Risk assessment for radon: A quick overview

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Gilbert W. Beebe
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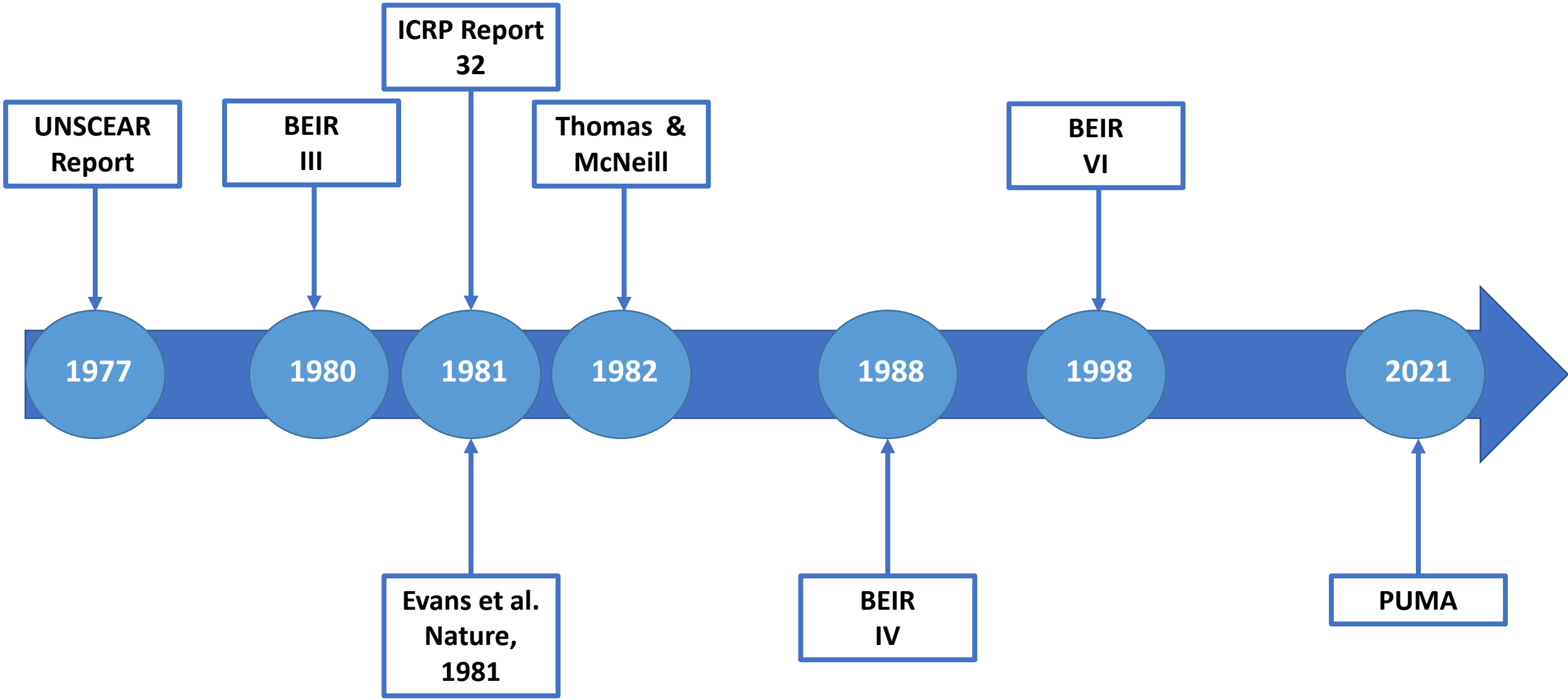
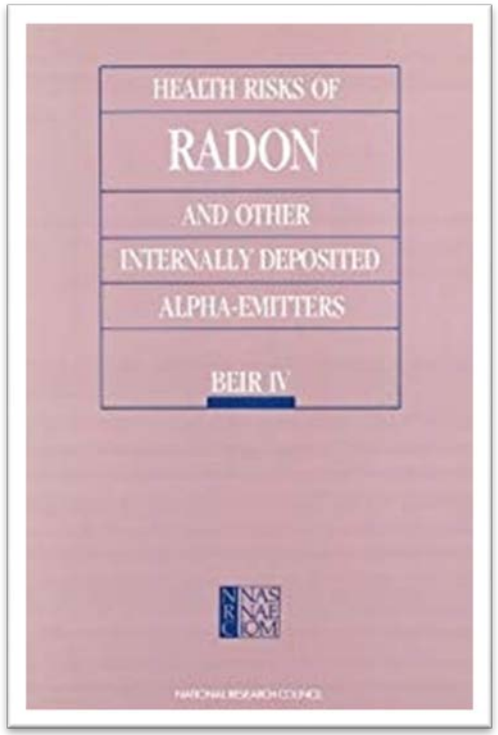
Timeline of Radon Lung Cancer Risk Assessment

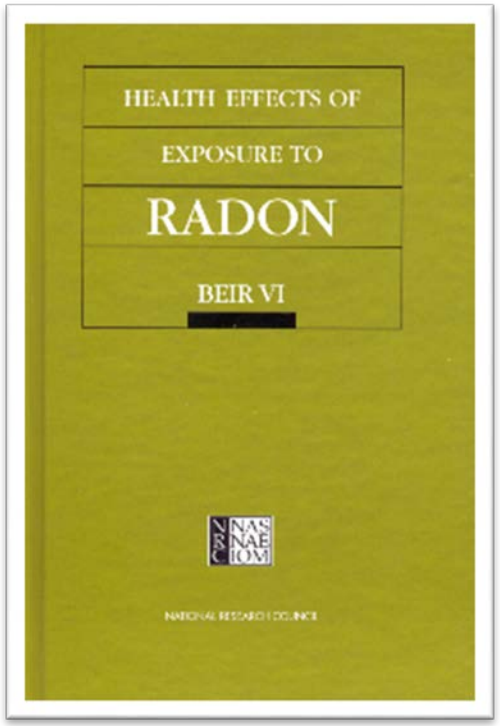


BEIR IV (1988)



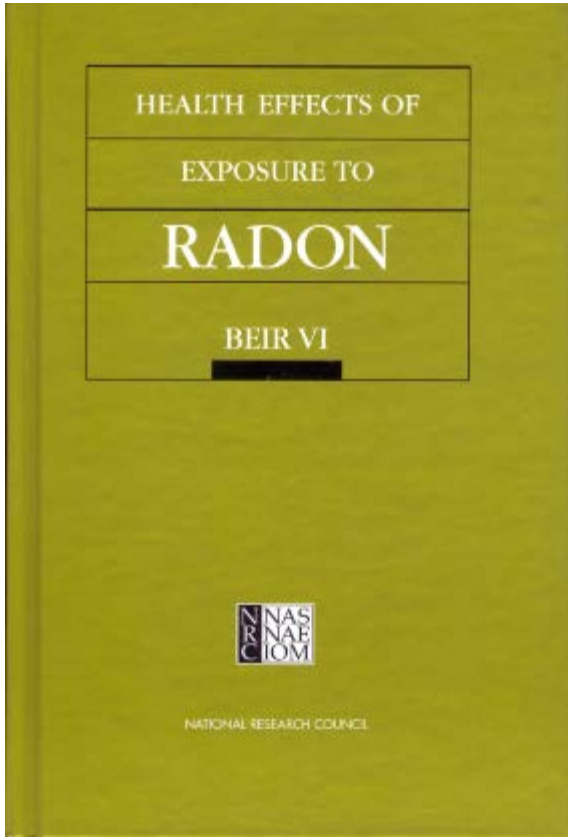
- Developed age- and time-dependent risk model based on four studies of underground miners
- Addressed lung dosimetry
- Estimated lifetime risks of lung cancer from radon; “lifetime lung cancer mortality rate associated with lifetime exposure at 0.2 WLM/yr is 0.074—an increase of about 10%”

BEIR VI (1998)



- Adopts linear no-threshold model for lung cancer risk
- BEIR VI model based on 11 cohorts of miners. Risk varies with:
  - Attained age
  - Time since exposure
  - Exposure rate
- Joint risk with smoking unclear
- Attributed US deaths 15.8-21.4K

BEIR VI: Assessing Radon's Risks



A Risk Model* For Lung Cancer and Radon

TSE/AGE/WL-cat model:

$$RR = 1 - \beta \times (w_{5\text{-}14} + \theta_2 w_{15\text{-}24} + \theta_3 w_{25+}) \times \phi_{age} \times \gamma_{WL}$$

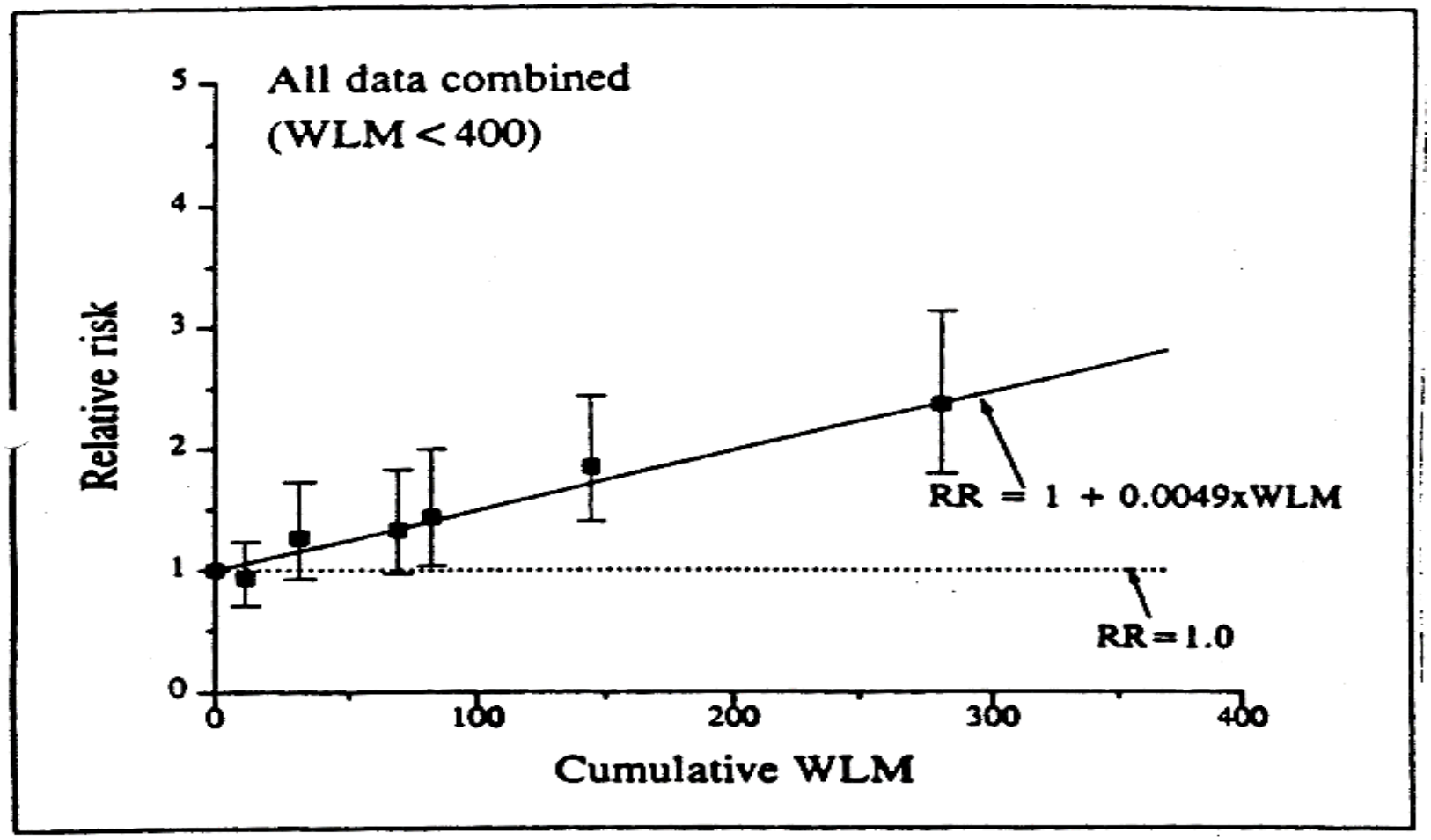
where $\beta = 0.0611$, $\theta_2 = 0.81$, $\theta_3 = 0.40$,

$$\phi_{age} = \begin{cases} 1.00 & \text{for age} < 55 \\ 0.65 & \text{for } 55 \le \text{age} < 65 \\ 0.38 & \text{for } 65 \le \text{age} < 75 \\ 0.22 & \text{for } 75 \le \text{age} \end{cases}$$

$$\gamma_{WL} = \begin{cases} 1.00 & \text{for WL} < 0.5 \\ 0.51 & \text{for } 0.5 \le \text{WL} < 1.0 \\ 0.32 & \text{for } 1.0 \le \text{WL} < 3.0 \\ 0.27 & \text{for } 3.0 \le \text{WL} < 5.0 \\ 0.13 & \text{for } 5.0 \le \text{WL} < 15.0 \\ 0.10 & \text{for } 15.0 \le \text{WL} \end{cases}$$

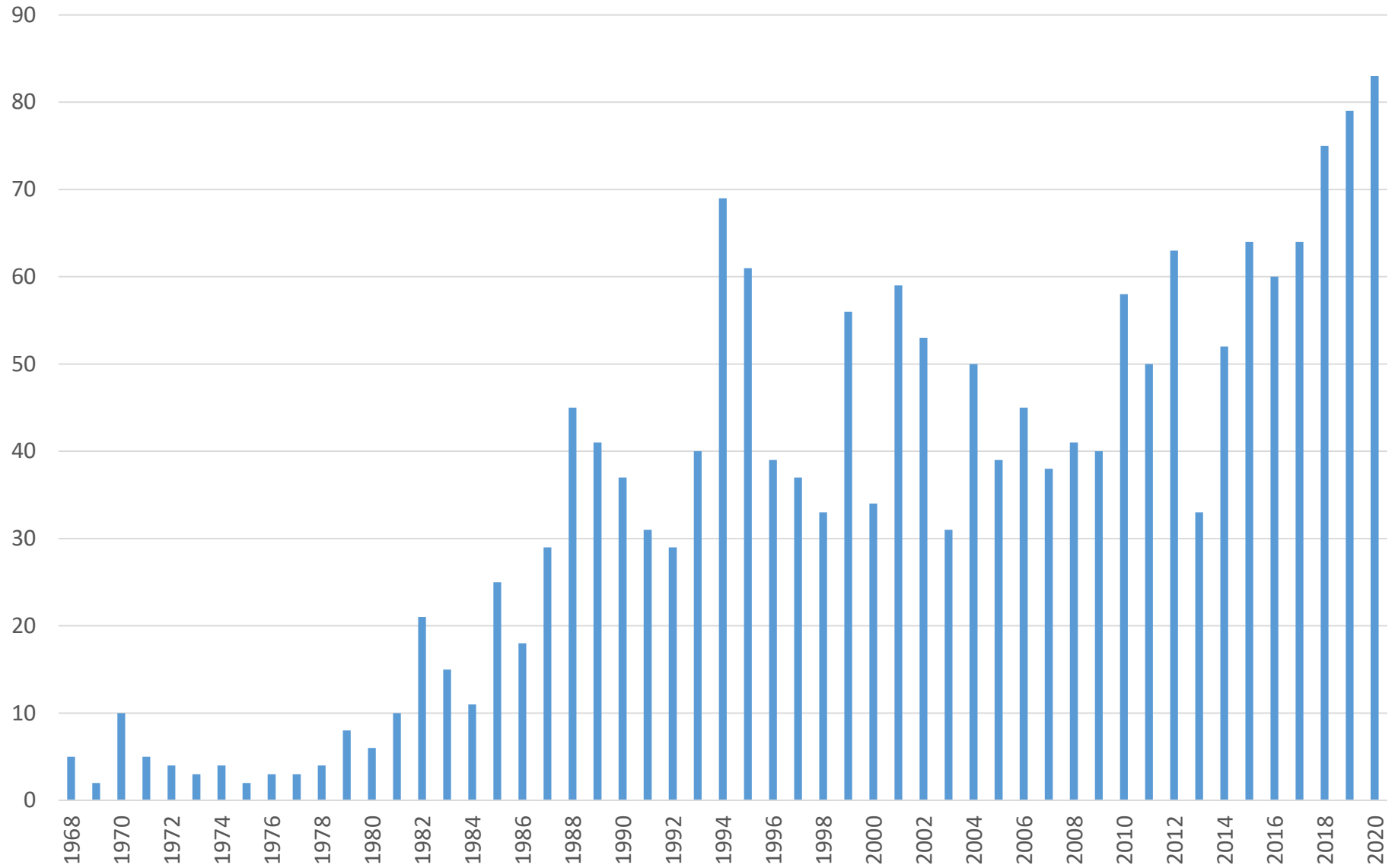
* Based on pooled analysis of 11 cohorts of miners.

Exposure-Response from 11 Miner Cohorts, Exposures < 400 WLM



Source: Lubin et al. J Natl Cancer Inst 1995; 87: 817-827

Radon and Lung Cancer Publications, The Last 50 Years



Radon since BEIR VI

- Bill Field: What we don't know about radon today.
- David Pawel and Bill Long: EPA's application of radon risk models: past, present, and future.
- David Richardson and Michaela Kreuzer: The pooled uranium miners analysis (PUMA).
- David Brenner and Igor Shuryak: Mechanistic studies on radon health effects.

TO BEER OR NOT TO BEIR?