# The internship of Egyptian nuclear safety specialists at Lithuanian Energy Institute

By request of the European Nuclear Safety Training and Tutoring Institute (ENSTTI), the Lithuanian Energy Institute (LEI) experts provided internship for the Egyptian nuclear energy specialists at LEI on 30th September – 21st December 2019. Actively participating in ENSTTI activities, up to now LEI has hosted a number of tutoring programs for Belarusian, Algerian and Egyptian specialists (regarding modelling of processes in containments, severe accidents analysis and emergency preparedness, deterministic and probabilistic safety assessment, modelling of severe accidents in nuclear reactors using ASTEC code and other topics).

Two trainees from the Egyptian Nuclear & Radiological Regulatory Authority (ENRRA) participated in the tutoring: Dr. Basma Mahmoud Mohammed Fouad Borai and PhD student Hend Mohammed Elsayed Saad. The experts from LEI, Dr. Aurimas Tonkūnas, Mr. Andrius Slavickas and Dr. Algirdas Kaliatka, shared their knowledge with the trainees during the tutoring 'Modelling of Neutron Kinetics in Nuclear Reactor Using SCALE Code'. This inter-national internship of 12 weeks was executed in the framework of the International Atomic Energy Agency (IAEA) program 'Multinational and Regional Training and Tutoring for Experts of the National Regulatory Authorities and Their Technical Support Organisations for Developing or Strengthening Their Regulatory and Technical Capabilities'. The tutoring was conducted using the ENSTTI methodology.

At the beginning of the tutoring, the tutees were introduced to the SCALE code and its modules. The tutees were introduced how to describe materials considering various available options of material definition and how to construct geometry considering presented geometry rules. In the first four weeks, the tutors presented and explained some basic modules of the SCALE code package for criticality analysis as KENO Va and KENO VI modules, or the T-NEWT module, which uses Monte Carlo or deterministic transport methods, respectively. The TRITON module for LWR lattice physics depletion calculations was presented for the tutees as well. By following the objectives of tutoring, the tutors were
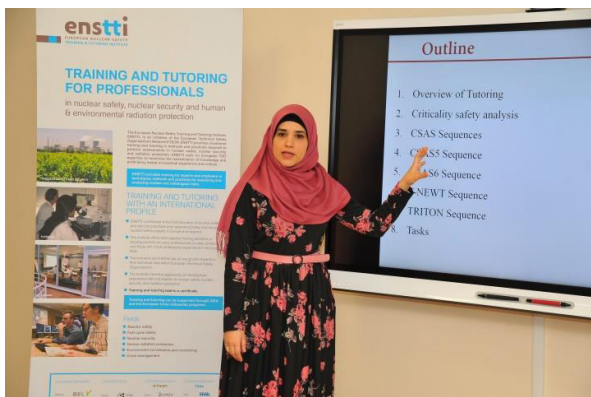
Dr. Basma Mahmoud Mohammed Fouad Borai (on the left) and PhD student Hend Mohammed Elsayed Saad (on the right)

more concentrated on practical parts of using SCALE. The practical exercises were given for the trainees for the acquisition of knowledge. Since the tutees already had the experience with similar computer codes, for example, MCNP and DRAGON, they made a fast progress with the SCALE code modules by finishing the introduction part, which covered simple examples, much faster than was expected.

After the introduction and practices with the modules for criticality and the burnup simulations, the trainees expressed wishes to use their achieved knowledge to use SCALE for the problems that were the most interesting for them – PWR and VVER fuel assemblies and reactor core. The tutees were introduced to some benchmarks related to PWR and VVER fuel assemblies and core simulation. These benchmarks have geometry details needed to simulate PWR or VVER fuel assemblies and core neutronics. Benchmark results were presented for the tutees to ensure that the models made by using the SCALE code are correct. Thus, the second month of tutoring was designated for making really complex models such as a VVER reactor core. Although it was a difficult task for the trainees, the tutors helped and supported them to perform and finish their tasks. The trainees demonstrated that the results of the models constructed using the SCALE code are in good agreement with the ones presented by benchmark participants.

During the last four weeks, the tutors explained some other modules of the SCALE code package in detail such as TSUNAMI for sensitivity and uncertainty analysis, MCDancoff for calculation of location-specific Dancoff factors and ORGIN-ARP for express isotopic depletion/decay calculations. According to the request of the tutees, the tutors also added extra presentations to explain the uncertainty and sensitivities calculations based on normal random sampling. This method is implemented in the SCALE 6.2 version using the SAMPLER module.

At the end of the internship, the trainees prepared reports in which they demonstrated the gained knowledge and the individual work done during the tutoring. The reports were addressed to the IAEA and ENSTTI authorities. The gained knowledge and individual activities

Group picture of the Tutoring Evaluation Workshop participants

were presented by the trainees to the LEI experts and Mrs. Frederique Boulesteix (Training and Tutoring Manager, ENSTTI) for the evaluation. The trainees were awarded with ENSTTI Internship Certificates as their achieved work was well evaluated.

Basma Mahmoud Mohammed Fouad Borai, one of the nuclear safety specialists from the Arab Republic of Egypt, who participated in the tutoring, visited the EUROSAFE Forum organized in Cologne (Germany) on 4–5th November 2019, where she received a Badge of Honour of the Directorate-General for International Cooperation and Development for the results achieved in training. It is the second internship for Basma at LEI. The first internship, for which she was awarded, took place at LEI in April–May and September–November 2018.

After the first internship, Basma Borai decided to extend her education in a different field and offered us to organize a new internship. This shows that our employees have already gained trust among foreign trainees.

During three months of tutoring, the trainees received information, skills and knowledge, related to the nuclear engineering, reactor physics and application of the SCALE code. These knowledges are required to build competencies and expertise in this field. This fellowship will help with the covering effectively and timely needs of all Egyptian national structures in charge of the nuclear power program. This internship was very useful for lecturers as well – it helped them to structure and deepen their knowledge, thus the competencies of the lecturers increased.

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