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ACTIVATED CARBON RADON ADSORPTION FOR BUILDINGS

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ABSTRACT

The subject of this paper is the patented radon static carbon adsorber which is constructed of open cell fibers impregnated with activated carbon and provided with an impermeable membrane on one side. The invention serves as a practical radon adsorber when installed on the floor of a structure or beneath the floor in a crawl space. When the device is installed in a crawl space, the adsorber is attached to the underside of the floor structure with the activated carbon facing down. When installed on a concrete slab or wooden floor, the adsorber is installed under the carpet pad with the membrane facing up and the activated carbon down. Assuming that the continuous layer of adsorber is sealed at the edges, the dynamic condition of the air between the house and crawl space is negligible. Under this condition the radon radioactive products are adsorbed into the carbon bed where it decays into its short-lived progeny.

INTRODUCTION

Radon is transported by two mechanisms: 1) convective flow, which is the movement of a gas driven by a pressure or temperature differential, and 2) diffusion, which is a radon scattering of a gas from an area of high concentration to an area of lower concentration. Convective flow is the major mechanism of radon transport into most homes.

The conceptual framework for a carbon bed adsorption system in dynamic condition for the control of indoor radon was presented by Rey Bocanegra and Phillip K. Hopke of University of Illinois, March 1989, ordered by the U.S. Environmental Protection Agency. They concluded that the successful use of a radon removal system is obviously limited to buildings with a low rate of air exchange between the basement and the house. This finding led us to the discovery of a radon carbon adsorber that is functional under conditions of near or no air flow and under relatively constant temperature. The pressure differential is lowered to a minimum by the impermeable membrane. The influence of relative humidity in the crawl space under these conditions is minimal.

MATERIAL AND METHODS

The patented static carbon adsorber providing the adsorption barrier is called *Radonall*. The US patent was issued in 1992 to Messrs. Stephen Schilling and Joseph T. Foldyna (Reg. U.S. Pat. of No. 5,174,8000).

The adsorber comprises two distinct layers. The adsorption layer is constructed of open cell fibers, saturated with activated carbon. The activated carbon is made of coconut shell material and has an activity level of 60% or more (carbon tetrachloride test method) with an adsorption area of 1500 sq m/gr. The carbon content per square foot of *Radonall* varies with fiber thickness from 10 gr for 1/4 in. thickness to 20 gr for 3/4 in. thickness. Activated carbon is a highly effective adsorbent of radon in the air; one gram at room temperature adsorbs the radon from 4 liters of air. The carbon content of *Radonall* used for a 1500 sq ft home, when radon averages 20 pCi/l is 10 gr/sq ft which provides full adsorption and decay capacity. The decay product, lead 210, remaining in the carbon is 0.0000117 gr/year. Under this condition, the lead 210 can be considered as a nearly non-radioactive product.

The impermeable layer bonded to the fibers is a material ranging in thickness from 0.01 to 0.03 of an inch. The layer is waterproof and, in combination with the activated fiber pad, is durable and puncture resistant. *Radonall* is manufactured in lengths of over 100 ft; the maximum width is 47 inches.

The combination of both materials creates a static adsorber that is based on no flow conditions, has no moving parts, consumes no energy, and requires no maintenance.

DISCUSSION

Existing methods for radon control are based on subfloor ventilation before entry in to the house. Although these techniques represent the best available technology, they do not guarantee reduction of radon levels below a prescribed standard. In some cases, because it is difficult to control pressure differentials, the ventilation systems actually caused the radon content to increase.

CONCLUSION

Radonall can be installed on or beneath the floor of a structure, depending on building construction. When located in the crawl space, the adsorber is attached to the underside of the structure with the carbon facing down and the impermeable membrane against the floor structure by stapling overlapped edges. When all vent openings are closed and the continuous layer of *Radonall* is sealed, the air exchange between the basement and the house is lowered to the minimum and allows the activated carbon to fully adsorb the radon.

When installed on concrete or wooden flooring *Radonall* is placed over the concrete or floor with the impermeable membrane facing up, so that the membrane protects the carbon from moisture. Carpet pad and carpet are than installed over the *Radonall* in the traditional manner.

Mechanical connections conform to standard construction practices and require no special training of installers.