Relationship among cancer, indoor radon and geology from Gejiu area*

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Abstract The mortality of lung cancer in Gejiu has reached the peak in the world. The indoor radon levels in Gejiu are measured by SSNTD. The results indicate that a higher indoor radon level widely exists in Gejiu area; the radon level in houses situated in geologic fault zone is 6 times as high as 2 km from fault zone; the radon level in soil in faults is 6~8 times as high as 1 km from faults; the radon level of the cancer patients' houses is 1.45 times as high as healths'. The relationship between indoor radon level and incidence of lung cancer is given for the first time.

Keywords Cancer, Indoor radon, Fault zone, Gejiu, Soil

1 Introduction

Lubin J H *et al* have proved that the lung cancer may be brought about by higher dose of radon.[1] The knowledge about the risk of cancer from indoor radon is only an inference of positive linear relationship, there are not yet direct evidences in lower level of indoor radon.

In the last two years, it has been proved that there is a high mortality of lung cancer in resident (excluding miners) in Gejiu and it occupies the first place in the world. We made an investigation on only peasants' houses and office workers', but miners'.

2 Method

All measurements were performed with solid state nuclear track detector (SSNTD).[3] The CR-39 of SSNTD is made in China and U.K. SSNTDs were treated with 6.25 mol/L alkaline at 70°C for 8 h, then observed and counted with the biological microscope made in Germany. The count must be reached about 3000 in order to reduce the statistical error to 0.02.

3 Distribution of radon

From July 1990 to present we have worked in a region of about 4000 km^2 in Gejiu area. Hundreds of SSNTDs were used and the levels of radon in soil and the indoor were determined (see Table 1)

Table 1 Indoor radon levels in various houses

District	Number of houses	Indoor radon/Bq·m^{-3}	Geology
City	88	471.9	limestone, near fault zone
Mine	14	480.4	limestone and granite ground
Shuitou	14	127.0	limestone, far from fault
Toudaoshui	16	829.1	limestone, right on fault

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One knows for certain that the rise in indoor radon level comes from the radon in soil.[2] Fig.1 shows that the farther the points measured from fault are, the lower radon level is.

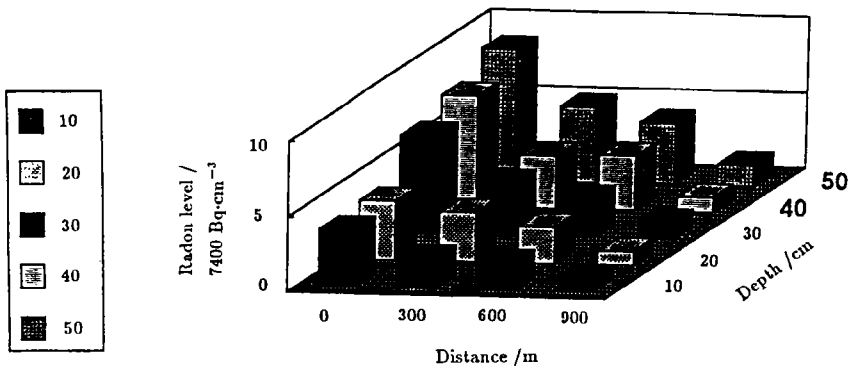

Fig.1 Relationship between the radon level in soil and the distance from a fault

4 Relationship between cancer and indoor radon

From July 1995 to April 1996 we had measured indoor radon levels of 143 resident houses in Gejiu area (see Fig.2). The residents include 60 cancer ones (major lung cancer, a few leukaemia, liver cancer). The average radon level of cancer patients is 332.13 $Bq \cdot m^{-3}$, but health's is 229.78 $Bq \cdot m^{-3}$. The cancer patients' indoor radon level is nearly 0.5 times higher than the health residents' (see Table 2).

Table 2 Contrast of indoor radon level in Gejiu area between 60 cancer patients and 83 health residents

Indoor radon level of cancer patients						Indoor radon level of health residents							
No	$Bq \cdot m^{-3}$	No	$Bq \cdot m^{-3}$	No	$Bq \cdot m^{-3}$	No	$Bq \cdot m^{-3}$	No	$Bq \cdot m^{-3}$	No	$Bq \cdot m^{-3}$	No	$Bq \cdot m^{-3}$
1	832	24	301	47	306	1	669	24	221	47	238	70	237
2	409	25	982	48	162	2	310	25	213	48	244	71	337
3	167	26	202	49	241	3	210	26	147	49	289	72	187
4	169	27	561	50	230	4	102	27	258	50	233	73	282
5	159	28	291	51	284	5	277	28	503	51	265	74	131
6	288	29	229	52	246	6	422	29	72	52	67	75	253
7	470	30	266	53	195	7	172	30	279	53	418	76	218
8	1146	31	357	54	233	8	220	31	179	54	350	77	299
9	187	32	320	55	207	9	201	32	253	55	295	78	416
10	387	33	411	56	309	10	138	33	153	56	109	79	224
11	259	34	267	57	277	11	243	34	169	57	144	80	374
12	562	35	398	58	278	12	246	35	417	58	248	81	221
13	263	36	366	59	204	13	184	36	410	59	384	82	313
14	262	37	427	60	222	14	121	37	200	60	242	83	689
15	487	38	444			15	187	38	15	61	82	–	–
16	324	39	246	–	–	16	177	39	149	62	369	–	–
17	247	40	518	–	–	17	167	40	310	63	236	–	–
18	306	41	270	–	–	18	460	41	251	64	258	–	–
19	332	42	232	–	–	19	140	42	314	65	186	–	–
20	321	43	246	–	–	20	166	43	181	66	256	–	–
21	247	44	294	–	–	21	199	44	307	67	496	–	–
22	277	45	185	–	–	22	374	45	216	68	190	–	–
23	351	46	269	–	–	23	159	46	556	69	232	–	–

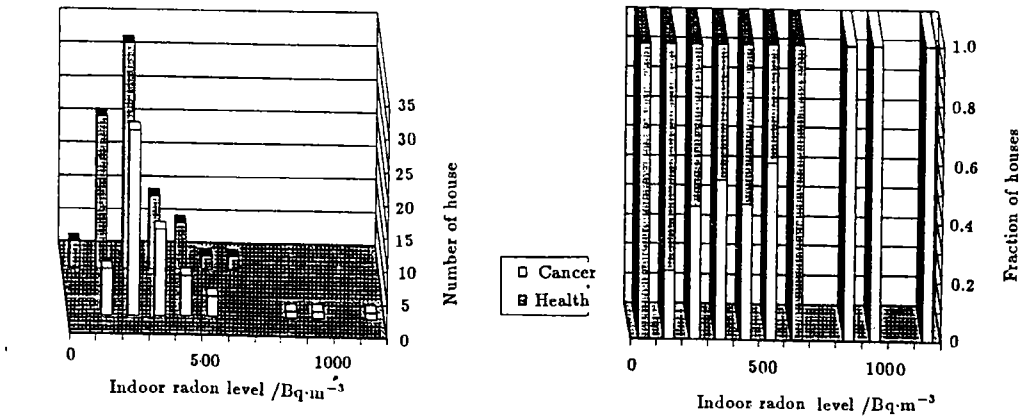

Fig.2 Distribution of indoor radon for the residents in Gejiu area

5 Conclusion

From July 1990~ April 1996, we had measured radon levels in rocks, soil, water and indoor radon level in Gejiu area by SSNTDs and made epidemiology survey. Our results show that geologic fault plays a more important role in determining the indoor radon level, compared with the concentration of uranium and thorium in rocks; for the indoor radon level less than 100 $Bq \cdot m^{-3}$ the cancer mortality is zero, but 0.23 for 100 to 200 $Bq \cdot m^{-3}$, and 0.45 for 200 to 300 $Bq \cdot m^{-3}$. So we may propose that indoor radon level should be lower than 200 $Bq \cdot m^{-3}$ in order to prevent residents from cancer risk.

References

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