UCLouvain

Ibnen2010

2021

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

Language :	English			
Place of the course	Autre site			
Prerequisites	The following BNEN courses are a prerequisite • Nuclear Energy: Introduction • Introduction to Nuclear Physics and Measurements Basic chemistry, material sciences, nuclear physics			
Learning outcomes	At the end of this learning unit, the student is able to: The objective is to provide students an overall view of the fuel cycle, from cradle to grave: • 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.			
Evaluation methods	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 Other infos	https://www.sckcen.be/fbnen 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	Learning outcomes	
Advanced Master in Nuclear Engineering	GNUC2MC	3		Q	