Virtual dosimetry for physical security at nuclear installations

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The physical security of nuclear installations has been a constant concern of the International Atomic Energy Agency (IAEA). Through reports and norms defined in the periodic planning of nuclear security [1] the IAEA guides the nuclear sites more intensely and shows commitment on the control and security of its radioactive materials. To promote greater efficiency of the control systems of these materials, trainings of security teams at nuclear installations have been provided periodically. One way to help these trainings is to include new computer simulation tools based on immersive virtual environments [2]. In the nuclear area some works have already demonstrated that such tools can assist in the training in nuclear installations [2, 3]. Virtual environments allow for the qualification for operational procedures without the need to expose users to rates of ionizing radiation. Other works also show the contribution of virtual reality to the nuclear area, such as the CIPRES [4], developed for the IBERINCO (Iberdrola Ingenieria y Consultoria) and for the Polytechnic Universidad of Valence, which allows the training of operators of nuclear installations through simulations of operations of fuel recharge; The Vrdose [5] is a tool which is able to show the distribution of the dose tax and to supply the estimate of occupational dose scenarios of work in nuclear installations. The exposition of human beings to high doses of radiation causes damages to health due to the somatic and genetic effect produced by ionizing radiations [6]. This justifies the use of computational systems as training tools to calculate virtual expositions to ionizing radiation instead of real ones. A way to create virtual computational environments is by means of game engines - tools for the production of games, which have already proved to be able to promote great assistance in the development of simulation systems [7]. Therefore, in this context, this work presents a methodology based on nucleus of games to verify the measurements of virtual radiation. This allows portable radiation detectors to be implemented through the use of virtual simulation tools. According to the application suggested in this study, the detectors were tested and inserted in the procedures of physical security of a nuclear plant. Virtual detectors also allow for the measurement and the training of diverse operations in the nuclear area, such as the training of radioprotection teams.

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