Planning Towards the BEIR VIII Report

Why this Meeting and Why Now?

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Purpose of BEIR Reports

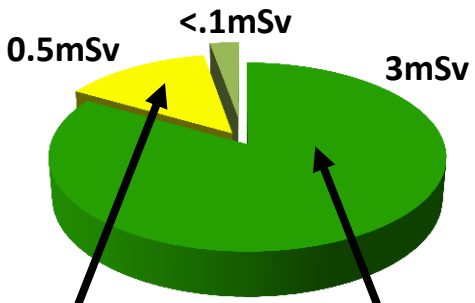
1. Advise the U.S. government on the relation between exposure to ionizing radiation and human health
2. Analyze key epidemiologic and experimental data to determine how regulatory bodies should best characterize risks of cancer and other serious health effects at doses and dose rates experienced by:
   - Radiation workers
   - General public

Why this Meeting?

- Notable increases in per capita low-dose radiation exposures in U.S. and elsewhere since early 1980s
- 10 years since the latest studies included in BEIR VII
- 1996 request for BEIR VII report→ 2006 publication
- Many new epidemiologic studies of health risks following low-dose radiation
- Advances in radiobiology, molecular and genetic studies

Radiation Exposure to the U.S. Population

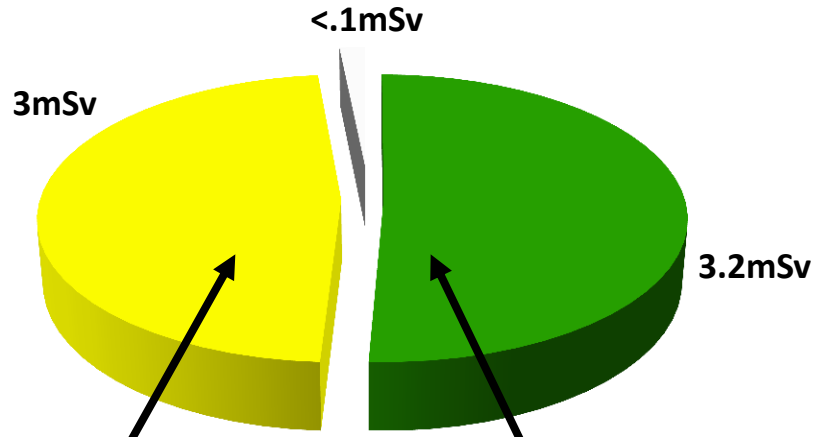
1980 per capita dose ~ 3.6 mSv



CT scanning 0.02 mSv
Nuclear medicine 0.1 mSv
Radiography/IR 0.4 mSv

Natural background 3.0 mSv

2006 Per capita dose ~ 6.0 mSv



CT scanning 1.5 mSv
Nuclear medicine 0.7 mSv
Radiography/IR 1.0 mSv

Natural Background 3.2 mSv

NCRP Report 160, 2009

Key Elements of BEIR VII

Overall objective: develop best possible risk estimates for exposure to low-dose, low linear energy transfer radiation in humans

Strategies:

- Conducted comprehensive review of epidemiologic data
- Defined principles forming basis for quantitative analysis
- Considered relevant biologic factors (DDREF, RBE, genomic instability, adaptive response, etc.) and genetic characteristics
- Assessed relevance to risk models of biologic data and models of carcinogenesis
- Identified potential target cells and problems in estimating dose to target cell

New Developments and Evolving Understanding of Health Effects of Low-Dose Radiation Since BEIR VII

Epidemiology

- New epi studies or new components of continuing studies
- Statistical associations of external radiation with:
  - Additional cancers, histologic subtypes, cancer precursors
  - Circulatory diseases, cataracts, ? other non-cancer outcomes
- Statistical associations of internal radiation with:
  - Thyroid cancer
  - Selected non-malignant thyroid diseases
- Incorporation of uncertainties
- Modification of radiation-disease relationship

Radiobiology, Molecular, Genomic & Epigenetic Research

- Non-targeted effects
- Adaptive responses
- DNA damage and repair
- Dose and dose rate effects
- Modulation of low-dose radiation effects by genetic and epigenetic factors
- Extrapolation of *in vitro* and animal responses to humans
- How endpoints examined after low-dose radiation may be related to health effects
- Advances in 'omics'

Morgan WF et al. Radiat Res 2013
Dauer LT et al. Radiat Prot Dosim 2010

Meeting Goals

- Is there sufficient new information to launch a comprehensive review for a BEIR VIII report?

  - Epidemiologic studies

  - Radiobiologic, molecular, genomic & epigenetic data

  - Integration of biologic and epidemiologic data

- What range of radiation exposure levels should be considered?