# Eyeglass Lenses for Personal Radon Dosimetry

Robert L. Fleischer[1], Stephen A. Hadley[1], Nicholas R. Meyer[1], and Alfred Cavallo[2] ([1]Department of Geology, Union College, Schenectady, NY 12308,(518)388-6985, FAX(518)388--6417,fleischr@union.edu; [2]Environmental Measurements Laboratory, U. S. Department of Energy, 201 Varick St., New York, NY 10014)

Radon, through its daughters, is recognized as a major cause of lung cancer among underground mine workers; and, according to the EPA, indoor radon is likely (within a factor of two) to cause 10,000 lung-cancer deaths per year in the United States. Although the effects of occupational exposures in mines have been documented in a good many studies, dose-response, radon-and-lung-cancer information for residential indoor exposure is yet to be documented clearly and decisively. The use of personal dosimeters -- rather than site dosimeters -- could supply more direct measures of exposure, for correlation with possible health effects of radon. Such records should be far more direct measures of radon exposure of individuals than are given by radon concentrations in homes, which has the disadvantages of the need to infer exposure using radon values on different levels and with the total omission of exposures outside of the home. Measurements in homes are vital to deciding when and where remedial action is merited, but for individuals the numbers obtained are indirect and therefore far less pertinent than direct measurements.

There is a simple method of supplying that need—using plastic eyeglass lenses as nuclear-track radon dosimeters. Eyeglass lenses in the United States are commonly composed of allyl-diglycol carbonate (CR-39), an alpha-particle-detecting plastic, thus making such lenses personal radon dosimeters.

Samples of such lenses have been obtained, etched to reveal that radon and radon daughter alpha tracks can be seen in abundance, and sensitivities have been calibrated in radon chambers and with a uranium-based source of alpha particles. Natural (*fossil*) track densities ranged from 3,000 to more than 25,000/sq cm for eyeglasses that had been worn for various times from one to nearly five years. The median track-formation rate was 3,160/cm$^2$-yr,which corresponds to approximately 33 Bq/m$^3$ (0.88 pCi/l). Average radon concentrations to which the wearers were exposed are inferred to be in the range 24 to 81 Bq/m$^3$ (0.6 to 2.2 pCi/l). Procedures for consistent, meaningful readout include etching to a specified track diameter, scanning a standard position on lenses, and calibrating each set of lenses by exposure to a standard source of alpha particles. In our work we used solid $Si_3U$ as a reliable, easily handled source. It has the special merit of forming a protective thin oxide that does not thicken or flake off and hence gives a constant flux of alpha particles.