Preface

The dependence of biological effectiveness on energy is an unresolved question in evaluating the risk of cancer in humans from exposure to low linear-energy transfer (LET) radiation (*i.e.*, photons and electrons). This dependence is relevant in estimating the level of cancer risk from exposure to low-LET radiation at lower energies (<150 keV) that are used in mammography and other medical-imaging procedures, and that are present in various occupational and public radiation exposure situations. The National Academies/National Research Council [*Health Risks from Exposure to Low Levels of Ionizing Radiation: BEIR VII Phase 2* (2006)] indicated that the biological effectiveness of lower-energy low-LET radiation based on chromosomal aberration data and biophysical considerations may be two or more times greater than for higher-energy low-LET radiation. However, the biological systems used in the experiments and the biophysical analysis provide only indirect evidence and may not be applicable to cancer in humans. Therefore, the assessment in this Report was undertaken.

This Report draws on an evaluation by specialists in microdosimetry, deoxyribonucleic acid (DNA) damage, cellular radiobiology, animal studies, and human epidemiology of the available evidence in those fields of study relevant to estimation of the relative effectiveness of lower-energy photons and electrons in inducing cancer in humans. For each specialty area (line of evidence), probability density functions (PDFs) are derived for the biological effectiveness observed for the endpoints studied in each line of evidence for defined lower-energy groups. Using these PDFs and evaluation of the relevance of the data from each line of evidence to the risk of cancer in humans, an evaluation is then made of the relative effectiveness of the defined lower-energy groups of photons or electrons (compared with higher-energy photons or electrons) in inducing cancer in humans.

This Report was prepared by Scientific Committee 1-20 on the Biological Effectiveness of Low-LET Radiation as a Function of Energy. Serving on Scientific Committee 1-20 were:

Steven L. Simon, *Chairman*
National Cancer Institute
Bethesda, Maryland

Members

Leslie A. Braby
Texas A&M University
College Station, Texas

Polly Y. Chang
SRI International
Menlo Park, California

Dudley T. Goodhead
Medical Research Council
Oxford, United Kingdom

Stephen C. Hora
Center for Risk and Economic Analysis of Terrorism Events
Los Angeles, California

Kiyohiko Mabuchi
National Cancer Institute
Bethesda, Maryland

Jerome S. Puskin
U.S. Environmental Protection Agency
Washington, D.C.

David B. Richardson
University of North Carolina
Chapel Hill, North Carolina

James D. Tucker
Wayne State University
Detroit, Michigan

Consultants

Keith F. Eckerman
Oak Ridge National Laboratory
Oak Ridge, Tennessee

David C. Kocher
Oak Ridge Center for Risk Analysis
Oak Ridge, Tennessee

Eliseo Vañó
Complutense University
Madrid, Spain

NCRP Secretariat

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Laura J. Atwell, *Office Manager*
James R. Cassata, *Executive Director* (2012 – 2014)
David A. Smith, *Executive Director* (2014 – 2016)
Kathryn D. Held, *Executive Director and Chief Science Officer* (2016)

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NCRP could not continue to address the radiation protection needs of the nation without the willingness of Council members to serve, review and advise and without the partnership of agencies to work together for the good of the people and the well-being of the nation.

John D. Boice, Jr.
President