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Editorial: Nuclear safety: Waste remediation, radiation protection and health assessment

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Editorial on the Research Topic
Nuclear safety: Waste remediation, radiation protection and health assessment

Radioactivity is a natural occurrence, and natural sources of radiation are environmental factors. Radiation and radioactive material can also be of artificial origin and have a wide range of useful applications, including medical, industrial, agricultural, and scientific applications, as well as nuclear power generation (Abojassim and Rasheed, 2021). Radiation dangers to persons and the environment from the use of radiation and radioactive materials must be assessed and managed through the implementation of safety standards (Martin et al., 2019). Ionizing radiation exposure of tissues or organs can cause cell death on a large enough scale to compromise the function of the exposed tissue or organ. This sort of consequence, known as 'deterministic effects,' is clinically evident in an individual only if the radiation dosage surpasses a particular threshold (Kamiya et al., 2015). A deterministic impact is more severe at a larger dosage over this threshold level (Mallya, 2019). As a result, all countries have adopted national radiation protection regulations and regulated safety standards. Justification, optimization, and dose limitation are the three main principles of radiation protection. Systematic rule implementation to check and ensure that the recommended safety guidelines of practice are strictly followed would aid and improve the safe practice of using ionizing radiations to generate optimum radiological images for correct diagnosis with lower doses for personnel, patients, and the general public (Fiagbedzi et al., 2022).

It is important to draw attention to technological developments in the field of radiation protection, such as the creation of environmentally friendly and reasonably priced materials for radiation shield construction (Eid et al., 2021; Saleh et al., 2021), the development of environmentally appropriate solutions for dealing with radioactive waste (Dawoud et al., 2023; Abdelhamid et al., 2023), and enhancing the characterizations of the materials utilized in immobilization of nuclear wastes (Saleh, 2014; Saleh et al., 2020a; Saleh et al., 2020b) or that used in packing of nuclear waste in order to achieve a human-safe and clean environment (Saleh and Koller, 2021).

Radiation dose, or the amount of energy conveyed per unit mass of an absorbing medium, can be evaluated or direct biological effects and compliance with radiation exposure limits can be monitored (Adlienė and Adlytė, 2017). Radiation safety professionals define radiation absorbed dose and dose rate for occupational, environmental, and medical exposures using carefully defined quantities and units (Adlienė and Adlytė, 2017). The effective dose assumes a recognized relationship between the physical quantities measured and the biological effect. Dosimetry is essential for radiation protection planning, biological effects assessment, and monitoring compliance with radiation exposure limits (Yonekura et al., 2019). *In vivo* experiments in animals and humans (e.g., individual follow-up after radiation exposure) have aided our understanding of radiation's effects on organisms (Lowe et al., 2022). Epidemiologic studies of human societies exposed to high doses of radiation, such as Japanese atomic bomb survivors and Chernobyl disaster responders, have offered pertinent data on the long-term consequences of exposure (Laine, 2022). One could investigate modifying the approach to performing a specific radiological procedure by examining effective dose for a specific patient population, such as adult women. Neither the equivalent nor effective dose should be used to estimate the risk of cancer in any specific organ or tissue (Harrison et al., 2016). Effective dose is not predictive of future cancer incidence in individuals or demographic groups because its theoretical and mathematical underpinnings are not depending on radiobiological correlations between dose and influence for individual organs or tissues (Kaiser et al., 2021). Fukushima and Chernobyl provide extremely uncommon chances to learn from the implementation of radiation safety instructions and techniques in difficult, real-world conditions. The linear no-threshold theory can be considered as the intellectual and practical framework for risk assessment and exposure management in the workplace and environment (Ulsh, 2018).

Therefore, this Research Topic entitled "Nuclear safety: Waste Remediation, Radiation Protection, and Health Assessment" It was proposed with the aim of bringing together relevant studies of radioactive contamination and exposure risks, together with innovative opinions on strategies for protection and reduction of radioactivity in exposure areas. In addition to providing assistance to decision-makers in finding quick and accurate solutions at the same time to prevent the exacerbation of the radioactive danger resulting from an occupational or medical accident or exposure. It also sheds light on the sustainable application of nuclear technology in agricultural and medicinal plants, which is considered one of the great challenges of modern economic technologies that provide high food productivity for human wellbeing.

Based on the foregoing, the subject of this issue consists of four research papers in which a group of researchers in different disciplines participated. Below is a brief summary of these papers: Low-activity hotspot investigation method *via* scanning using deep learning, in this work Bae et al. proposed the applicability of the *in situ* residual radioactive hotspot detection technology employing a continually moving detection system with a deep learning model trained on simulated count rate data. The approach used a picture created from scanning data and ANN-based deep learning. The ANN model was trained using the data generated by a Monte Carlo simulation.

Lu et al. demonstrate the neutron multiplicity of six various forms of weapons-grade plutonium samples is simulated using an optimized boron-coated straw tube neutron multiplicity counter in this work. The mass simulation results for samples of different shapes indicated varying degrees of negative deviations with increasing mass under the point model equation, and the deviations increased with increasing mass. The experiment conducted by Sayed et al. aims to boost the synthesis and quality of physiologically active secondary metabolites in order to minimize the usage of agrochemicals. As a result, they held a field trial throughout the 2018 and 2019 seasons. There were three types of treatments (gamma irradiation, nanoselenium, and chitosan) and three types of fertilizers (nitrogen (N), phosphorus (P), and potassium (K), moringa leaf extract, and humic acid). The experiment was carried out utilizing a very random block as a factor. Huang et al. suggested a deterministic diagnosis method for SDG faults based on information flow. This approach evaluates the goodness of fit of all causal pairings connected to compensation variables or inverse variables to the entire information flow curve and finds the sub-information flow curve with the highest. Furthermore, the primary loop subsystem of a nuclear reactor was tested in the simulation system PCTran AP1000, proving the practicality of this technology.

We hope that readers will find these papers interesting and beneficial in their innovative research in this field. The Editors of this research topic are like to express their appreciation to all of the authors for their significant contributions, as well as to the professional reviewers for their time, devotion, and valuable comments.

Author contributions

All authors contributed equally to the conception, drafting, and editing of this editorial manuscript, moreover, they contributed equally to guest editing the Research Topic.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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