Radiation and Health Physics

Research Project: "A Study of Radon, Thoron and their progeny in Kashmir Valley"

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INTRODUCTION OF THE PRESENT WORK

In view of the fact that radon, thoron and their progeny concentrations contribute the most to the natural radiation dose to general populations, large scale and long-term measurement of radon, thoron and their progeny concentrations has been receiving considerable attention (Mayya *et al.,* 1998). Radon and thoron present in outdoor and indoor air as they exhaled from soil and building materials. It is critically important that inhalation of radon and their progeny concentrations has been shown experimentally to cause lung cancer in rats and observed to cause lung cancer in men exposed to large amounts in the air of mines. Even though measurement of radon, thoron and their progeny concentrations was done over the past 50 years in many countries, with the improvement of experimental apparatus and technical formulation, the same is going on till today. With these improvements, monitoring of radon, thoron and their progeny concentrations are well correlated with the prediction of earthquakes (Ramachandran *et al.,* 2004). Fault region also plays vital role in the out gassing process of radon and thoron from soil. The measurement of radon, thoron and their progeny concentrations also leads to the knowledge of the presence of radioactive elements, which are the sources of these elements. Since Uranium-238 is the parent nuclei of Radon and Thorium-232 that of Thoron, hence with the concentrations of these gases in air, one can predict the presence of high or low concentrations of the source radioactive elements.

In India, measurements of these concentrations have been done for the past many years which were undertaken by Environment Assessment Division (EAD), Bhabha Atomic Research Center (BARC), Mumbai (Ramachandran *et al.,* 2003). With these results conditions of some places, mines, etc. can be studied well. In North-East India, in spite

of its geological and seismic characteristics the radon data remained almost unrepresented (Dwivedi and Ghosh, 1991).
Radon is a natural radioactive gas that occurs ubiquitously throughout the world. Radon having an atomic number of 86, is a colourless, odourless, tasteless and radioactive noble gas that generally lacks activity towards other chemical agents. It is the heaviest member of the rare gas group (~100 times heavier than hydrogen and ~7.5 times heavier than air) and has a half-life of 3.82 days. It is denoted by 222Rn. Thoron is an isotope of radon, it has atomic number 86, mass number 220 and half life of 55.3 seconds (Pillai and Paul, 1999). It is denoted by 220Rn. The main characteristic of 222Rn and 220Rn among other natural radioactive elements is the fact that their behaviour is not affected by chemical processes (Nazarof, 1988). In addition, their concentration levels depend strongly on geological and geophysical conditions, as well as on atmospheric influences such as barometric pressure and rainfall. Formed as a result of the natural radioactive series in the earth's crust they are free to move through soil pores and rock fractures; then to escape into the atmosphere. 222Rn and/or 220Rn exhaled from the earth's surface into the free atmosphere is rapidly dispersed and diluted by natural convection and turbulence. When a dwelling is present, they may migrate into this structure and accumulate indoors in sufficient quantities to pose a health hazard.

Radon and thoron decay with the emission of alpha particles and produce daughter nuclei – polonium, lead and bismuth. These daughter nuclei emit alpha or beta particles.

Among these daughter nuclei, 218-Po and 214-Po from 222-Rn and 216-Po and 212-Po from 220-Rn have short half-life, and these are the progenies which are under consideration.

The present work tries to explore the concentration of radon, thoron and their progeny in **Kashmir Valley** with special reference to **Srinagar, Bud gam** and **Ganderbal Districts** which will be the first ever such study in the Valley. In this experimental work, indoor concentrations are measured using solid state nuclear track detector (SSNTD). The activities of the source radioactive elements viz., uranium and thorium for the considered gases in soil are measured using NaI (Tl) detector in which soil samples are collected and analysed. This will be used to understand the deposition of the mentioned radioactive elements in Kashmir Valley and can be well correlated with the concentrations of radon and that of thoron in dwellings. Measurement of radon and thoron concentrations will be carried out using twin cup dosimeters inside which a detector, LR-115 films are mounted. In these films nuclear tracks will be formed due to alpha particles decay from the measured radioactive gases which will then be analysed. The progeny concentrations of these gases will be measured using direct progeny sensor (DPS) mounted along with the twin cup dosimeters.