Cancer risk due to exposure to high levels of natural radon in the inhabitants of Ramsar, Iran

S.M.J. Mortazavi\textsuperscript{a,*}, M. Ghiassi-Nejad\textsuperscript{b}, M. Rezaiean\textsuperscript{c}

\textsuperscript{a}Medical Physics Department, School of Medicine, Rafsanjan University of Medical Sciences (RUMS), Rafsanjan, Iran
\textsuperscript{b}National Radiation Protection Department (NRPD), Iranian Nuclear Regulatory Authority (INRA), P.O. Box 14155-4494, Tehran, Iran
\textsuperscript{c}Social Medicine Department, School of Medicine, Rafsanjan University of Medical Sciences (RUMS), Rafsanjan, Iran

\textbf{Abstract.} Inhabitants of Ramsar, a city in northern Iran, are exposed to levels of natural radiation as high as 55–200 times higher than the average global dose rate. Furthermore, radon levels in some regions of Ramsar are up to 3700 Bq m\textsuperscript{-3}. To assess the association between the radon concentration and frequency of lung cancer, lung cancer patients recorded over the past 2 years in eight districts of Ramsar with different levels of radon were studied. Data from the Ramsar Health Network show that both crude lung cancer rate and adjusted lung cancer rate in one district with the highest recorded levels of external radiation and radon concentration are lower than those of the other seven districts. It can be concluded that lung cancer rate may show a negative correlation with natural radon concentration. © 2004 Elsevier B.V. All rights reserved.

\textit{Keywords:} Radon; Lung cancer; Ramsar

\section{1. Introduction}

Radon has long been known to be among the main causes of lung cancer. Ramsar in Iran is famous for its high natural radiation areas and maximum radon levels in some regions of Ramsar are up to 3700 Bq m\textsuperscript{-3}. Note here that US EPA recommends some remedial actions for the houses with their indoor radon levels 200 Bq m\textsuperscript{-3} or higher. In the
present study, we conducted preliminary analysis of lung cancer risk among Ramsar residents.

2. Radon and lung cancer in Ramsar

Ramsar is divided into eight health districts (Fig. 1, Panel A) and a health center provides primary health services in each health district. Indoor radon concentration levels were previously measured in each dwelling by the Iranian Nuclear Regulatory Authority experts. A wide variety in the radon levels was observed and that is mainly due to the geological variation of the area [1,2]. The overall cancer mortality, lung cancer mortality and neonatal death rate of different districts in the years from 2000 to 2001 were collected. The radon prone areas were located in a district named Ramak. Therefore, the risk of radon-induced lung cancer was expected to be higher in this district compared to other seven districts. Our study showed that the highest lung cancer mortality rate was in Galesh Mahaleeh, where the radon levels were normal. Interestingly, the lowest lung cancer mortality rate was in Ramak, where the highest concentrations of radon in the dwellings were found (Fig. 1, Panel B).

3. Concluding remarks

In this study, we could not find any positive correlation between indoor radon levels and lung cancer rate in the inhabitants who lived in the dwellings with high levels of radon for many generations. Clearly, more research is needed to determine if life-long exposure to high levels of indoor radon leads to an increased risk for the development of cancer.

References