

As I look back on an exciting and satisfying career studying the effects of radium deposited internally in man, one overall conclusion appears to be worth emphasizing. Given the number of people who acquired radium internally, it is remarkable how few suffered significant damage. To be sure, those who eventually developed radium-induced malignancies suffered severely. Those who acquired very large internal quantities of radium, as did many of the early dial painters, also suffered from what we today suspect were acute radiation doses leading to early deaths. However, the great majority of exposed individuals went through life with no recognizable consequences of their exposures. They lived as long as, and apparently in as good health as, their unexposed neighbors. This fact seems to have been little appreciated and seldom mentioned, but it may be the most important finding of the entire study.

In the same vein, we should note that acquiring sufficient radium internally to put one at risk is not easy. Many individuals were referred to the Center for Human Radiobiology at Argonne for body content measurements after exposure to radium in the workplace or at a contaminated site, only to find no detectable radium in their bodies. Intravenous injection is by far the most effective method for obtaining a high radium burden. Oral ingestion of material with a high specific activity is also effective, in spite of the fact that 80% of what is ingested is not absorbed into the body. Except for a few radium chemists, who may have inhaled as well as ingested radium, only exposure in the dial painting industry, from medical treatments, or from self-administered radium has led to serious consequences. This fact has also not been widely disseminated.

The appendix to this review lists all of the measured radium cases, a total of 2,403 individuals whose records were in the files at the end of 1990. For each case the route of exposure, the dates of exposure, the years of birth and death, the measured body content, the calculated intake and dose, and the cause of death have been listed. This appendix was created from the Argonne radium databases by Thomas J. Kotek, to whom I am indebted for valued assistance during the writing of this manuscript.

These 2,403 cases, however, are not all of the measured cases. Some individuals referred to Argonne for measurement after suspected radium exposure were not considered radium cases when no radium was found by gamma-ray measurements. In contrast, individuals who worked in the radium dial industry or as radium chemists but were found to contain no measurable radium were listed as radium cases on the basis of their exposure history.