Assessment of the Scientific Information for the Radiation Exposure Screening and Education Program

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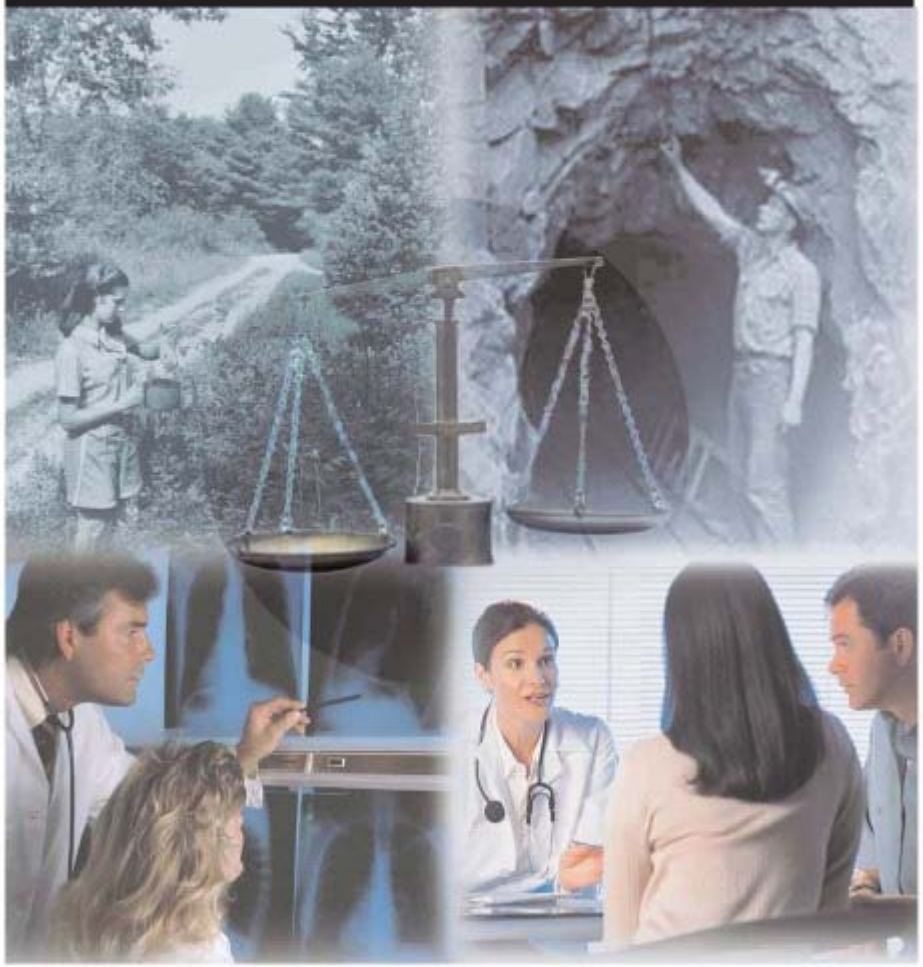
NATIONAL RESEARCH COUNCIL
OF THE NATIONAL ACADEMIES

ASSESSMENT OF THE **SCIENTIFIC INFORMATION** FOR THE **RADIATION EXPOSURE SCREENING** AND **EDUCATION PROGRAM**



RECA Criteria

- **The person is in a specific class defined by RECA**
- **The person has developed one of the specific cancers or other diseases specified by RECA**

RECA Criteria

Populations covered:

- **Uranium miners**
- **Uranium millers**
- **Ore transporters**
- **Downwinders**
- **On-site participants**

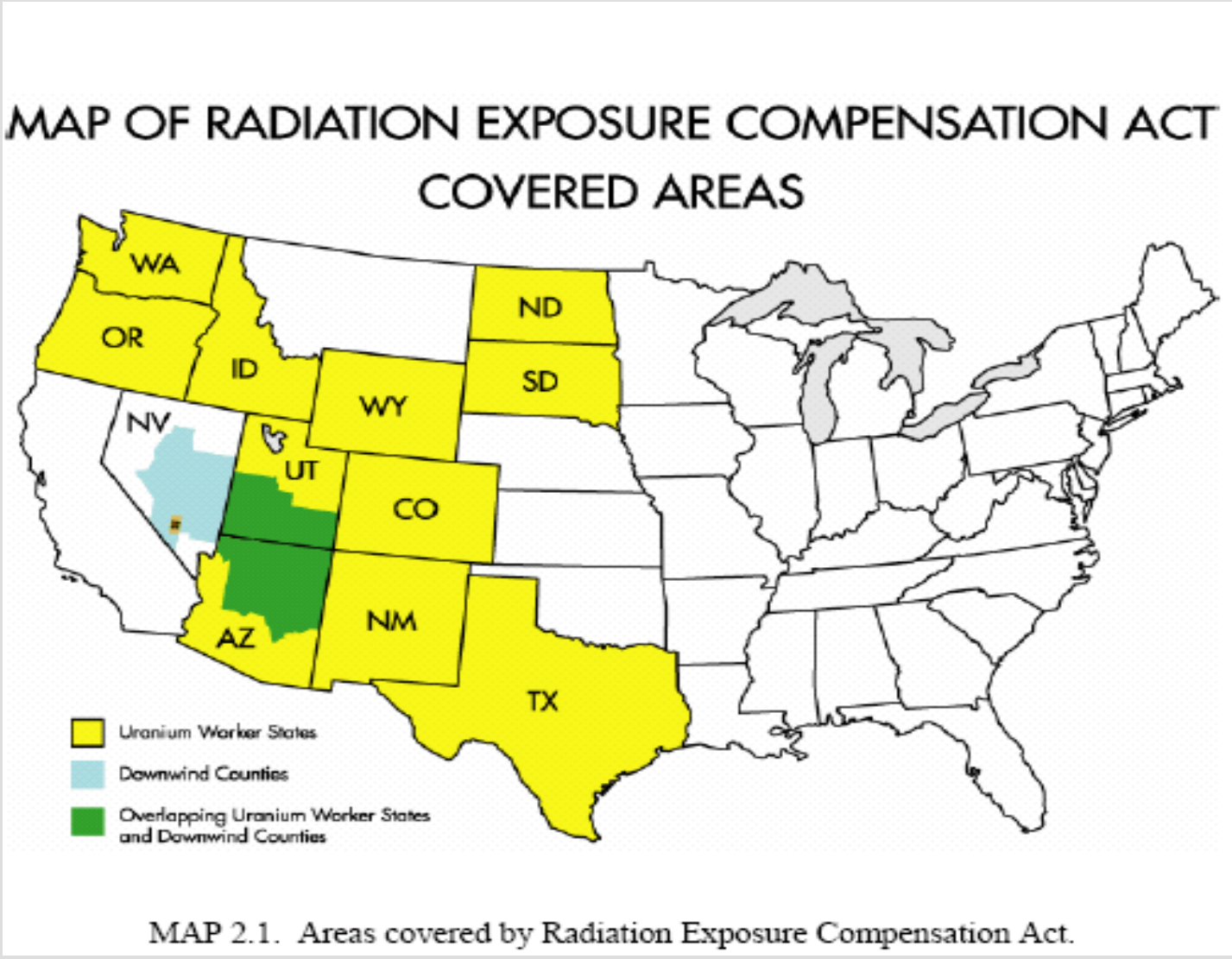
Diseases Covered by RECA

Table 2.1. Populations and Diseases Eligible for Compensation under RECA.

Diseases and Conditions	Uranium Miners	Uranium Millers	Ore Trans-porters	Down-winders	Onsite Participants
Malignant Neoplasms					
Bile ducts				√	√
Brain				√	√
Breast				√	√
Colon				√	√
Esophagus				√	√
Gall bladder				√	√
Leukemia[a]				√	√
Liver[b]				√	√
Lung cancer[c]	√	√	√	√	√
Multiple myeloma				√	√
Non-Hodgkins Lymphomas				√	√
Ovary				√	√
Pancreas				√	√
Pharynx				√	√
Renal Cancer		√	√		
Salivary Gland				√	√
Small intestine				√	√
Stomach				√	√
Thyroid				√	√
Urinary Bladder				√	√
Nonmalignant Conditions					
Chronic renal disease[d]		√	√		
Cor pulmonale[e]	√	√	√		
Pneumoconiosis	√	√	√		
Pulmonary fibrosis, fibrosis of lung	√	√	√		
Silicosis	√	√	√		

[a]Excluding chronic lymphocytic leukemia.
[b]Except when cirrhosis or hepatitis B is known to be included.
[c]Includes any physiologic condition of the lung, trachea, or bronchus that is recognized as lung cancer by the National Cancer Institute.
[d]Including nephritis and kidney tubal tissue injury.
[e]Relating to fibrosis of the lung.

Areas Covered by RECA



MAP 2.1. Areas covered by Radiation Exposure Compensation Act.

Charge to NAS Committee

- **Make recommendations to HRSA that are based on scientific knowledge and principles:**

  whether other classes of individuals or additional geographic areas should be covered under the RECA program

Dose Comparisons

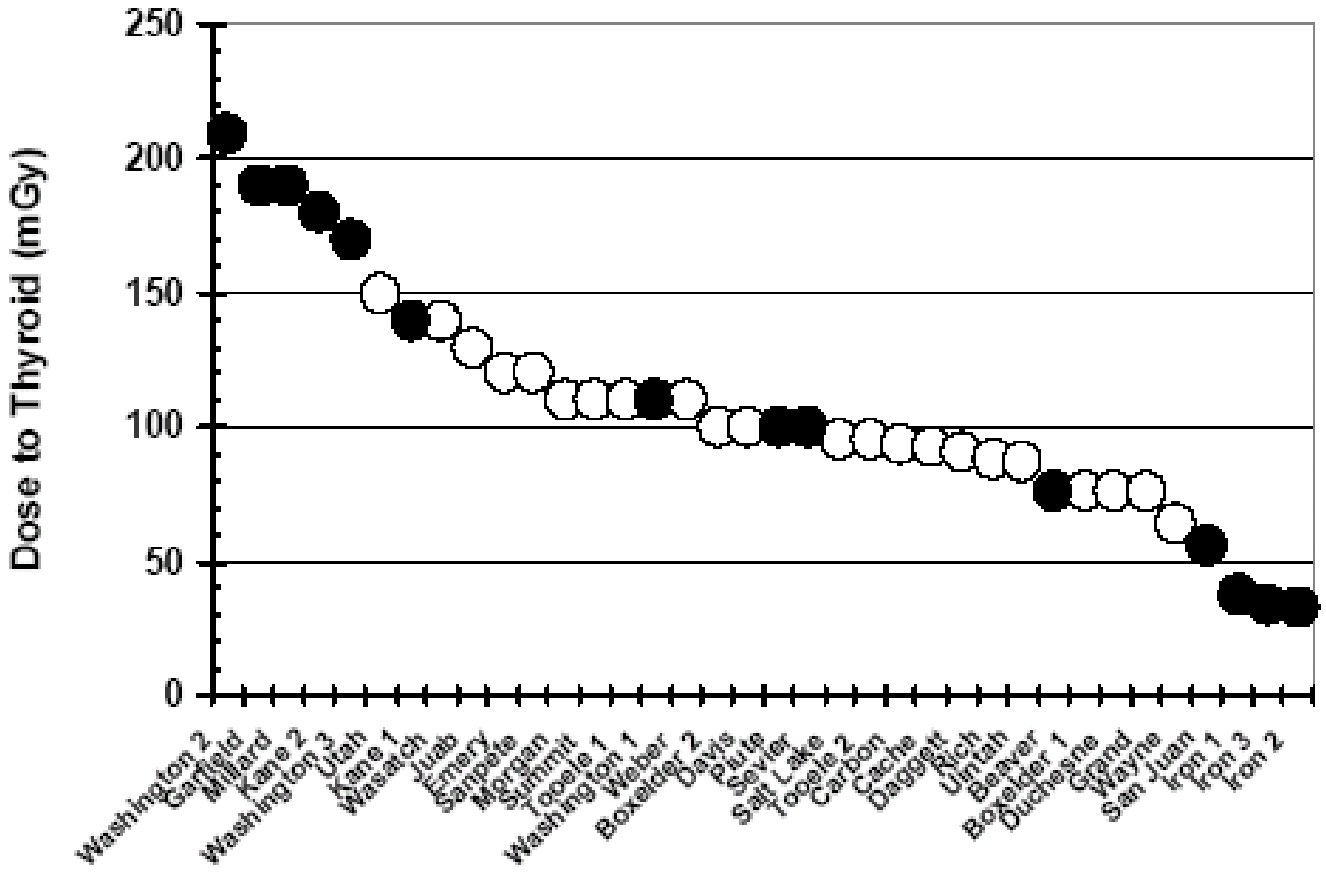


Figure 5.1. Calculated absorbed dose to the thyroid of a person born in 1948 who resided in same county in Utah for entire period of NTS testing.

Dose Comparisons (II)

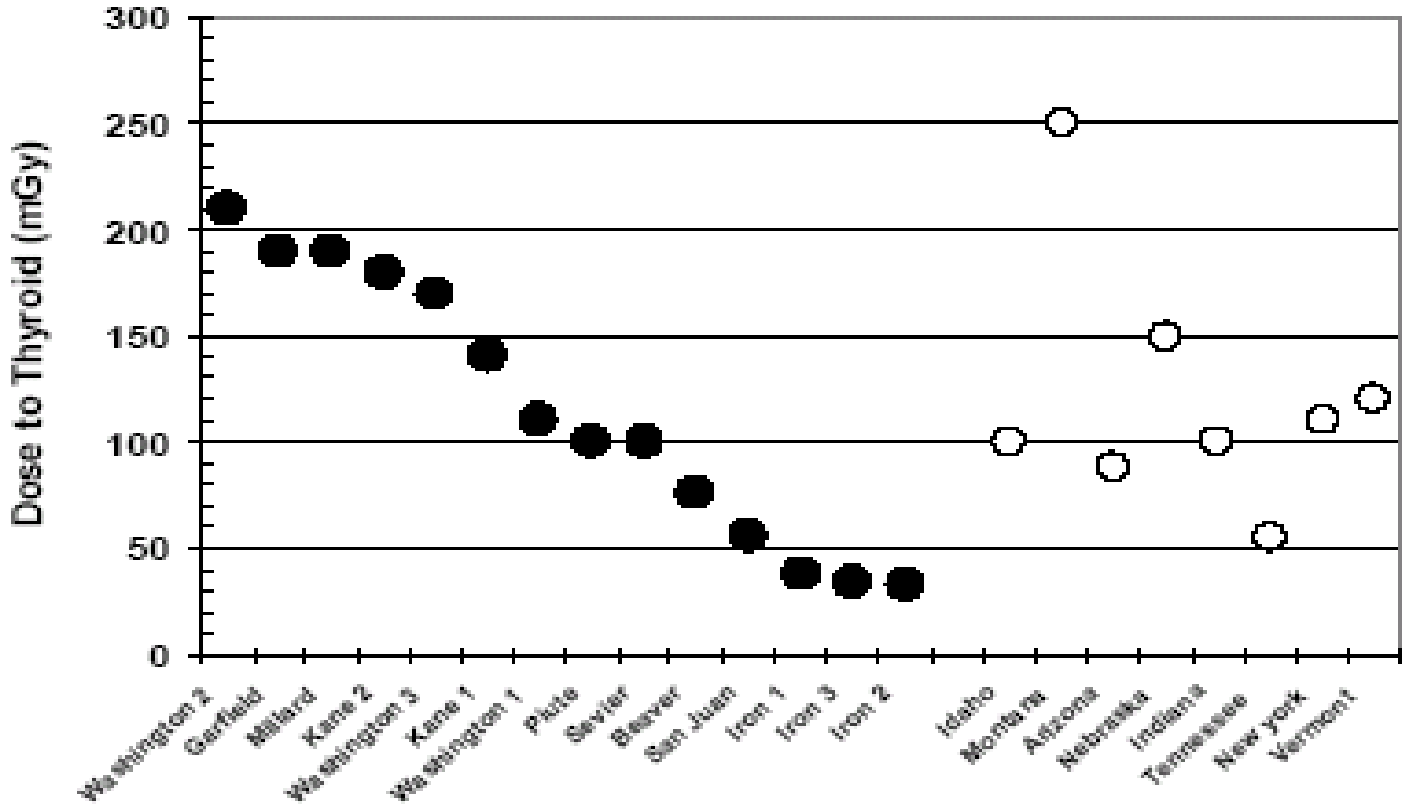


Figure 5.2. Calculated absorbed dose to the thyroid of a person born in 1948 who resided in same county for entire period of NTS testing. The solid circles are for counties in Utah that are currently eligible for compensation in RECA and the open circles are counties in states other than Utah.

Risk-Based Approach

The committee recognized that including absorbed dose in the determination of eligibility for compensation would not be sufficient because the risk of radiation-induced cancer depends on the age at exposure and age at diagnosis in addition to dose. A process based on risk would use dose and the other criteria to determine the probability that an identified cancer was caused by radiation rather than by other agents.

Probability of Causation (I)

One approach that is being used in US (REVCA and EEOICPA) and in the UK is referred to as probability of causation (PC) or assigned share (AS)

$$PC / AS = R_{rad} / R_{rad} + R_{baseline}$$

R_{rad} is the risk that a specific radiation-induced tumor will develop at a given age

$R_{baseline}$ is the risk that a specific cancer from all other causes will develop at the same age

Probability of Causation (II)

- A significant issue is the choice of a value of PC/AS that is accepted as “proof” that radiation was responsible for the diagnosed cancer in an individual.
- A PC/AS value of 0.5 assumes that it is as likely as not that the cancer was caused by radiation,. A PC/AS value of greater than 0.5 assumes that it is more likely than not that the cancer was caused by radiation.
- Uncertainty also needs to be incorporated into the decision-making process

Probability of Causation (III)

Obtaining a PC/AS is in effect a process of determining the ERR for a person exposed to radiation and diagnosed with cancer. The determination of an ERR for a particular person must rely on dosimetry to determine dose and how the ERR depends on dose. The dose is generally measured through a dose-reconstruction process.

Radiation Dose and Risk Assessment

NCI 1997 ^{131}I Study

- Radiation doses to the thyroid from ^{131}I released from tests at the NTS.The NAS Committee worked with updated maps provided by NCI including those that included other radioisiotopes.
- NCI developed dose calculator that uses date of birth, sex, locations and dates of residence and milk consumption patterns

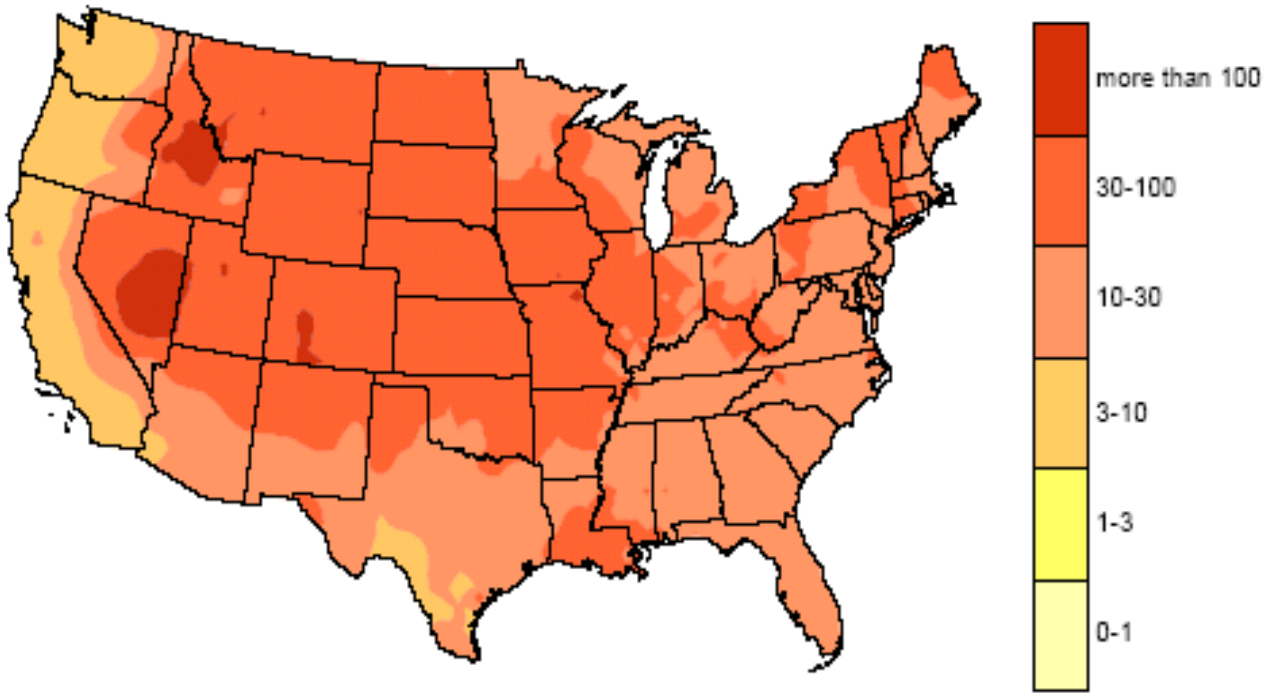


Figure 4.1. Geographic distribution of estimated total (external + internal) dose (mGy) from all NTS tests to the thyroid of children born on 1 January 1951 and who were average milk drinkers (map courtesy of National Cancer Institute).

CDC/NCI 2001 Draft Feasibility Study

- Calculates the deposition densities from NTS fallout for the 33 other radionuclides that contributed substantially to the radiation dose.
- In general, the doses are very low for radionuclides other than ^{131}I in comparison to the dose from external radiation.

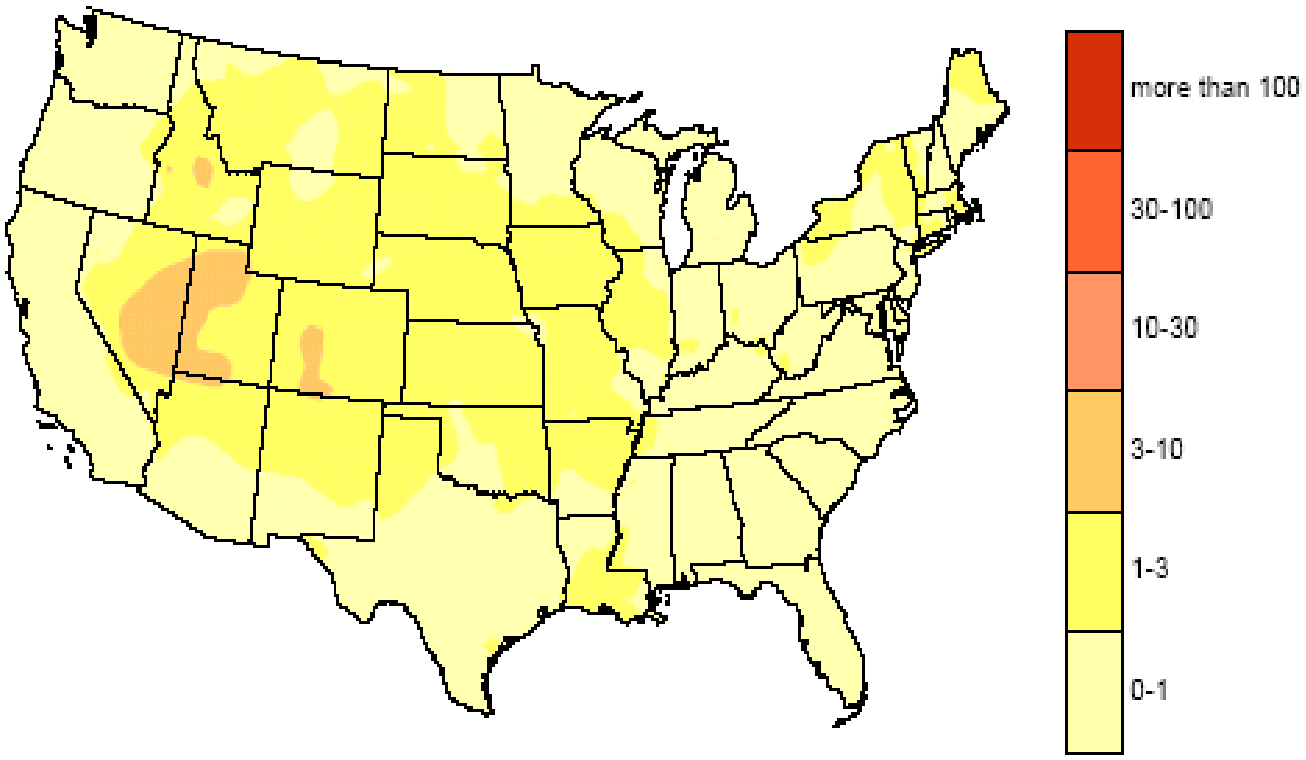


Figure 4.3. Geographic distribution of estimated total (external + internal) dose (mGy) from all NTS tests to the red bone marrow of children born on 1 January 1951 (map courtesy of National Cancer Institute).

Radiation Dose Estimation

- More work needed for ^{131}I dose and thyroid cancer risk based on new data
- NRC (2003) additional work for other radionuclides not warranted because of very small doses and uncertainties in distribution and location

Tools for Determining PC/AS (I)

- **NIH Radioepidemiological Tables**

The tables were intended to provide a means for estimating the likelihood that a person who has or had any of several radiogenic cancers developed it as a result of exposure to ionizing radiation from the nuclear weapons tests in Nevada.

Tools for Determining PC/AS (II)

- **Committee on Interagency Radiation Research and Policy Coordination (CIRRPC) Tables**

For screening claims of radiation-induced cancer. A person passed the screening test when there was at least a 1% probability that the estmated PC/AS exceeds 0.5. This will still avoid development of those cases for which there is virtually no chance that the true PC would be as large as 50%.

2003 Revisions to NCI-CDC

- New incidence and mortality risk data
- Calculation of risk and AS for all ages at exposure
- New cancer sites
- New analytic approaches
- More attention to uncertainty and presentation of risk
- Use of organ-specific equivalent dose
- **Interactive Radio-Epidemiological Program** (IREP 5.3) developed for estimating PC/AS

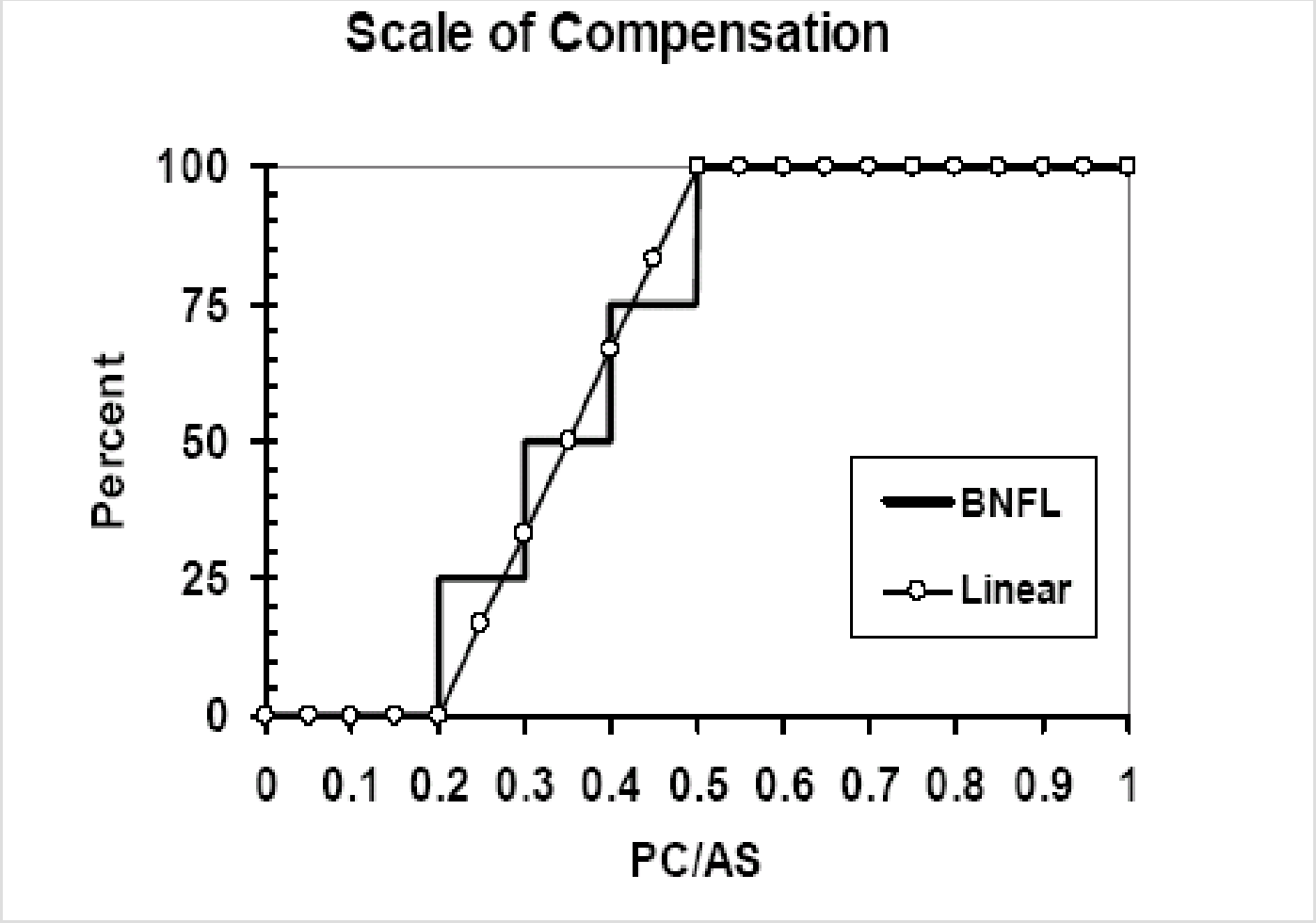
Implementation of IREP

Compensation Programs

- NIOSH-IREP in use
- EEOICPA uses modified NIOSH-IREP

Use of PC/AS in Adjudication

- British Nuclear Fuels Ltd developed Compensation Scheme for Radiation-Linked Diseases (CSRLD)
- Adapted from risk-projection models developed by BEIR V
- Uses a sliding scale for compensation


Scale of Compensation
100
75
50
25
0
Percent
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
PC/AS
BNFL
Linear

Recommendations (I)

- Congress should establish a process using probability of causation/assigned share (PC/AS) to determine the eligibility of any new claim for compensation for a specified RECA-compensable disease in people who may have been exposed to radiation from fall-out from US nuclear weapons testing. Further, Congress should establish criteria for awarding compensation on the basis of computed distributions of PC/AS for any person making such a claim.

Recommendations (II)

- Prior to implementation of the revised compensation program, the NCI or other appropriate agencies should perform a population-based preassessment of all radiogenic diseases using PC/AS to provide guidance to individuals who might apply for compensation by determining the likelihood any individuals in a given population have of being compensated. The calculation would use data for the maximal doses that such individuals may have received from fallout.

Recommendations (III)

- Uncertainties in PC/AS cannot be avoided and may be part of the compensation decision process. Because of substantial gaps in the existing data, the uncertainties in estimated doses - - - - the uncertainties in the associated PC/AS estimate are large. This emphasizes the need to choose compensation criteria carefully. For example, the PC/AS value associated with a high percentile of uncertainty could exceed the criteria for compensation even for some very small median doses.

Recommendations (IV)

- The CDC and the NCI or other appropriate agency should complete dose estimates for all significant radionuclides in fallout from US nuclear weapons testing to the population groups identified. This should include all the major sources of dose related to nuclear weapons tests considered to have potential health consequences that the CDC-NCI 2001 draft feasibility study described.

Recommendations (V)

- An updated dose calcualtor, similar to the existing NCI dose calculator for ^{131}I, should be developed for determining dose to the thyroid and other importaant organs from fallout. Such an updated dose calculator should be directly coupled to a risk calculator similar to IREP Version 5.3 that can compute PC/AS and propagate uncertainties for establishing credibility intervals. (This should be maintained.)

Recommendations (VI)

- On the basis of currently available scientific evidence, no additional diseases should be added to the list of diseases that should be considered for compensation under RECA.

COMMITTEE TO ASSESS THE SCIENTIFIC INFORMATION FOR THE RADIATION EXPOSURE SCREENING AND EDUCATION PROGRAM

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