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Regional Training Course on Computational Fluid Dynamics (CFD) for Industrial Process Flow Modelling and Simulation, Everly Hotel, Putrajaya, MALAYSIA, 3 to 7 October 2022

Malaysia through Malaysian Nuclear Agency (Nuclear Malaysia), Ministry of Science and Technology and Innovation (MOSTI); was successfully organized a Regional Training Course on Computational Fluid Dynamics (CFD) entitled Industrial Process Flow Modelling and Simulation, which was held on 3 to 7 October 2022 at Everly Hotel, Putrajaya. The objective of this event was to inculcate the awareness among the participants on Computational Fluid Dynamics (CFD) modelling and introduce them to the fundamentals and first principles of CFD as applied to industrial flow modelling. There were 9 countries from the Asia Pacific region participated in this event which made up to 21 participants. Moreover, the event was the inaugural activity under IAEA TC Project RAS 1030 entitled "Using Radioisotope Techniques and Computational Fluid Dynamics Simulation for Troubleshooting and Optimizing of Industrial Processes".

CFD is the analysis of fluid flows using numerical solution methods. CFD is a quick and advanced simulation tool which is used for modelling, predicting and improving the fluid flow phenomenon of a system or a process. Radioisotope techniques or Radiotracer Technology for troubleshooting and optimizing industrial processes has been promoted by IAEA to its Member States for the last 50 years. Malaysia, in particular, has planned to reinforce the human capital team of radiotracer so that any diagnostic and troubleshooting of processed plants can be carried out when there is prompt request from industries.

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However, the industrial players are very skeptical in allowing injection of the radioactive source inside their plant and their responds are really slowing down the utilization of radiotracer technology especially in oil & gas, petrochemical, mineral and processing industries. The hybrid of CFD and radiotracer technology therefore will generate good synergies to enhance acceptance of radiotracer technology by industries in which the ability of tracking and monitoring of tracer whereabouts can be observed. Due to the aforementioned reason, the International Atomic Energy Agency and Malaysian Nuclear Agency has come out with the initiative to host the Regional Training Course.

Figure 1. Group photos of the participants with the Top Management of Nuclear Malaysia (above) and the participants only (below)

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Figure 2. Top Management of Nuclear Agency attended the officiating ceremony of the event

On the first day, the event was started with the speech from Dr. Gerardo Antonio Maghella Seminario, the IAEA Technical Officer, followed by the welcoming speech from Dr. Noraishah Othman, the Course Director and last but not least the officiating remark by Director General of Malaysian Nuclear Agency, Dr. Abdul Rahim bin Harun. Our Local lecturer was CFD Expert, Dr. Muhammad Ariff Asyraf Ehsan from PETRONAS Research Sdn. Bhd.

Figure 3. Sequence of speakers at the first training course day

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Figure 4. A look inside the auditorium

The course started with the installation of CFD Software using Ansys Student Version License. Each participant was issued with a laptop that met the specification of Ansys software and he/she has to install the software individually. The idea of using the student version is to ensure that each Member State is not deprived from integrating the radiotracer activities with CFD simulation at their home country since it is free and easy to access. Basically, the course comprised with lectures and hands-on activities respectively. Participants were given opportunities to explore the software themselves upon completion of each lecture with assistance of the expert and facilitators. They started with drawing the given dimension, extracting the fluid domain from the object, meshing (discretize) the object and finally providing the parameters to each boundary condition before running the simulation and post-processing respectively.

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Figure 5. Hands-on training were carried out daily with assistance from expert and facilitators

The participants were also taught on how to create the pulse tracer injection at the inlet of the process unit and developed the residence time distribution (RTD) curve at the process outlet using the software. They also visualized the process flow inside the unit operation that they drew themselves provided the correct assignment of boundary conditions. The ability to observe the insights of the process really intrigued them in which the process can lead the engineers to provide recommendations on how to improve the process subsequently.

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The host also organized the Technical Visit at the Multiphase Flow Facility in which the participants were shown the process of the Separator Unit which is a horizontal large vessel designed to separate production fluids into their constituent components of oil, gas and water and widely used in petroleum production. The dimensions of the separator were noted and the inlet flow rate was simulated using CFD software. The rig is also capable to be used for determination of flow rate or peak to peak measurement whereby the individual scintillation detector can be assigned accordingly.

The results of the separator unit was discussed together with the lecturer and prior to that, participants were required to download the case file. The lecture and hands-on activities on the separator were considered as the advanced application of CFD which involved multiphase flow. The Eulerian Model was chosen since separator unit consisted of non- homogenous fluid and involved three different phases (ie; water, oil and gas). They were also taught on how to assign the individual phases prior commencing the simulation. The results showed the vivid discrimination between phases.

Finally, it was a courtesy of IAEA to host the welcoming dinner on day three. On the last day, there was an assessment conducted in order to test the understanding of CFD simulation among participants. The handing out of certificate to each participant was done by Director of Industrial Technology Division, Dr. Nor Pa'iza Bin Mohamad Hasan. Moreover, Dr. Gerardo was also outlined the activities and also possible contributions that can be assisted from IAEA for the next four years during RAS 1030 implementation for the betterment of the region.

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Figure 6. Technical Visit at Multiphase Flow Facility at Block 60, Nuclear Malaysia

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Figure 7. Dinner hosted by the IAEA

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Figure 8. Token of appreciation from Malaysian Nuclear Agency

Figure 9. Certificate ceremony

text: Ms. Noraishah Binti Othman, Malaysian Nuclear Agency, MALAYSIA

photos: various photographers, training course participants