radioactive materials or chemicals and exposure, which include x-ray machines, electron microscopes, particle accelerators, atomic energy plants, nuclear explosions or accidents. The risks of excess radiation exposure are not insignificant, potentially leading to a variety of health issues, from cataracts, damage of the DNA cells in the human body, acute radiation syndrome (ARS), radiation injuries, hair loss, birth defects, and the development of cancers [2]. For the reasons stated above, it is critical to strictly adhere to radiation protection and safety principles and measures such as ALARA (as low as reasonably achievable). This principle means that even if it is a small dose, if receiving that dose has no direct benefit, one should try to avoid it. To do this, you can use three basic protective measures in radiation safety: time, distance, and shielding [3,4]. However, there are other measures, namely; dispersal, source reduction, source barrier, personal barrier, decorporation, effect mitigation, optimal technology, and limitation of other exposures. The usage of personal protective equipment for a first responder or radiation worker could go a long way to minimize exposure; equipment such as respirators for inhalation; protective clothing from radioactive material off of skin and hair; alarming dosimeters for time; and tracking accumulated doses in an area with elevated radiation levels. If radioactive material gets on to skin, clothing, or hair, it is important to get it off as quickly as possible [5].

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SIMULATION OF NEUTRONICS DEPENDENCE OF SILICON CARBIDE COATING LAYER FOR SURFACE MODIFICATION OF ZIRCONIUM ALLOY CLADDING CONCEPTS

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Surface modified Zr-alloys are envisioned to replace and improve the robustness of current and future light water reactors (LWR) fuel cladding as part of the accident tolerant fuel (ATF) cladding concepts. Several potential cladding materials such as Cr, Mo, SiC, FeCrAl and many others have been coated on varieties of Zr-alloys and studied in many literatures. In this study, SiC micro- composite deposited on Zr-alloy (E110) were simulated under normal reactor operating conditions in order to assess its coating thickness dependence on key neutronic parameters such as the reactivity coefficient, K-effective value and atomic densities under the burnup conditions with Monte Carlo code, SuperMC. The simulation results show that external covering of Zr-1Nb alloy tubes fuel rods with SiC coatings between 0.05mm to 0.25 mm thick has negligible effects on the generation of neutrons. Also, the corresponding reactivity penalties measured are very small and proportional to the coating thickness, and the change in the atomic density of each isotope of the reaction product is almost negligible.

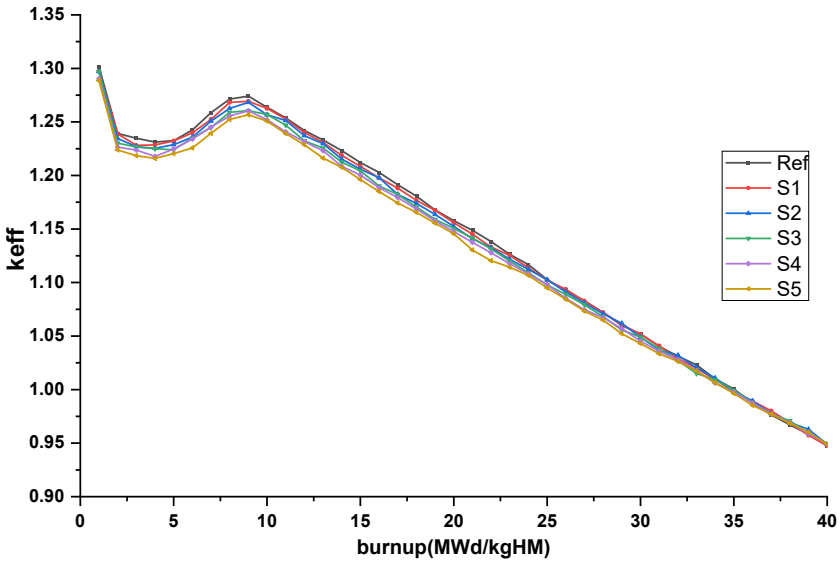

Fig. 1. Dependence of multiplication factor from fuel burnup

PHYSICAL PROTECTION SYSTEM EFFECTIVENESS EVALUATION MODELS: CHALLENGES

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Physical protection systems (PPS) are the combination of systems used to protect valuable facilities or entities from theft, sabotage or any malicious human activities. These valuable facilities may include nuclear power plants, airports, military installations, banks and other related facilities. These are facilities with high consequential effects on society if malicious activities were carried out successfully on them. Malicious activities, which may include sabotage, theft, terrorism, hostage-taking, the release of a harmful substance into the environment, and other illegal activities by human. The PPS has the primary functions of detection, delay and response to an attacking adversary. These functions are carefully design to meet some special needs of the facility and they are usually evaluated through analytical models for effectiveness after been designed. This work examined the challenges faced by the PPS elements from mostly non-analytical factors such as human reliability, national security culture, training and knowledge, and such as economy and ecology.

The work highlights different PPS evaluation models, then EASI model input parameters were used to explain these challenges as they relate to PPS effectiveness. The relationship between these factors and the PPS effectiveness were established to be in a mixed of direct or indirect proportions, this is mostly vivid in newcomer member societies. Solutions, recommendations and further insights were provided by the researchers.

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