

Red Marrow Dosimetry for Former Radium Workers

R. E. Toohey¹, R. E. Goans², C. J. Iddins³, N. Dainiak³, S. L. McComish⁴ and S. Y. Tolmachev⁴

¹*M. H. Chew & Associates*; ²*MJW Corporation*; ³*Oak Ridge Institute for Science and Education*;

⁴*United States Transuranium and Uranium Registries*

A collaboration between the Radiation Emergency Assistance Center and Training Site (REAC/TS) at the Oak Ridge Institute for Science and Education (ORISE) in Oak Ridge, TN and the United States Transuranium and Uranium Registries (USTUR) at Washington State University in Richland, WA has resulted in the discovery of a possible long-term biodosimeter that could be useful for population screening and/or epidemiological studies. The pseudo-Pelger-Huet (pseudo-P-H) anomaly consists of characteristic bi-lobed nuclei in neutrophils that can be easily assessed by light microscopy of a peripheral blood (PB) smear. Since PB cell culture is not required (as with dicentric chromosome analysis), a marked reduction in time to obtain results is achieved. A set of 166 PB smears from former workers in the luminizing industry was provided by the USTUR from the National Human Radiobiology Tissue Archive and examined at REAC/TS; the anomaly was characterized as the percentage of pseudo-P-H cells among neutrophils. The radium intakes of most of the subjects are given in R. E. Rowland's publication "Radium in Humans: A Review of U.S. Studies" (1994). The published intakes, based on whole-body counts, had to be modified to accommodate changes in the ICRP biokinetic model for radium since they were originally calculated. Red marrow doses were computed from the adjusted intakes of ²²⁶Ra and ²²⁸Ra by using the ingestion dose coefficients given in ICRP Publication 67. However, because many of the workers started in their teens, doses were adjusted for age at intake; the dose coefficient for a 15-year-old was used for intakes occurring before age 25, and the adult dose coefficient was used for intakes at age 25 and above. Starting dates of exposure ranged from 1914 to 1950, and ages at first exposure ranged from 13 to 40 years. Exposure durations ranged from 1 to 1800 weeks and the vast majority of these PB samples were drawn between 1973 and 1975 at the time of the whole-body counts. Calculated red marrow doses ranged from zero to 13.6 Gy-eq, computed with a radiation weighting factor of two for alpha particles producing tissue reaction effects. A companion paper by R. E. Goans et al. presents the dose-response data for the pseudo-P-H anomaly in these cases. Acknowledgements: this work was supported by the U.S. Department of Energy under contract number DE-AC05-06OR23100 with Oak Ridge Associated Universities and award number DE-HS0000073 to Washington State University.

USTUR-0393A-16