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EDITORIAL

Dear readers,

It is a great pleasure to provide you with the third issue of Atom Indonesia in 2023, namely Vol. 49 No. 3 (2023). The Atom Indonesia Vol. 49 No. 3 (2023) contains ten articles discussing various aspects and applications of nuclear science and technology. The contributors of those articles are not only from various national institutions and universities but also from international institutions.

"Determination of the Diagnostic Reference Level (DRL) in Samarinda Hospitals" was written by *R.* Jannah under collaboration with R. Munir and E. R. Putri from Department of Physics, Faculty of Sciences and Mathematics, Mulawarman University, Samarinda, Indonesia. The diagnostic reference level (DRL) is a form of investigative level used as a tool to help optimize protection to radiation exposure for diagnostic and interventional procedures. The purpose of this study was to determine the local DRL values for the examination of the abdomen, thorax, and head at radiology installations. The modality used was 128-slice CT scan. The numbers of patients whose data were used were 200 for abdominal examinations, 160 for thoracic examinations, and 100 for head examinations. Overall, the total patient whose data was used was 460. Data processing in this study was carried out with a quantitative analysis technique, namely descriptive statistics. This analysis technique used secondary data obtained from the results of recaptures or archival books for examination of the abdomen, thorax, and head. Data processing was carried out with a measure of diversity through the calculation of the third quartile in the data distribution. It was assumed that 75 % of patients performed examinations with a common diagnosis. The results of these calculations are visualized in the form of graphs of the relationship of computed tomography dose index volume (CTDIvol) with the number of patients and a graph of the relationship of dose length product (DLP) with the number of patients. In the abdominal examination, a CTDIvol of 12 mGy and a DLP of 1545.5 mGy·cm. In the thoracic examination, a CTDIvol of 11 mGy and a DLP of 903 mGy·cm were obtained. For the head examination, a CTDIvol of 34.25 mGy and a DLP of 2190.25 mGy·cm were obtained. The conclusion obtained from this study is that the DRLs are relatively low, but they still need to be optimized by medical physicists.

"Neural Network Predictions of Atomic Form Factors and Incoherent Scattering Functions" was explored by B. Mohammedi, H. Benkharfia and N. Mellel from Nuclear Research Center of Birine, Algeria under collaboration with B. Beladel from Department of Physics, Ziane Achour University, Djelfa, Algeria, K. Bessine from LDRSI Laboratory, Saad Dahlab University, Blida1, Algeria and N. Moulai from Ecole Normale Superieure Kouba Algeirs, Algeria. In order to predict atomic form factors and incoherent scattering functions which are used to calculate the coherent and incoherent total scattering cross sections, a technique based on artificial neural networks of the multilayer type was implemented. In this context, two neural models have been developed and compared with those in the literature. This study revealed both the accuracy of the results obtained and the effectiveness of the designed model. The mean relative error for the least estimated property does not exceed 16.5 %. The software realized in this way give a prediction of the above parameters for the input variables Z: Atomic number, x: $\sin(\vartheta/2)/\lambda$ and E: Photon energy, and it provides users with flexibility for prediction. The advantages of this technique lie in its very fast handling, due to its ease of use, and in the two integrated networks, which it guarantees for a variety of input parameters such as atomic number, photon energy, and momentum transfer variable.

"The Effect of Sr2+ and Fe3+ Cations and the Stirring Speed on The Precipitation of Barium Sulfate in a Batch System" was written by S. Susilowati, N. Karaman and Sukirmiyadi from Master of Environmental Science, Engineering Faculty, University of Pembangunan Nasional "Veteran" East Java, Surabaya, Indonesia under collaboration with A. R. Prayuga, D. T. Aruba and L. Suprianti from Department of Chemical Engineering, Engineering Faculty, University of Pembangunan Nasional "Veteran" East Java, Surabaya, Indonesia. The batch system investigation explored the effect of Sr^{2+} and Fe^{3+} cations and the stirring speed on the characteristics of precipitated barium sulfate. A series of experiments were conducted to evaluate the rate of barium sulfate precipitation in laboratory equipment

from brines containing barium ions (3500 ppm) and varying amounts of Sr^{2+} and Fe^{3+} ions (10 and 20 ppm). Kinetic analysis was also performed to explore how stirring speeds (240 and 480 rpm) affect barium sulfate scales' crystallization by increasing the stirring speed and promoting Sr^{2+} and Fe^{3+}-cation solubility while decreasing the precipitation rate. All solid crystals obtained were mostly pure barite, as the X-ray diffraction (XRD) method confirmed. The SEM micrograph of barite morphology revealed particles with tablet-shaped crystals 2 to 5 nm in size. With the presence of Sr^{2+} and Fe^{3+}-cation, the shape of barium sulfate was modified into spherical tablets or flower-like clusters of tablets. Meanwhile, the morphological changes could result from increased stirring rates. Moreover, the kinetic results yielded a general reaction rate equation that might be used to estimate barium sulfate deposition in pipelines for various brine, supersaturation, and mixing time durations.

"Evaluation of Changes in Dose Estimation on Abdomen CT Scan with Automatic Tube Current Modulation Using In-House Phantom" was explored by A. Taopik from Department of Physics, Faculty of Mathematics and Natural Sciences, Universitas Indonesia, Depok, Indonesia and Installation of Radiology and Nuclear Medicine, Cipto Mangunkusumo National Central General Hospital, Jakarta, Indonesia, L. E. Lubis from Department of Physics, Faculty of Mathematics and Natural Sciences, Universitas Indonesia, Depok, Indonesia and Radiology Unit, Universitas Indonesia Hospital, Depok, Indonesia, D. S. K. Sihono and D. S. Soejoko from Department of Physics, Faculty of Mathematics and Natural Sciences, Universitas Indonesia, Depok, Indonesia. This study evaluates the effect of the Automatic Tube Current Modulation (ATCM) technique on pitch and effective diameter variation in estimating dose values and noise levels for abdominal examination on Philips Ingenuity CT scan machine using in-house Phantoms. The in-house phantoms are oval in shape with three effective diameter sizes, namely 23.2 cm, 28.3 cm, and 33.3 cm to represent abdominal region. The three size Phantoms were scanned using an Ingenuity 128 Philips CT scan with the abdominal protocol exposure parameters of 120 kVp tube voltage, Dose Right Index (DRI) variations of 10,11,12,13, and 14, and pitch variations of 0.6; 0.8; 1.0; 1.2; and 1.49. The changes in mAs, CTDIvol, and noise to the Philips reference value were then verified (i.e. an addition of one DRI value increases mAs by 12 %). For evaluation, a metric to express the change in DRI is defined as Δ_{DRI}. The study demonstrates that noise level is influenced by object size; size information of the object could be useful to predict the change of tube current and pitch due to ATCM with respect to selected DRI. The DRI value is proportional to the tube current, thus selecting the DRI at a certain pitch will directly determine tube current. The Δ_{DRI} in general, according to Philips specifications, is verified to be approximately 10 % to 13 %, except for DRI 10 to 11 which is relatively high on average 15 % to 17 %. Increasing DRI increases the $CTDI_{vol}$. The CTDI/mAs constantly ranges of 0.06 to 0.07. The value could serve as a characteristic parameter for quality assurance. The ATCM specifications of the Ingenuity 128 CT Scanner is according to Philips regulations.

"Uncovering the Distribution Zones of Uranium and Thorium in Bangka Island" was explored by Ngadenin, H. Syaeful, K. S. Widana, I. G. Sukadana and F. D. Indrastomo from Research Center for Nuclear Fuel Cycle and Radioactive Waste Technology, National Research and Innovation Agency (BRIN), KST B.J. Habibie, South Tangerang, Indonesia under collaboration with R. Fauzi from Research Center for Geological Resources, National Research and Innovation Agency (BRIN), KST Samaun Samadikun, Bandung, Indonesia and Widodo from Indonesian Nuclear Technology Polytechnic, National Research and Innovation Agency (BRIN), KSE Achmad Baiquni, Yogyakarta, Indonesia. Radioactive minerals, especially containing uranium and thorium, can be used as a core element of nuclear fuel. Bangka Island is located in The Southeast Asian Tin Belt where it has a large uranium and thorium potential. The purpose of this study is to delineate distribution zone of uranium and thorium in Bangka Island. The study methods consist of radiometric measurement and mapping, petrographic analysis, and mineralogical analysis of pan concentrate samples. Based on radiometric measurement, positive anomaly value of equivalent uranium (eU) is ranging from 5-15 ppm while of equivalent thorium (eTh) is ranging from 45- 75 ppm. The result of petrographic analysis from several outcrops of Klabat Granite indicated that there are monazites found in several samples of Mangkol Granite and of Bebuluh Granite. Radioactive mineral indication also can be identified as pleochroic halo within biotite in samples of Pelangas Granite and Menumbing Granite. Based on the result of mineralogical analysis of pan concentrate samples, it was identified that monazites can be found in all samples. Monazites constitute the percentages ranging from 2.82-10.66 %. Zircon also can be identified with percentages ranging from 9.13-76.75 %

while ilmenite and magnetite minerals have average percentages of 24.09 % and 5.97 %, respectively. Favorable zones can be delineated in outcrops of Klabat Granite, Ranggam Formation and alluvial deposits in northern, northwestern, northeastern, central, and southeastern parts of Bangka Island. The occurrences of monazites in those lithological units are the main factors of high radioactivity in Bangka Island. Based on petrographic and mineralogical composition, those granite bodies which are correlated with Klabat Granite are mostly associated with ilmenite series with S-Type granitic rocks.

"Analysis of Radiation Exposure Level on Linen and Other Objects in Patient Rooms at Nuclear Medicine Installation" was written by A. Putri, R. Munir and E. R. Putri from Mulawarman University, Barong Tongkok Street No.4, Samarinda, Indonesia under collaboration with R. Zurma from Nuclear Medicine Installation, Abdoel Wahab Sjahranie Hospital, Palang Merah Street No. 1, Samarinda, Indonesia. Analysis of radiation contamination levels has been carried out using an Atomtex surveymeter in the patient rooms after thyroid cancer ablation therapy, in the Nuclear Medicine Installation, Abdoel Wahab Sjahranie Hospital. This study aims to measure the level of radiation exposure based on the rate of radiation exposure and radiation contamination of objects in the patient rooms after ablation therapy, and to find out how long linen can be washed since the first measurement. Data collection was carried out once a week, on the same weekday, for five weeks for objects in the patient rooms by using the surveymeter at a fixed distances from the objects' surfaces. Radiation contamination measurements for linen items were carried out for 3 d by aiming the surveymeter to container containing linen items from certain distances. Based on this study, the level of radiation exposure obtained is categorized as low because the value range is below 10 μSv/h. The radiation contaminations for some objects are categorized as low-level exposure because the value is less than 3.7 Bq/cm2. Other objects tend to be in the moderate-level category because the value is more than 3.7 Bq/cm2 and less than 37 Bq/cm2. The values obtained refer to the standard issued by BATAN. It can be concluded that the patient rooms in the Nuclear Medicine Installation of Abdoel Wahab Sjahranie Hospital are safe.

"Comparative Analysis of Turbulence Models for Thermal-Hydraulic Simulations in Aqueous Homogeneous Reactors" was explored by D. M. Pérez and A. G. Rodríguez from Departamento de Energia Nuclear, Universidade Federal de Pernambuco (UFPE), Cidade Universitária, Avenida Professor Luiz Freire 1000, Recife, PE, Brasil and Centro Regional de Ciências Nucleares (CRCN-NE/CNEN), Cidade Universitária, Avenida Professor Luiz Freire 200, Recife, PE, Brasil under collaboration with C. A. B. de Oliveira Lira from Centro Regional de Ciências Nucleares (CRCN-NE/CNEN), Cidade Universitária, Avenida Professor Luiz Freire 200, Recife, PE, Brasil and D. E. M. Lorenzo from University of Havana, Avenida Salvador Allende y Luaces, Quinta de Los Molinos, Plaza de la Revolución, 10400, Havana, Cuba. This article presents a comparative study of various turbulence models applied in the context of thermal-hydraulic simulations for liquid fuel reactors, specifically Aqueous Homogeneous Reactors (AHR) using Computational Fluid Dynamics. The objective was to assess the suitability of the turbulence models by comparing their results with data obtained from Large Eddy Simulation (LES). For that purpose, was compared the flow behavior predicted using the k-ε, SST, GEKO, DES, SBES, and LES turbulence models. The calculations were carried out in a simplified computational model derived from a pre-existing three-dimensional AHR conceptual design. By utilizing this simplified model, the study aimed to focus on the computational differences between the turbulence models, while minimizing the influence of other factors. The calculation results revealed that the k-ε model exhibited significant discrepancies with the LES, with relative differences for the fuel solution maximum temperature reaching up to 75 %. Among the remaining RANS models, the Shear Stress Transport (SST) model demonstrated the best compromise between accuracy and computational efficiency, with differences below 5 % and requiring only 1/5th of the time, compared to the LES model. The Scale-Resolving Simulation (SRS) models, DES and SBES, provided a more comprehensive description of flow behavior and results closer to LES, albeit with higher computational demands. Between these two models, only the DES model exhibited relative differences below or equal to 1 % compared to the LES model for the studied thermohydraulic parameters.

"Analytical Studies on the Radionuclide Levels of Sediment and Water in an Agricultural Environment in the Egyptian Delta" was written by R. Shady from Department of Physics, Faculty of Science, Tanta University,Tanta, Egypt and Department of Physics, College of Science and Arts in

Uglat Asugour, Qassim University, Uglat Asugour, Kingdom of Saudi Arabia under collaboration with A. E. A. Elzain from Department of Physics, Faculty of Science, Tanta University,Tanta, Egypt and Arts in Uglat Asugour, Qassim University, Uglat Asugour, Kingdom of Saudi Arabia. This paper is an environmental investigation of the concentration values of radioisotopes and hazardous elements, aimed to shed light on industrial pollution and the effect of using fertilizers in the period of irrigation water drainage from cultivated lands, especially in the River Nile, irrigated, and draining channels in the middle portion of the Egyptian river delta. Different samples were analyzed, both for water and sediment. Many physical and chemical characteristics of samples were investigated. Among them are the quantitative measure of the acidity or basicity of aqueous or other liquid solutions (pH), grain size, and the total organic matter content (TOM) have been determined for sediments. pH and TDS, beside other types of pollutants, were determined for water samples. The water and sediment samples pH are slightly alkaline. The mean value of TDS for water samples is 488 mg/l, while he usual TDS value in river is 500 mg/l. The TOM values show that the sediment samples are poor in organic matter content. The bicarbonate range in the water samples is smaller than the same range in river water. The levels of Ra-226, Th-232, and K-40 activity in sediments are highly correlated. Natural radionuclides seem to correlate with the artificial Cs-137 in sediment. For this peruse, a 240 cm3 high-purity germanium reagent Type-B was used to quantify the levels in each sample with a relative accuracy of 50 %. The radioactive element K-40 is having a typical value of 12.5 Bq/kg. The concentrations of both Cu beside Zn in water samples is smaller if compared with values that quoted by the WHO, the US-EPA, and the EC. It was also found that the average levels for both Cd and Mn are found to be close to the internationally recommended levels. The water and sediments in the southern part of the canal contain higher concentrations of heavy metals and radioactive isotopes than in the rest of the canal.

"Temporal Trends and Spatial Relationships of Radioactive Isotopes (I-131, Cs-134, and Cs-137) in Response to Nuclear Events: A Comprehensive Analysis Using Time Series Graphs, Regression, and Multivariate Techniques" was explored by B. Nasution, W. Ritonga and from R.C. Siagian from Physics Departemen, Universitas Negeri Medan, Medan, Indonesia under collaboration with A. Doyan from Master of Science Education, Postgraduate Program, University of Mataram, Indonesia, P. D. Pandara from Department of Physics, Sam Ratulangi University, Manado, Indonesia, and L. Alfaris from Department of Marine Technology, Politeknik Kelautan dan Perikanan Pangandaran, Pangandaran, Indonesia. This research aims to comprehend the evolution of radioactive isotopes Iodine-131 (I-131), Cesium-134 (Cs-134), and Cesium-137 (Cs-137) over time in diverse locations and analyze their relationships with the independent variables Longitude and Latitude using Linear Regression, Principal Component Analysis (PCA), and Canonical Correlation Analysis (CCA). The data used in this study were processed from the "DE.xlsx" file, including the imputation of missing values with 0 and column transformation into factors. The results of the Linear Regression analysis indicate a significant association between these isotopes and Longitude and Latitude. Additionally, PCA and CCA analyses reveal complex relationships between the isotopes and independent variables. This research provides valuable insights into the historical trends of radioactive isotopes Iodine-131 (I-131), Cesium-134 (Cs-134), and Cesium-137 (Cs-137) in various locations. The novel aspect and uniqueness of this study lie in the utilization of a comprehensive analytical approach, combining Linear Regression, PCA, and CCA to comprehend the relationships between isotopes and specific environmental factors. Moreover, this study significantly contributes to understanding the phenomena of radioactive isotopes and can serve as a foundation for further research in this field. The findings of this research are expected to support efforts in preventing and managing potential environmental and human health impacts of radioactive isotopes in the future.

On behalf of Atom Indonesia, I would like to thank you all for your contributions and endless support that have allowed Atom Indonesia to reach an outstanding performance over all the years. This outstanding achievement could not have been reached without great efforts and cooperation from the editors, reviewers, management personnel, authors, and readers.

Editor in Chief