:
<http://www.enen.eu/en/projects/annette/eoi1.html>



LINK TO COURSE LIST



LINK TO THE APPLICATION FORM