RADON PERMEABILITY OF 60-MILS LIQUID BOOT® SPRAY-APPLIED VAPOR BARRIER

EXECUTIVE SUMMARY

A series of laboratory tests were conducted on samples of CETCO's LIQUID BOOT® 60 mils vapor barrier which were exposed to radon, and a measurement of their ability as a diffusion barrier was taken. The samples were tested using 222Rn (half-life of 3.823 days) permeability testing. The results showed zero traces of radioactivity in the collectors with the LIQUID BOOT® vapor barrier membrane, proving its effectiveness in mitigating radon intrusion.

OBJECTIVES AND PROCEDURES

Experimental Objective: The objective of this experiment is to investigate the effectiveness of LIQUID BOOT® 60 mils as a barrier when exposed to radon.

22RN Permeability Procedure: To evaluate the material duplicate EML radon collectors were utilized. These are similar to those used to measure environmental concentration levels of radon in air. The collectors are metal cans, 8 cm diameter × 2.4 cm height. They are filled with 50 g of activated carbon (Calgon type PCB 6 × 16 mesh). The collector lids have 3.2 cm diameter holes to allow for radon, water vapor, and other gases to diffuse readily.

In order to measure the effectiveness of LIQUID BOOT® vapor barrier two collectors with the holes left open were compared to two collectors with the holes each covered by a 7.8 cm diameter section of the LIQUID BOOT® vapor barrier elastomeric membrane, acting as a diffusion barrier. The collectors were then placed in the 20 M3 radon test chamber under conditions of 20°C and 50% humidity. They were exposed in the EML radon chamber with an average concentration of 23 pCi/L from 15:00 on 02/18/1992 through 8:00 on 02/24/1992 for a total of 137 hours. After exposure, radioactive concentrations were measured.

RESULTS AND DISCUSSION

TABLE 1: RADIOACTIVITY CONCENTRATIONS AND AMOUNT WATER ADSORBED BY COLLECTORS WITH AND WITHOUT A LIQUID BOOT® MEMBRANE.

COLLECTOR		RADIOACTIVITY CONCENTRATION (pCi/L)	WATER ADSORBED (g)
Without LIQUID BOOT® vapor barrier	A	2495 ± 10	2
	B	2497 ± 10	2
With LIQUID BOOT® vapor barrier	C	0	0
	D	0	0

As stated in the Radon Control Requirements, "If the measured long-term average indoor radon concentration exceeds 4 pCi/L, indoor radon levels shall be reduced." The collectors were exposed to higher concentrations of radon than would happen environmentally, and those with the LIQUID BOOT® vapor barrier membrane reduced concentrations to 0 pCi/L. Therefore, LIQUID BOOT® vapor barrier is an efficient barrier to 222Rn diffusion.

CONCLUSIONS

The conditions of the radon permeability test with high levels of exposure were not able to permeate the LIQUID BOOT® vapor barrier elastomeric membrane. Without the membrane concentrations reached levels that were highly dangerous to human health. To prevent such occurrences and keep radioactive concentrations below the regulatory limit outside of the laboratory, a mitigation system must be installed, such as the LIQUID BOOT® vapor barrier membrane. Through testing, it has shown high efficiency in retarding the diffusion of radon. Its high quality can be utilized in radon intrusion mitigation from soil under basement floors and foundation walls and radon's adverse health effects.

REFERENCE

Preliminary Report of the Indoor Quality Code Development Committee: Requirements for Radon Control for Group R, Division 3 Occupancies. Tech. no. Appendix Chapter 12. Whittier, CA: International Conference of Buildings Officials, 1990. Print.

ATTACHMENT

Department of Energy Lab Report

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February 24, 1992

Paul W. Dooley
Director of Operations
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Dear Mr. Dooley

I received the liquid boot material that you sent me for 222Rn permeability testing. To evaluate the material, I used duplicate EML radon collectors similar to those we use to measure environmental concentration levels of radon in air. The collectors consist of 8 cm diameter x 2.4 cm height metal cans filled with 50 g of activated carbon (Calgon type PCB 6 x 16 mesh). They have lids with 3.2 cm diameter holes so radon and other gases and especially water vapor diffuse readily. In the underside surface of the lids of two collectors with 3.2 cm holes, I placed a 7.8 cm diameter section of the liquid boot elastomeric membrane to act as a diffusion barrier to radon. The holes in the lids of the other two collectors were left open for unobstructed diffusion of gases.

Collectors with and without liquid boot membranes were conducted in the 20 M3 radon test chamber. Conditions of temperature and relative humidity were 20 oC and 50% respectively. The duplicate collectors were exposed in the EML radon chamber from 1500 2/18/92 through 0800 2/24/92, for a total of 137 hours. The concentration of radon in the chamber averaged 23 pCi/L (851 Bq/M3). The radioactivity concentrations measured in the two collectors without the liquid boot membrane were 2495 and 2497 ± 10 picocuries respectively. The collectors with the liquid boot membranes measured zero radioactivity indicating the membrane is opaque to 222Rn. At the same time, the radon collectors without the membranes adsorbed 2 g of water from air by diffusion. There was no measurable water in the collectors with the liquid boot membranes. From these simple tests at standard atmospheric conditions, it appears that the special liquid boot elastomeric membrane is an efficient barrier to 222Rn diffusion. The possibilities for use in new construction are obvious in preventing radon intrusion from the soil under the basement floor and foundation walls.

Sincerely

Andreas C. George

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Radiation Physics Division