UCLouvain

lbnen2010

2019

Nuclear fuel cycle (Centre d'étude nucléaire-Mol)

In view of the health context linked to the spread of the coronavirus, the methods of organisation and evaluation of the learning units could be adapted in different situations; these possible new methods have been - or will be - communicated by the teachers to the students.

3 credits		Q1

Language :	English
Place of the course	Autre site
Aims	The objective is to provide students an overall view of the fuel cycle, from cradle to grave: 1 • The front-end of the fuel cycle: ore extraction, conversion and enrichment, fuel fabrication and use in the power plant, spent fuel reprocessing and recycling of re-enriched reprocessed U and Pu as MOX in PWR. • The back-end of the fuel cycle: the radioactive waste management, ranging from waste characteristics, waste treatment technologies, disposal technologies, safety assessment of geologic disposal. - - - - *The contribution of this Teaching Unit to the development and command of the skills and learning outcomes of the programme(s) can be accessed at the end of this sheet, in the section entitled "Programmes/courses offering this Teaching Unit".*
Evaluation methods	**Due to the COVID-19 crisis, the information in this section is particularly likely to change.** Oral examination; written preparation
Content	**First part -The front-end of the fuel cycle (H Druenne)** • Uranium extraction and treatment of ores; worldwide resources ;Conversion of concentrated ores ; • U enrichment: Basic principles of isotopic separation. Theory of the cascade (symmetrical cascade) and description of the main techniques; • Fabrication process and description of the various current commercial fuel types; • Basics of the in-core fuel management; • Isotopic evolution under irradiation regarding residual heat and source term; • Reprocessing of UO2 fuel elements: description of the PUREX process ; • Recycling of U and Pu: technology and industrial limits, equivalence principle and MOX neutronic design; • Interim storage : description of the main concepts for dry and wet storage. **Second part -The back-end of the fuel cycle (P. Van Iseghem)** • Categories, inventory of radioactive waste • Conditioning and immobilisation of radioactive waste • Characterization of radioactive waste (general; scaling factors; destructive analysis; non-destructive analysis) • Assessment of the safety of geological disposal (methodology; some typical results from the safety assessment) • Impact of new fuel cycles on radioactive waste disposal • Geological repositories: key criteria for designing a disposal concept, overview of ongoing international programmes, and discussion of the Belgian supercontainer concept. • Technical visits to the Belgoprocess facility and to the ESV underground research laboratory in clay on the SCK-CEN site
Inline resources	https://www.sckcen.be/fbnen
Other infos	This course is part of the Advanced Master programme in nuclear engineering organized by the Belgian Nuclear Higher Education Network (BNEN). BNEN is organised through a consortium of six Belgian universities and the Belgian Nuclear Research Centre, SCK-CEN and takes place at the SCK-CEN in Mol. **Prof. Pierre Van Iseghem** -Université de Liège **Prof. Hubert Druenne**- Université de Liège
Faculty or entity in charge	EPL

Programmes containing this learning unit (UE)

Program title	Acronym	Credits	Prerequisite	Aims
Advanced Master in Nuclear Engineering	GNUC2MC	3		