

RC – 7. EPIDEMIOLOGICAL METHODS ON RESIDENTIAL RADON AND CANCER RISK

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This refresher course focuses on the presentation of epidemiological studies that led to confirmation and quantification of the lung cancer risk associated with prolonged residential radon progeny exposure. Radon gas is a naturally occurring, odorless, and colorless noble gas released from the decay of radium-226. The radiologic significant exposures from radon come mainly from two of its alpha-producing decay products, polonium-218 and polonium-214. Documentary evidence from as far back as the 16th century indicates that elevated radon exposure was probably responsible for excess lung cancer mortality of miners in some Central European mines, such as the silver mines in Germany and Bohemia. Cohort studies have consistently shown underground miners exposed to high levels of radon to be at excess risk of lung cancer, raising questions about potential lung cancer risks at the lower concentrations of radon exposure typically found in homes. Historically, risks projections for residential exposure were based on extrapolations from underground radon-exposed miners, assuming a linear relative risk model. However, there was concern among some scientists that differences between the mine and residential environment may limit the generalizability of risk estimates based on miner data. The U.S. National Research Council Committee on the Biological Effects of Ionizing Radiation (BEIR VI) committee pointed out that the most direct way to assess the association between prolonged residential radon exposure and lung cancer was through the use of case-control studies of individuals residentially exposed. However, case-control studies of residential radon and lung cancer have provided ambiguous evidence of radon lung cancer risks. The BEIR VI committee attributed much of the inconsistency between the individual residential radon case-control studies' risk estimates to the uncertainty in radon exposure reconstruction between studies and small sample size of individual studies. To address some of these problems the BEIR VI Committee proposed pooling individual studies. In 2005 results of two major pooling studies exposure have become available. Risk estimates from the European (Darby et al., 2005) and North American (Krewski et al., 2005) pooling studies are quite similar and indicate a linear increase of lung cancer risk with increasing residential radon exposure. Collectively, the combined analyses provide direct evidence of an increased lung cancer risk associated with the estimated long-term residential radon exposure. There is also good consistency with results of large studies among miners exposed to radon at much higher levels. Globally an estimated 6-15% of lung cancers are thought to be due to radon, underlining the importance of radon as one of the most important environmental carcinogens.

To illustrate the epidemiological methods used in residential radon risk assessment we will closely examine the example of a combined analysis of the seven large-scale case control studies conducted in North America (Krewski et al., 2006 in the Special Issue of Journal of Toxicology and Environmental Health. Part A Current Issues, Volume 69 Issue 7 & 8 2006).

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and R. William Field

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