COMMISSION

COMMISSION RECOMMENDATION
of 20 December 2001
on the protection of the public against exposure to radon in drinking water supplies

(notified under document number C(2001) 4580)

(2001/928/Euratom)

THE COMMISSION OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Atomic Energy Community, and in particular Article 30, the second paragraph of Article 33, the first paragraph of Article 38, and the second indent of Article 124 thereof,

Having regard to the opinion of the Group of Experts appointed by the Scientific and Technical Committee pursuant to Article 31 of the Treaty,

Whereas:

(1) Council Directive 96/29/Euratom of 13 May 1996 laying down basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionising radiation [1] lays down a framework for controlling exposures to natural radiation sources arising from work activities. Title VII of the Directive applies to work activities within which the presence of natural radiation sources leads to a significant increase in the exposure of workers or of members of the public. Member States are required to identify work activities which may be of concern.

(2) In view of the large geographical variability in the natural occurrence of radon and in the extent to which the population and water supplies are affected, a flexible approach is needed to allow Member States to apply the concept of optimisation, while ensuring protection of the most highly exposed part of the population. Such an approach is in accordance with Article 6(3)(a) of Directive 96/29/Euratom.

(3) The Group of Experts set up under Article 31 of the Euratom Treaty has provided technical guidance [2] for the implementation of Title VII of Directive 96/29/Euratom [1]. The guidance includes the protection of workers to inhaled radon in establishments where significant amounts of radon may be released from water into indoor air.

(4) Commission Recommendation 90/143/Euratom of 21 February 1990 on the protection of the public against indoor exposure to radon [3] introduces reference and design levels for indoor radon. The reference level for consideration of remedial action is 400 Bq/m^3 and the design level for future constructions is 200 Bq/m^3.

(5) Surveys in Member States have shown elevated concentrations of radon in some ground waters, particularly in regions with crystalline rocks. There are circumstances under which radon concentrations in drinking water are radiologically significant as they expose the population to enhanced doses and should not be disregarded from the radiation-protection point of view. High concentrations are often related to individual drilled wells, but sometimes also to waterworks utilising rock or soil aquifers.

(6) In many Member States there is increasing awareness of the significance of exposure of the population to radon in drinking water. Several countries have already or are drawing up dose-control policies. In many cases the control policies are drawn up in accordance with the protection principles established by the Council Directives 96/29/Euratom and 98/83/EC of 3 November 1998 on the quality of water intended for human consumption [4].

[1] OJ L 159, 29.6.1996, p. 1.

[2] Radiation Protection 88. Recommendations for the implementation of Title VII of the European Basic Safety Standards Directive (BSS) concerning the significant increase in exposure due to natural radiation sources. European Commission, Luxembourg, 1997.

[3] OJ L 80, 27.3.1990, p. 26.

[4] OJ L 330, 5.12.1998, p. 32.

(7) Radon is a naturally occurring radioactive noble gas, the most significant isotope of which is radon-222 with a half life of 3,82 days. This isotope is a member of the uranium-238 decay series and its presence in the environment is associated mainly with the trace amounts of its immediate parent, radium-226, in rocks and soil. Because radon is an inert gas, it can move rather freely through porous media such as soil or fragmented rock. Where the pores are saturated with water, as in soil and rock under the water table, radon is dissolved into the water and is then transported by it. Water-saturated soil with a porosity of 20 % and a radium concentration of 40 Bq/kg, which is the world-wide average in the earth's crust, causes at equilibrium a radon concentration in ground water of the order of 50 Bq/l.

(8) Surveys in Member States have shown that radon concentrations in surface waters are very low, usually well below 1 Bq/l. Concentrations in ground water vary from 1 to 50 Bq/l for rock aquifers in sedimentary rocks, to 10 to 300 Bq/l for wells dug in soil, and to 100 Bq/l to 50 000 Bq/l in crystalline rocks. The highest concentrations are usually associated with high uranium concentrations in the bedrock. A characteristic of radon concentrations in rock aquifers are their variability; within a region with fairly uniform rock types some wells exhibit concentrations far above the average for that region. Significant seasonal variations in concentrations have also been observed.

(9) Radon in domestic water supplies causes human exposure through ingestion and inhalation pathways. Radon can be ingested by direct consumption of tap or fresh bottled water. Radon is released from tap water into indoor air which causes exposure to radon by inhalation.

(10) In its report of 1993, the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) ([5]) estimated that the committed effective dose from ingestion of radon in water is 10^{-8} Sv/Bq for an adult and somewhat higher for a child and an infant. In 1998, the National Research Council, a committee in the United States, presented a conversion factor of $0.35.10^{-8}$ Sv/Bq ([6]). The committee did not find sufficient scientific evidence to introduce separate dose estimations for different age groups. In addition to the conversion factor, the ingestion dose depends also on the annual consumption of water. Estimates on the annual committed effective dose absorbed by an adult by the ingestion of water containing 1 000 Bq/l vary between 0,2 mSv and 1,8 mSv, depending on the annual water consumption and the range of conversion factors used.

(11) The increase in indoor radon concentration caused by tap water depends on various parameters such as the total consumption of water in the house, the volume of the house and the ventilation rate. Both the UNSCEAR and the National Research Council estimate that 1 000 Bq/l of radon in tap water will on the average increase the indoor air radon concentration by 100 Bq/m^3.

(12) Radon in drinking water is controllable in the physical and engineering sense; effective methods for removing radon from drinking water have been developed ([7]) and are commercially available. Accordingly, an appropriate system needs to be established for reducing significant exposures. An important part of the system is the adoption of reference levels for consideration of remedial or preventive action.

(13) The methods and equipment used for removing radon and long-lived radon decay products from water do not significantly differ in techniques or in costs between an existing water supply and a new supply planned for future use. Consequently, the same criteria, including the reference levels, may be used for remedial action on the existing water supplies and for setting preventive requirements for new water supplies.

(14) For an individual water supply, whereby no water is supplied as part of a commercial or public activity, the exposure caused by radon in water is a phenomenon fairly similar to that of radon in dwellings. Accordingly, similar radiological protection criteria should be applied. Considering both the ingestion and inhalation pathways, the annual effective dose caused by water containing 1 000 Bq/l radon is, according to current knowledge, very comparable to that caused by an indoor radon concentration of 200 Bq/m^3, the design level established in Recommendation 90/143/Euratom.

(15) Where water is supplied as part of a commercial or public activity, such as through a waterworks, the consumer does not have the same opportunity to control the received dose as an owner of an individual supply. It follows that the consumer must be confident that the water does not pose any risk to human health. In addition, remedial action taken on that water affects a large number of people, which makes the action more cost-effective at lower radon concentrations than is the case with an individual supply. Consequently, it is justified to adopt a more stringent control policy, including a lower reference level, for water supplied as part of a commercial or public activity than for an individual supply. Small amounts of radon in water are ubiquitous

([5]) UNSCEAR 1993 report. Sources and effects of ionising radiation. United Nations Scientific Committee on the Effects of Atomic Radiation, New York, 1993.

([6]) Risk Assessment of Radon in Drinking Water. Committee on Risk Assessment of Exposure to Radon in Drinking Water, Board on Radiation Effects Research, Commission of Life Sciences, NRC (National Research Council). National Academy Press, Washington DC, 1999.

([7]) The Commission has funded and is funding several research projects on the risk of exposure to radon. The TENEWA project (Treatment Techniques for Removing Natural Radionuclides from Drinking Water) carried out under the CEC contract No FI4PCT960054 has produced a significant amount of information on the removal techniques, including information on the possible radiological hazards caused by removal devices.

and therefore no remedial action should be required if the concentration is less than 100 Bq/l. National surveys might show that a higher reference level needs to be adopted for implementing a practical radon programme. However, it is unlikely that public or commercial distribution water with a radon concentration exceeding 1 000 Bq/l could be considered justifiable from the radiation protection point of view.

(16) The radon concentration of water at the point of delivery is unlikely to be greater than that at the source, as in the case of a waterworks. Usually a measurement at the source is sufficient to demonstrate compliance with the reference concentration and no separate measurements are needed at the various points of use. However, the radioactive decay and possible aeration of radon during delivery may need to be taken into account, for example, in assessing the doses.

(17) Directive 98/83/EC requires the Member States to monitor the concentrations of natural radionuclides in drinking water, but in addition to radon, radon decay products are also excluded from the scope of the Directive. There are circumstances under which polonium-210 and lead-210 (long-lived decay products of radon) in drinking water pose a comparable or a higher radiation risk than some natural radionuclides monitored in accordance with the Directive. Accordingly, polonium-210 and lead-210 should not be disregarded in monitoring and in taking action to reduce exposures caused by natural radionuclides in drinking water. Reference concentrations for polonium-210 and lead-210 should be established and they should be monitored according to the principles set for natural radionuclides by the Directive. The indicative dose of 0,1 mSv and the principles of dose calculation established in the Directive should be used for deriving the reference concentrations.

(18) High radon concentrations indicate a potential presence of other radionuclides of the uranium decay series in the water, although the correlation is not always unambiguous. When remedial action is taken to reduce radon concentration, the presence of other natural radionuclides should be screened and, where appropriate, be analysed in more detail so that a suitable technique can be chosen to remove all the radiologically significant natural radionuclides from the water at the same time, in a cost effective way.

(19) Specific guidance should be made available to the waterworks and to the owners of public water supplies on the different methods available for removing radon and long-lived radon decay products from water. The guidance should include, in particular, instructions on the handling and disposal of accrued radioactive waste and on the ways of minimising possible exposure due to radon released from a removal device or by the increase in external gamma radiation in the vicinity of a removal device.

(20) Simple metrological procedures should be established to ensure that measurements of radon and radon decay products in water yield data of the appropriate quality and reliability.

(21) Owing to the special characteristics of the problem, adequate public information is an important element both in improving the controllability of exposure and in securing a positive public response.

(22) The purpose of this Recommendation is to provide guidance to the Member States for setting controls on exposures caused by radon and radon decay products in drinking water,

HEREBY RECOMMENDS:

1. This Recommendation concerns the radiological quality of drinking water supplies regarding radon and long-lived radon decay products.

2. An appropriate system should be established for reducing exposures to radon and long-lived radon decay products in domestic drinking water supplies. Within this system adequate public information and response to public concern deserve particular attention. Under the system attention should concentrate on the highest exposures and on those areas where action is most likely to be effective.

3. For the purpose of this Recommendation, 'drinking water' shall mean:

   (a) all water either in its original state or after treatment, intended for drinking, cooking, food preparation or other domestic purposes, regardless of its origin and whether it is supplied from a distribution network, from a tanker, or in bottles or containers,

   (b) all water used in any food-production undertaking for the manufacture, processing, preservation or marketing of products or substances intended for human consumption unless the competent national authorities are satisfied that the quality of the water cannot affect the wholesomeness of the foodstuff in its finished form.

   Natural mineral waters covered by Council Directive 80/777/EEC [8] and waters which are medical products according to Council Directive 65/65/EEC [9] are excluded from the scope of this Recommendation, since special rules for those types of water have been established.

[8] OJ L 229, 30.8.1980, p. 1.
[9] OJ Special Edition 1965–1966, p. 20.

4. Representative surveys should be undertaken to determine the scale and nature of exposures caused by radon and long-lived radon decay products in domestic drinking water supplies originating from different types of ground water sources and wells in different geological areas unless this information is already available. The surveys should be designed in such a way that underlying parameters, and especially the geology and hydrology of the area, radioactivity of rock or soil, and well type, can be identified and used later for directing further action on the highest exposures. The surveys should cover, in particular:
   (a) drilled wells, especially those in crystalline rock areas,
   (b) waterworks using rock or soil aquifers.
5. For water supplied as part of a commercial or public activity, the following action should be taken:
   (a) above a concentration of 100 Bq/l, Member States should set a reference level for radon to be used for consideration whether remedial action is needed to protect human health. A level higher than 100 Bq/l may be adopted if national surveys show that this is necessary for implementing a practical radon programme. For concentrations in excess of 1 000 Bq/l, remedial action is deemed to be justified on radiological protection grounds;
   (b) measurements of radon concentration should be required if there is a specific reason to suspect, on the basis of the results of representative surveys or other reliable information, that the reference level might be exceeded;
   (c) where significant concentrations of polonium-210 and lead-210 are suspected, on the basis of the results of representative surveys or other reliable information, monitoring of these nuclides should be arranged in conjunction with the monitoring of other natural radionuclides required by Directive 98/83/EC;
   (d) above a reference concentration of 0,1 Bq/l for polonium-210 and 0,2 Bq/l for lead-210, consideration should be given to whether remedial action is needed to protect human health.
6. For an individual water supply, from which no water is supplied as part of any commercial or public activity, the following action should be taken:
   (a) a level of 1 000 Bq/l should be used for consideration of remedial action;
   (b) the urgency of the remedial action should be commensurate with the extent to which the reference concentration is exceeded;
   (c) where remedial action is considered necessary because of radon, the levels of other natural radionuclides should be screened and where appropriate as a result of the screening, other natural radionuclides should be analysed and removed from the drinking water with the same remedial action;
   (d) where remedial action is considered necessary, the consumers concerned should be informed of the radon levels of the water and of the remedies available to reduce such levels.
7. Where measurements indicate that the radon in tap water contributes significantly to exceeding the threshold set for indoor radon, remedial action on this source should be considered.
8. Drinking water distributed in public premises such as residential homes, schools, and hospitals should comply with the principles of point 5.
9. Measurements should be made with appropriate methods and equipment which have undergone approved calibration and quality assurance programmes.
10. Member States should provide guidance on different methods available for removing radon and long-lived radon decay products from water. Member States should provide instructions on the handling and disposal of radioactive waste generated by the removal process and on ways to minimise possible exposure caused by radon released from a removal device or by the increase in external gamma radiation in the vicinity of a removal device.
11. The exposure of workers to inhaled radon in establishments where significant amounts of radon may be released from water into indoor air, in particular in waterworks, spas and swimming pools, should be controlled according to Title VII of the Directive 96/29/Euratom and according to the Recommendations, 'Radiation Protection 88', made in 1997 for the implementation of that Title by the Group of Experts established under Article 31 of the Euratom Treaty.
12. Member States should consider to what extent the intentional use of radon-bearing water for its prospective therapeutic effects is justified by its economic, social or other benefits when set against the health detriment it may cause.

This Recommendation is addressed to the Member States.

Done at Brussels, 20 December 2001.

For the Commission
Margot WALLSTRÖM
Member of the Commission