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(ACE 46/94)
for information

Radon in Hong Kong Buildings

1. Introduction

1.1 Radon, which is a colourless, odourless and radioactive gas, is a naturally occurring decay product of radium. It is present in most soil and rock, particularly granite, and decays into a series of short-lived radioisotopes that take the form of very tiny particles. Overseas epidemiological studies have shown that the exposure to radon and its decay products increases the incidence of lung cancers. Some research also suggests an association with leukaemia.

1.2 Hong Kong has a potential for elevated radon levels because more than a third of the territory area is granite, and granitic materials are widely used in concrete in buildings.

1.3 After preliminary studies indicated that some Hong Kong buildings had elevated radon levels, a comprehensive territory-wide survey was carried out during 1993 to characterise and illustrate the nature and extent of the radon problem. This paper describes the main findings of this survey and discusses the way forward.

2. The Territory-Wide Survey and Results

2.1 In the survey, measurements were made with alpha-track detectors. A total of 1,100 such devices were representatively deployed in premises all over Hong Kong, and 829 valid samples were recovered.

2.2 The overall average radon concentration for all premises covered in the survey was 98 becquerels per cubic metre (Bq/m^3) with residential premises averaging $86 \text{ Bq}/\text{m}^3$. More details on average concentrations found in other types of premises are given in Annex 1. The Environmental Protection Department has made a preliminary estimate of the associated risk and found that exposure to such levels may account for about 13% of total lung cancer deaths. It was also noted that, as shown in the figures in Annex 2, about 5% residential and 10% non-residential were found to exceed $200 \text{ Bq}/\text{m}^3$, which is the guideline level recommended by the World Health Organization and the International Commission on Radiological Protection for triggering off improvement measures to be put in place. This compares with corresponding figures for residential premises of 0.4% for UK, 0.7% for Germany, 10% for Sweden, 4% for USA and 3% for Canada.

3. Factors Affecting the Radon Levels

3.1 The main findings from the survey on contributing factors affecting the radon level in Hong Kong buildings are as follows:-

- (a) Granite as a building material is the main cause of elevated radon level in buildings in Hong Kong.
- (b) Except for premises at basement and ground floors, the floor level of a premises does not affect radon levels significantly. The radon comes mainly from the granite in the concrete used in buildings.
- (c) The ventilation rate of a building is an important factor affecting radon levels. Premises with fully opened windows were found to have radon levels about 30% less than those with closed or very seldom opened windows. Radon levels in air conditioned premises are found to be higher since a high proportion of the air is re-circulated resulting in radon accumulation.
- (d) Wall and floor covering materials exhibit a significant effect by inhibiting the passage of radon into the premises. Whilst normal emulsified paint only has a marginal effect, wall covering materials such as wall paper and glazed ceramics are capable of reducing radon levels by 25% to 50%. Plastic or mosaic floor tiles achieve reductions of about 15 to 25%.
- (e) Newer buildings generally have higher radon levels than old ones. This is probably due to the more air tight windows and design of recent buildings.

3.2 It is generally true that radon levels in Hong Kong buildings can be reduced significantly by simple measures such as opening windows more often or improving the ventilation rate. As an example of this, it was found that the adoption of a range of mitigation measures in some 20 premises which previously exceeded the 200 Bq/m³ level, brought them all down to well below this level.

4. Proposed Way Forward

4.1 The following actions are important for addressing the radon situation in Hong Kong:

(a) Setting a radon guideline for Hong Kong

Many advanced countries have taken account of the technical feasibility of reducing radon concentration as well as current radon levels in buildings, and adopted indoor radon guidelines ranging from 100 to 400 Bq/m³ above which levels control measures are expected to be taken to reduce the radon concentration. The World Health Organization and the International Commission on Radiological Protection have recommended a maximum level of 200 Bq/m³ and this is considered to be appropriate and practicable to be adopted as a guideline for Hong Kong.

(b) Provision of information on radon risk and mitigation measures

It is considered appropriate to inform the public of the potential risks and provide advice on simple mitigation measures in the form of an information leaflet (a sample of which is attached at Annex 3). Architects, building engineers and developers should also be advised to design and construct buildings to provide low radon exposure potential.

(c) Establishment of a regular survey programme

A programme should be established to strengthen and regularly update the database on the radon level in the territory. Such a programme should also identify high risk premises and ensure that specific mitigation measures are taken.

The EPD will also recommend the commissioning of studies to identify and evaluate the effectiveness of mitigation measures for those categories of premises with greater susceptibility to higher radon levels if this proves necessary.

5. For Information

Members are invited to take note of the findings of the radon survey and the proposed actions to minimise the exposure of the public to radon.

Air Services Group
Environmental Protection Department
September 1994