Environmental Radon Levels and its Exposure to the Public in China

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Environmental Radon Levels and its Exposure to the Public in China

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Abstract:

Latest reports on radon levels and its exposure to the public in China were reviewed. Some problems, such the increase of indoor radon levels accompanying the change of building materials which was caused by the social development and high exposure to thoron progeny in some special areas were indicated and discussed. An outline of the situation on environmental natural radiation was described as well.

Key words: environment, natural radiation, radon, thoron, exposure

Naturally occurring background radiation is a topic that has evoked curiosity and concern of the scientist and layman alike in recent years due to the shift in focus of health effects, from acute high level exposure of radiation to chronic low level exposure. In China, several local and nation wide investigations on natural radiation were carried out for a better understanding of environmental safety and utilizations in the past decades.

For natural radionuclide contents in soil in China, a fargoing investigation which covered 80% country area and 29 provinces was carried out in 1983-1990[(1)]. Totally 13866 soil samples were collected and analyzed. The results of ^{226}Ra and ^{232}Th, the mother radionuclides of ^{222}Rn and ^{220}Rn, are 36.5 $Bqkg^{-1}$ and 49.1 $Bqkg^{-1}$, respectively, higher than the world average. Furthermore, the geographical distribution of the natural radionuclide content in soil appears apparently regional. For ^{238}U, ^{226}Ra and ^{232}Th, their contents in the south part of China are higher than that in the north part. As an example, **Figure1** shows the provinces or regions average ^{232}Th soil contents which are higher than 50 $Bqkg^{-1}$. The rather high ^{232}Th soil contents in the south part of China hints a potential of high thoron exposure, especially in the dwellings which building materials are mud and the brick made of local soil enriched of ^{232}Th. There are also a special dwelling structure named cave dwellings in the areas of North West China, its poor ventilation conditions and rather high thoron exhalation rates of indoor building surface would made a high radiation exposure to the public contributed from both thoron and its decay products concentrations.

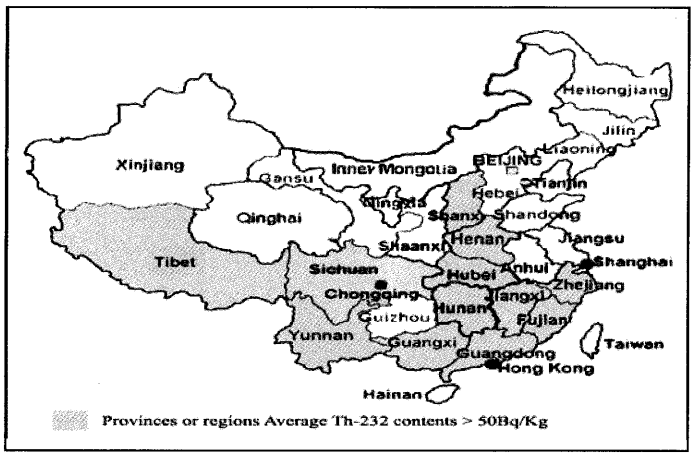

Figure1 The geographical distribution of ^{232}Th contents in soil in China

There has been a worldwide concern about the health risk from the exposure to radon because

the inhalation of radon accounts on average for about one-half of all natural sources of radiation. Nationwide survey on radon levels were carried out not only in China but also in other Asia countries, such South Korea and Japan.

Three largest surveys performed in China until now were reviewed and main results concerning indoor radon levels were showed in Table 1. There are several problems that should be discussed. The first one is the increase of indoor radon levels during last decade and its considerable factors. It is shown that the lasted result was much higher than the results before. However it is quite complicated to make the reason of the increase clear. First it is hard to compare the results simplifying; since the methods of the previous two times were grab air sampling, while the lasted one was passive cup monitors using CR-39 solid track detectors, and the integrating period was 3 months. Whereas the increase is convinced there are at least two considerable impact factor should be analyzed; one is the change of living standard going with the development during the last decade; here especially the popularization of the use of air conditioner in cities, that is sure will cause the increase of indoor radon levels by the poor ventilation. The change of building materials is another important factor that should be researched in detail in the future. More and more cinder is used as a component of bricks, concrete and cements which will make the increase of radionuclide contents in building materials. Further more, the increase of the porosity of building materials can also cause the high flux of radon. At the same time, more and more people is going to live in high buildings in all over China, and indoor radon concentration in high building is lower compared with flat dwellings in general.

The second problem discusses here is high thoron exposure in Asia countries. There is a traditional style of dwellings which made of wood and mud in both Japan and Korea, and a higher concentration of thoron and its decay products were reported. The reason may be the differences of building materials and structure compared with modern style of dwellings or apartment. In China the problem is reported more serious in some areas with high ^{232}Th soil contents and in cave dwellings. The indoor average EEC of thoron were reported to be 0.8 and 0.9 Bqm^{-3} of China and Korea, which are 3 times higher than the world average.

Table 1 Results of national survey on indoor radon concentrations (Bqm^{-3})

Period	Dwelling Number	Arithmetic mean	Range
China 1983-1990[1]	6708	24	1.2-365
1984-1990[2]	10,811	22.5	LLD-386.8
2002-2005[3]	3098(26 cities)	43.8±37.7	15.9-83.3
Korea[4] 1999-2004	3575	53.4±57.5	
Japan[5] 1992-1996	899	15.5	LLD-208
World average[6]		40	

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