

INDOOR EXPOSURE IN THE COUNTRIES OF THE EUROPEAN COMMUNITIES

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I. INTRODUCTION

In the 1980 European Community Council Directive (1) laying down the basic radiation protection safety standards it is explicitly stated that the dose limits contained therein do not apply to exposure resulting from natural background radiation, defined as: "all ionizing radiation from natural terrestrial and cosmic sources, to the extent that the exposure which it causes is not significantly increased by man". By implication, therefore, the dose limits do apply to any exposure to sources of terrestrial and cosmic origin which is "significantly" higher as a result of human action but the word "significantly" is not defined.

In the case of radon in houses it may be reasonably argued that the dose limits should indeed apply to doses arising from soil radon which enters the air space of houses, in that the human activity of building a house irrevocably alters the radon concentration gradient from the soil, both spatially and temporally. Prior to the construction exposure to radon diffusing from a particular piece of land may be insignificant due to atmospheric dilution but, trapped in house air as a consequence of building, it may give rise to significantly enhanced exposure. In the case of radon from building materials a similar line of argument may be developed. It is therefore reasonable, to propose some form of dose limitation for radon in houses, whether from building materials or the soil.

In many E.C. Member States there is in fact increasing awareness of the significance of indoor exposure of the population to radon and its daughters. Several countries already have or are drawing up dose control policies. Action at E.C. level to establish such policies on a Community-wide basis is, therefore, urgently required to avoid a diversity of limits in the different Member States creating confusion leading to a negative psychological impact on the population as regards hazards from ionising radiation in general and giving rise to distortion of trade in construction materials between Member States. These reasons prompted the E.C. Commission to initiate a series of actions in both the regulatory and research fields.

II. ACTIONS IN THE REGULATORY FIELD

The Commission asked the Group of Experts, set up under the terms of Article 31 of the Euratom Treaty to advise on radiological protection matters, to review the problems of indoor exposure and in particular:

- to make an inventory of surveys of exposure of the public from natural radiation in dwellings that have been completed or are being carried out in E.C. Member States,
- to review the recommendations of international radiation protection organisations to limit natural radiation exposure,
- to carry out a survey of activities in different countries for limiting exposure in dwellings.

An ad hoc Working Party, established by the Article 31 Group of Experts with the above terms of reference, produced a report which was subsequently adopted by the Group and published in 1987 (2). Apart from considering all of the above, the report extends technological countermeasures dosimetry risk assessment and surveys conducted outside the Community.

E.C. SURVEY RESULTS

In recent years an impressive number of national and regional surveys of exposure from natural radiation have been carried out in the E.C. Member States with particular regard to indoor exposure and especially that from radon and its daughters. Some of these surveys were carried out under contract to the European Commission within the framework of the Radiation Protection Research Programme (3,4,5).

Temporal average values for indoor radon concentrations in the populated areas surveyed mostly ranged from about 20 to 50 Bq/m³. However, the log normal distribution extends values to include a small percentage of houses with concentrations in excess of 400 Bq/m³ and some individual dwellings with concentrations a further order of magnitude higher. In the case of high indoor concentrations (> 400 Bq/m³) available evidence generally indicates the underlying soil as the main source.

³Assuming an exposure to dose conversion coefficient of 20 Bq/m³ per mSv/y, average indoor radon concentrations in the E.C. give rise to effective doses ranging from 1 to 2,5 mSv/year, but some members of the public receive doses in excess of 20 mSv/year.

CURRENT NATIONAL REGULATORY APPROACHES WITHIN THE E.C.

Many countries are considering a natural radiation control policy and have set up working groups to draw up proposals. In some the work is well advanced and recommendations on remedial action levels and limitations for future housing are being prepared. In the U.K. the National Radiological Protection Board (NRPB) issued recommendations in 1987 on exposure control of radon daughters in dwellings (6) and the Government has already adopted measures to deal with the problem in some parts of the country (7).

The results of the Article 31 experts' report (1) prompted the E.C. Commission to ask the experts to draw up a proposal for an E.C. policy on exposure to radon daughters in dwellings. Draft recommendations are in an advanced state of preparation and should be presented to the Commission shortly. They follow closely the principles given in I.C.R.P. Publication 39 (8) in stressing the importance of the controllability of the exposure; for this reason in recommending limiting values they distinguish between existing and future housing. They further stress the need to use the principles of optimisation in the application of either remedial or preventive measures

Finally, they emphasise the need to develop criteria for identifying regions, sites and construction characteristics which are likely to result in significantly high indoor radon levels.

III. ACTIONS IN THE RESEARCH FIELD

In the current (1985-1989) Radiation Protection Research Programme several items relate to natural radiation exposure (4,9)

- the physico-chemical properties of radon daughter aerosols; studies are being carried out to evaluate the electrical charge and size of radon daughter particulates and their dependence on environmental conditions such as humidity, trace gases and aerosol loading;
- the evaluation of risks due to inhalation of radon daughters; an overall model is under development, relating effective dose to radon gas concentration, taking into account ventilation rate, aerosol concentration and size distribution and plate out velocities;
- measurement of radon exhalation from building materials and soils, one study deals with the development of an instrument to measure "in situ" radon exhalation, another with the development of a model relating actual exhalation rates to three dimensional measurements;
- development of countermeasures; for this purpose test structures have been erected on a soil with artificially enhanced radium concentrations. The effects of various types of floors are being tested.

IV. CONCLUSIONS

Within the European Community, several Member States are working on the development of radon control policies. To avoid public confusion and distrust, the Commission, in collaboration with the Article 31 Group of Experts, defined the principles of a harmonised approach and formulated several recommendations. The most important of these is the acceptance of the guidance given in ICRP publication no 39 and the indication of the need for the development of effective remedial or preventative techniques based on the principles of optimisation. This will require research in the fields of dosimetry, risk assessment, epidemiology and control technology.

REFERENCES

- (1) Council Directive 80/836/Euratom of 15 July 1980, amending the Directive laying down the Basic Safety Standards
Official Journal of the European Communities No L243/1-4,
17 September 1980
- (2) Exposure to Natural Radiation in Dwellings of the European Communities
C.E.C. - DG V, Luxembourg, May 1987
- (3) C.E.C. Radiation Protection Programme; Final report 1980-84
EUR 9733, 1985
- (4) C.E.C. Radiation Protection Programme; Synthesis of Results
1981-1984, EUR 10394, 1986
- (5) C.E.C. Radiation Protection Programme, Progress Report 1985,
EUR 10452, 1986
- (6) Exposure to Radon Daughters in Dwellings; National
Radiological Protection Board (UK); Advise document in
relation to radiological protection, ASP 10, January 1987
- (7) Hansard, House of Commons, Official Reports Command 189, 27,
January 1987
- (8) The Principles of Limiting Exposure of the Public to Natural
Sources of Radiation; ICRP Publication 39, Annals of the
I.C.R.P., V14, No 1, 1984
- (9) C.E.C. Radiation Protection Programme, Progress Report 1986;
to be published.