

## **RADON RELEASE: DETECTION PROBLEMS AND ASSESSMENT OF RISK FACTORS**

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The indoor radon exposition is internationally known as a health hazard. For this reason, many countries have introduced specific laws and regulations and radon-risk maps have been produced. In Italy the radon exposure legislation regards only workplaces (D. Lgs. n. 241/00, 2000) and only one National Survey in the 90's has been conducted by APAT, ISS and ARPA regional agencies (Bochicchio *et al.*, 2005). This survey assessed the exposure to indoor radon concentration in national dwellings on large scale. In absence of guidelines, only few Italian Regions have prepared a surveying protocol using independent standards in order to identify "radon prone areas", inducing bigger uncertainty on the definition of a national risk map. In the present work a standardized methodology for indoor radon measurements has been set up in collaboration with ENEA and U-Series Srl (Bologna), with attention to the development of a passive measurement technique (solid state nuclear track detectors). The developed technique has been validated through an interlaboratory comparison conducted by the German Federal Office for Radiation Protection (BfS).

An indoor radon monitoring survey has been conducted in all Italian Regions with the developed methodology and 5425 measurements have been elaborated, also to verify the relapse of seasonal fluctuations on radon concentrations. A new map of annual average radon concentration for each Italian Region has been produced and, as a consequence of our developed methodology (measurements only in underground rooms), indoor radon concentrations resulted generally higher than the concentrations obtained in the National Survey.

The project of a radon chamber for the evaluation of radon emanation from geomaterials has been followed and the chamber was built at U-Series Srl laboratory.

Data from a wide sampling (Lombardia, with the case studies of Milano Province and Milano city, Emilia Romagna, Toscana, Puglia) of radon indoor monitoring have been elaborated and georeferenced, using geo-statistical technique, to produce a map of annual average radon concentration. Applying the international approach (Dubois *et al.*, 2007; Zhu *et al.*, 2001) recently introduced, the maps have been integrated with geological knowledge of highest concentration macro-areas identified in order to better determine them. This study allowed to point out not negligible radon concentrations also in traditionally no-risk zone, for example the North plain zone of Milan Province and the city of Milan; so some hypothesis have been formulated to understand the geological origin of the radon source in these sites.

Indoor radon concentrations were measured hourly with a continuous radon monitor for two case studies; the analyzed data showed the influence of ventilation control on radon concentration variability.

The application of the developed methodology will be useful to give advices to fill legislation gaps or to draft urban development plans.

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