NATURAL RADIACTIVITY FROM BUILDING MATERIALS IN SPAIN

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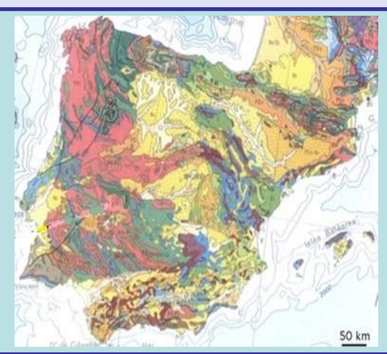
INTRODUCTION .The industrial construction sector is very important in **Spain**. Building materials used in this industry are sources of radiation from natural radionuclides they contain. The European Commission published some recommendations to facilitate the trade of these materials in the E.U. The studies about this subject have increased notably during last years. This, probably, can be associated with the increase interest from natural radiation radiological risk on indoor exposure.



All building materials have varying amounts of natural radionuclides. They belong to natural radionuclides of uranium (^{238}U) and thorium (^{232}Th) series, together with the radioactive isotope of potassium (^{40}K). The analyzed samples come from factories located in different parts of the Iberian Peninsula and the Canary Islands. This survey involved 18 cement plants, 40 tile factories, and several gravel quarries of limestone, siliceous and granitic nature.

MATERIAL AND METHODS

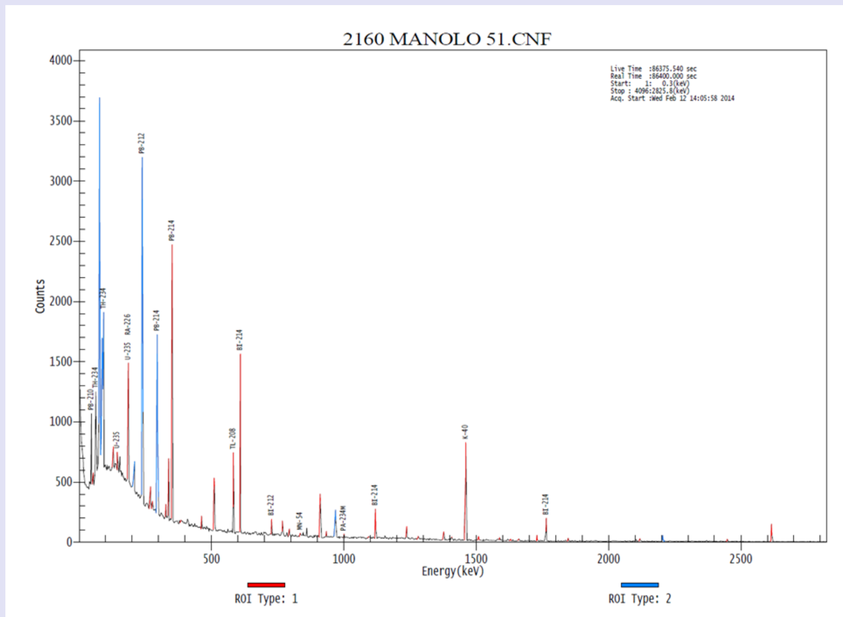
The samples were supplied by manufacturers of Spain, have been classified and have been made a physic-chemical characterization of the samples received. The chemical composition of the samples of cement, brick, ceramic and roofing tile has been made using ICP-MS and XRPD. The concentration of the natural radioactivity in the selected cements and ceramics were conducted with a coaxial ReGe detector. The energy an absolute efficiency calibration of the spectrometer was made using a sample certificated by IAEA-312 and IAEA-385. We have used Genie-2000, v.2.0 software to analyze the gamma spectrums.

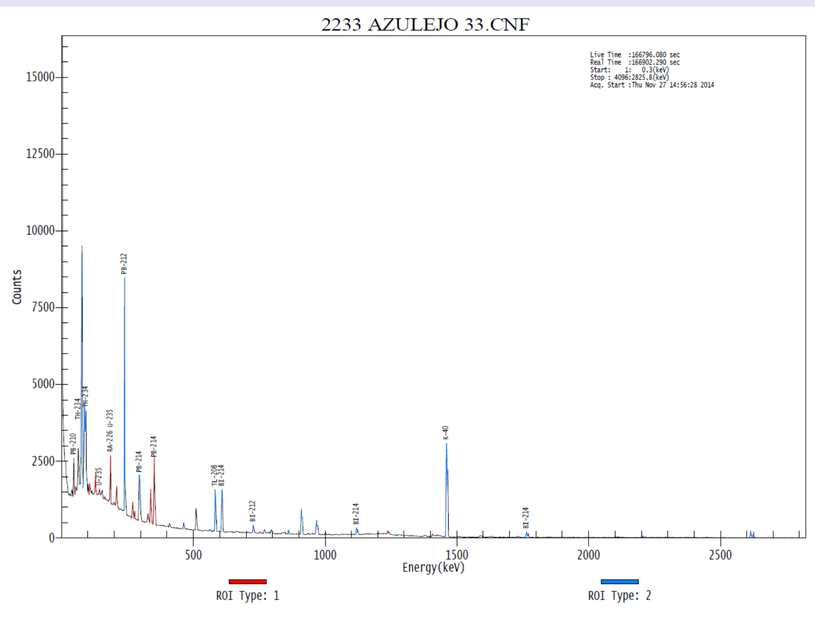
The activity concentration index (I) is derived for identifying whether a dose criterion is according to the radiological protection principles concerning the natural radioactivity of buildings materials

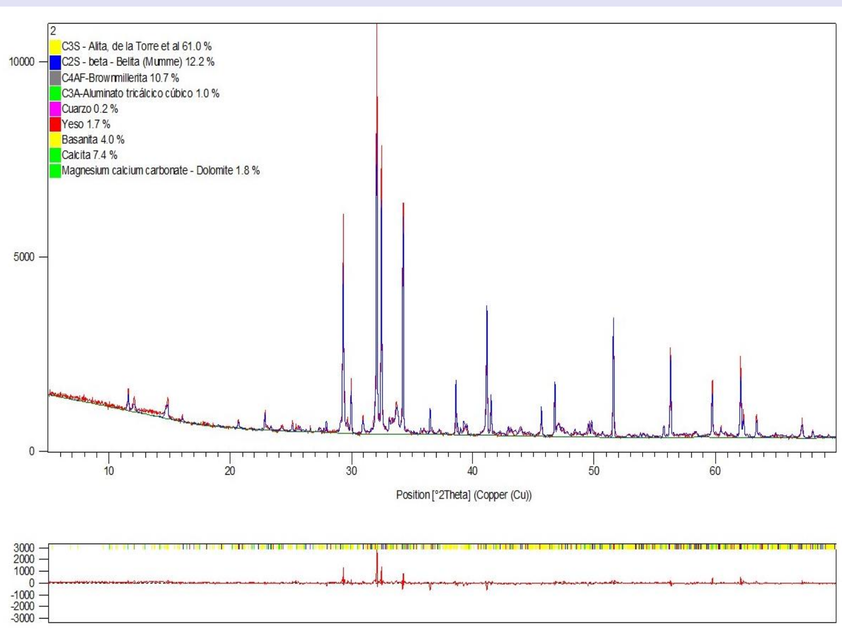
$$I = \frac{C_{Ra}}{300 Bq.kg^{-1}} + \frac{C_{Th}}{200 Bq.kg^{-1}} + \frac{C_{K}}{3000 Bq.kg^{-1}}$$

RESULTS

We have measured a total of 54 samples of cement, 32 of ceramics and 15 of bricks and roof tiles. All the samples are subjected even spraying process, drying at 100 ºC and sieved. These are placed in a cylinder of polyethylene for containers sealed to analyze. The samples were stored for the time necessary to help achieve the balance between the daughters of the Ra- 226. The Ra -226 activity was determined by quantifying the activity from Bi-214 peak (1764.5 keV) and Pb-214. The activity of the Th -232 is obtained from the measurement of Tl -208 peak (2614.5 keV). ^{40}K was measured directly, from the emission line of 1460.8 keV. The analysis of the samples by ICP-MS informs us of the presence uniform chemical elements 80 being significant average concentrations for Ca, Si, Fe, Al and K. The next figures are the gamma spectroscopy from cement and ceramic tile. Also the X-ray diffractogram which has enabled us to identify and determine the % of each of the phases present in the sample is attached.







N	Sample	Ra-226 (Bq/Kg)	Th-232 (Bq/Kg)	K-40 (Bq/Kg)	I index
54	Cement	38,5	8,7	291,3	0,27
15	Brick	93,3	18,7	728,9	0,65
32	Tile (ceramic)	94,7	15,3	808,9	0,66

CONCLUSION

The results of this study clearly show that the concentration activities from samples from different locations are mostly low and below the proposed reference level of European Commission Report 112 and the Council Directive 2013/59 / Euratom.

However there are specific natural stone as building material with radiological heterogeneities that must be studied.

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