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Analysis of the natural radon progeny concentrations in the automatic Spanish surveillance network for the period 2000 to 2002

D. Arnold, A. Vargas and X. Ortega

Institute of Energy Technologies, Technical University of Catalonia, Barcelona, Spain
(delia.arnold@upc.edu / Fax: +34934017149 / Phone: +34934011709)

The Spanish Nuclear Safety Council (CSN) is responsible for the radiological surveillance in Spain together with regional governments (i.e, SCAR in the Catalan autonomous community). The CSN together with the National Meteorology Institute (INM) are responsible for the sparse automatic stations network (REA) which consists of 24 radiometeorological stations all over Spain and another station in Penhas Douradas (Portugal) within the REVIRA (Red de VIgilancia Radiologica Ambiental) program. This continuous radioactive pollutant monitoring network provides atmospheric radiological surveillance in real time, including gamma dose rate, arti?cial alpha and beta air concentration, radioactive iodine air concentration, radon progeny concentration and also meteorological parameters.

A representative period, from 2000 to 2002, of the REA historic dataset, has been analysed and a statistical study has been done to characterise each REA site according to measured values. First of all, the 3-year average behaviour was studied. Local variability of radon progeny concentration is mainly due to different radon exhalation rates of the station surroundings according to its geological composition and the influence of radon-poor air coming from the sea. This can be noticed in the directionality appeared in polar plots that relate radon progeny concentration, wind direction and wind velocity. It is important to point out that the significant effect of the surroundings may vary depending on the meteorological situation. For instance, in a stagnation period one site is only affected by nearby sources while in strong advective situation radon,

which was exhaled several hundreds of kilometers far from the station, could be detected. The characterisation of each site has also been done on a daily and seasonally basis. The typical diurnal cycle of radon progeny concentration with a maximum in the early morning hours and a minimum in the afternoon is clearly shown. This temporal evolution is determined by the evolution of the PBL along the day, with a shallow nocturnal layer trapping radon and radon progeny during night giving high concentration values, and a well developed mixing layer during the day, allowing radon and radon progeny to dilute within all the volume of this deep layer. However an inverse behaviour in a station located on a mountain ridge has been observed. This different behaviour has been found also for other types of pollutants, and it can be due to the upslope and downslope winds typical of mountain-valley systems and also to the more or less strong inversion which tends to form in valleys. If such inversion conditions persist, low concentrations on the mountains and high ones in the valleys may continue for days.