Subcommittee Report on the University of Michigan Radon Policy

Submitted to the Radiation Policy Committee

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At the September 11, 2008 Radiation Policy Committee (RPC) meeting a subcommittee was formed to review the University of Michigan (UM) policy for radon mitigation action levels. The current policy was approved at the September 15, 1988 RPC meeting. "The recommended UM radon action levels of 4 pCi/L for occupied space and 8 pCi/L for unoccupied space were approved." (9/15/88 RPC Minutes).

The subcommittee consisted of Ruthann Nichols, Ph.D., Kimberlee Kearfott, Sc.D., Mitchell Goodsitt, Ph.D., and Joseph Miklos, Ph.D. This subcommittee was charged to review the existing UM radon mitigation policy and recommend if this should be modified and, if so, to what action levels.

Currently, the only U.S. regulation governing the radon concentration in the workplace is from the Occupational Safety & Health Administration (OSHA) Permissible Exposure Limit (PEL). This OSHA PEL is based on the 10CFR20, Appendix B, Table 1, Derived Air Concentration (DAC) of 3×10^{-8} uCi/mL for radon-222, which corresponds to 30 pCi/L of radon and radon decay products. The DAC is based on exposure to this concentration for 2000 working hours per year (40h/w x 50 w/y) and results in an annual dose of 5000 mrem.

A search of radon action levels for other countries showed a range of 150 Bq/m^3 (4.1 pCi/L, (37 Bq/m^3 = 1 pCi/L)) to 1000 Bq/m^3 (27 pCi/L) for residential dwellings. The UK has an action level of 200 Bq/m^3 (5.4 pCi/L) for residential dwellings and 400 Bq/m^3 (10.8 pCi/L) for the workplace. (Radiation Protection Dosimetry Vol. 130, No. 1, pp 38-42, 2008.) Another paper suggested an action level of 225 Bq/m^3 (6.1 pCi/L) for the workplace. (Radiation Protection Dosimetry Vol. 111, No. 1, pp 51-54, 2004.) The International Commission on Radiological

Protection Report 65 (ICRP 65) recommends an upper reference level of 600 Bq/m^3 (16.2 pCi/L). The International Atomic Energy Agency (IAEA) Safety Report Series No.33 Radiation Protection in Workplaces other than Mines, 2003, suggests an action level of 1000 Bq/m^3 (27 pCi/L) for the workplace.

The U.S. Environmental Protection Agency (EPA) suggests an action level for residential dwellings of 4 pCi/L. The risk to an individual is based on an individual being in this annual average radon concentration for 18 hours per day, seven days per week (126 h/w) for 70 years of their lifetime. However, the EPA suggests mitigation if the average of two short-term (less than 90 days in length) measurements indicate radon concentrations greater than 4 pCi/L.

To have a "radon problem" three things are required. There needs to be:

1) A source of radon.

2) An entry mechanism for radon.

3) A person who is breathing the radon. (This is most important!)

The current UM policy for radon mitigation requires mitigation of "unoccupied space" greater than 8 pCi/L. However, if the area is unoccupied there is no need to conduct radon testing or radon mitigation. If it is suspected that the area may become occupied, it would be valid to test, but not mitigate, unless it is occupied.

The current radon policy requires mitigation if "occupied space" has a radon concentration greater than 4 pCi/L. This was based on public perception of the EPA's residential dwelling action levels. Most individuals do not spend 18 hours per day, seven days per week for 70 years of their lifetime in the workplace.

This UM Radon Policy will require radon mitigation in "occupiable space" or "habitable space" if the annual average radon concentration is greater than 4 pCi/L during the time individuals are present. "Occupiable space is defined in the Michigan Building Code (MBC), 2006 as… "A room or enclosed space designed for human occupancy in which individuals congregate for amusement, educational or similar purposes or in which occupants engage at labor, and which is equipped with means of egress and light and ventilation facilities meeting the requirements of this code." "Habitable Space" is defined in the Michigan Building Code, 2006 as… "A space in a building for living, sleeping, eating, or cooking. Bathrooms, toilet rooms, closets, halls, storage or utility spaces and similar areas are not considered habitable spaces." For the purpose of this policy "occupied areas" will be defined using the combined MBC definitions of Occupiable space and Habitable space."

Subcommittee Recommendations to the RPC

It is recommended that the RPC approve the following radon mitigation strategy for UM buildings:

1) If short-term radon monitoring (less than 90 days in length) measurements in occupied areas are less than or equal to 4 pCi/L, no mitigation is required and no further radon testing is required unless changes are made to the building structure which involve excavation of the ground under or around the building, or if there is a change in the ventilation of the building.

2) If short-term radon monitoring measurements in occupied areas are greater than 4 pCi/L, but are less than or equal to 10 pCi/L, more testing should be conducted. The testing should include live-time (continuous) monitoring and an evaluation of occupancy, and may involve long-term monitoring (greater than 90 days). If the annual average concentration exceeds 4 pCi/L while the space is occupied, mitigation should be conducted to reduce the annual average concentration to ≤4 pCi/L while the space is occupied.

3) If short-term radon monitoring measurements in occupied areas exceed 10 pCi/L, but are less than or equal to 27 pCi/L, more testing should be conducted as described in Recommendation 2 (above). If over a period of monitoring of 6 months or less, the average radon concentration is greater than 10 pCi/L while the space is occupied, mitigation should be conducted to reduce the annual average concentration to ≤4 pCi/L while the space is occupied. If over a period of monitoring of 6 months or less, the average radon concentration is less than or equal to 10 pCi/L while the space is occupied, more testing will be conducted in accordance with this policy.

4) If short-term radon monitoring measurements in an occupied area exceed 27 pCi/L, and follow-up short-term or live-time measurements and an evaluation of occupancy indicate that the area is occupied when the radon concentration is greater than 27 pCi/L, the area should be mitigated as soon as practicable to reduce the annual average concentration to ≤4 pCi/L while the space is occupied.

It is recommended that the RPC approve the following radon measurement strategy for UM buildings. Radon testing should be conducted:

1) In buildings undergoing renovations involving excavation of the ground under or around the building.

2) In buildings prior to their demolition if new buildings are planned to be built on the site.

3) In buildings undergoing HVAC unit replacement.

4) If requested by building occupants, or as part of an indoor air quality study if no historical testing data are available.

5) In buildings with elevated radon history.

6) In buildings with mitigation systems to insure that the mitigation systems are operating properly.

7) In new buildings when they are ready for occupancy.

8) If elevated radon concentrations are suspected in a building by UM Occupational Safety & Environmental Health staff.

It is recommended that the RPC review the University of Michigan Radon Policy as needed, or required by regulatory changes.

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