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Study of the SEPOR BARITA RX as an alternative of radiological protection to Lead.

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Introduction

Lead, like lead sheet, is used as a radiation attenuator. It is a solution with serious environmental and economic impacts. Although it is a solution where the advantage is essentially based on the thickness required for the need for attenuation, its replacement by SEPOR BARITA is a consequence of the advantages of this product.

Barite is a mineral whose radiological properties are known. Although it is a mineral with a high density, difficult to apply, its incorporation in a mortar, in the appropriate proportions, results the SEPOR BARITA. A mortar with radiological protection properties, along with the workability and uniformity of a common mortar. In order to understand the correspondence between Radiation Sources Vs Attenuation Vs Application Thickness between Lead and SEPOR BARITA, an analysis / study was carried out at the Laboratory of Radiological Protection and Safety of Instituto Superior Tecnico, whose method, results and conclusions are presented.

Methods

The experimental geometry used to determine the attenuation properties of this material is described in IEC 61331-1: 1994, called "narrow beam geometry". The radiation qualities used for this study are those described in ISO 4037-1, N-80, N-100, N-120 and N-150. For the measurements, a PTW M23331 ionization chamber with 1 cm3 of sensitive volume connected to an electrometer PTW UNITED E was used. The applied measurement methodology consisted in the accomplishment of five initial measurements without plate of attenuation and next five measurements with each one of the plates made available for test. In addition, measurements of the ambient conditions were made in order to standardize the measurements to the standard ambient conditions, namely: 200C temperature, 1013.25 hPa pressure and 50% relative humidity.

From the experimental results, it was calculated the mass attenuation coefficient, μ/ρ, of this SEPOR BARITA material, and the equivalent lead thickness of this material, for each of the radiation qualities used, using the data from the The mass attenuation coefficient of lead published by the National Institution of Standards and Technology (NIST).

Results

From the obtained results, the attenuation ratios (I / I0) of the different thicknesses of the attenuating material were obtained. These results are shown in the following figures:

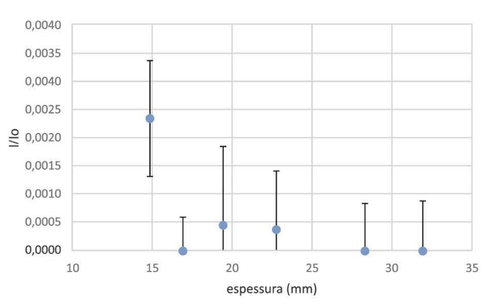

Figure 1: Results of the attenuation studies for the quality of N-80 radiation.

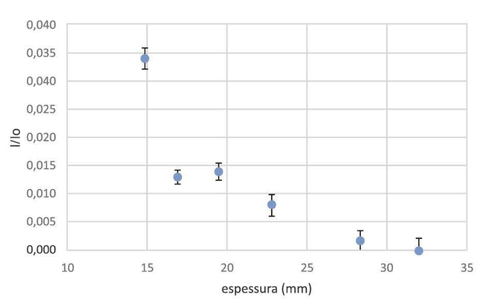

Figure 2: Results of the attenuation studies for the quality of N-100 radiation.

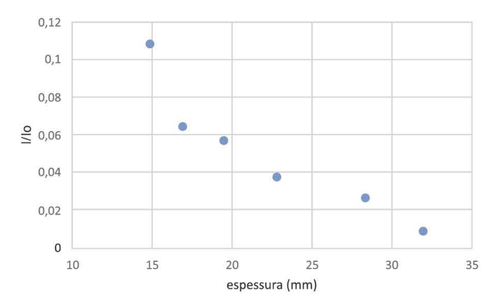

Figure 3: Results of the attenuation studies for the quality of N-120 radiation.

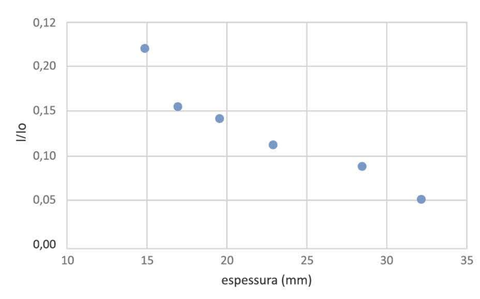

Figure 4: Results of attenuation studies for N-150 radiation quality.

Conclusions

According to the tests and results obtained, the SEPOR BARITA material is an excellent alternative to lead. In spite of the thickness required for the lead equivalent to be clearly superior - in lead we treat with mm and with this material with cm -, With a theoretical consumption of 21 kg/m2/cm, its easy application and the possibility of adjusting several thicknesses confers an optimal solution for radiological protection. For example: for a x-ray tube of 100 kVp, with a 17 mm application of SEPOR BARITA, it is possible to achieve the same protection of 2 mm of Lead sheet. Two great assets of the SEPOR BARITA are: economic solution more favorable than lead, comes to have a cost 5 times smaller, and greater durability.

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