

each dose estimate. Dose estimates will be distinguished by type of radiation (low linear energy transfer (LET), protons, neutrons, alpha, low-energy x-ray) and by dose rate (acute or chronic) for external and internal radiation dose.

### Subpart D—Requirements for Risk Models Used To Estimate Probability of Causation

#### §81.10 Use of cancer risk assessment models in NIOSH IREP.

(a) The risk models used to estimate probability of causation for covered employees under EEOICPA will be based on risk models updated from the 1985 NIH Radioepidemiological Tables. These 1985 tables were developed from analyses of cancer mortality risk among the Japanese atomic bomb survivor cohort. The National Cancer Institute (NCI) and Centers for Disease Control and Prevention (CDC) are updating the tables, replacing them with a sophisticated analytic software program. This program, the Interactive RadioEpidemiological Program (IREP)<sup>1</sup>, models the dose-response relationship between ionizing radiation and 33 cancers using morbidity data from the same Japanese atomic bomb survivor cohort. In the case of thyroid cancer, radiation risk models are based on a pooled analysis of several international cohorts<sup>1a</sup>.

(b) NIOSH will change the risk models in IREP, as needed, to reflect the radiation exposure and disease experiences of employees covered under EEOICPA, which differ from the experiences of the Japanese atomic bomb survivor cohort. Changes will be incorporated in a version of IREP named NIOSH-IREP, specifically designed for adjudication of claims under EEOICPA. Possible changes in IREP risk models include the following:

(1) Addition of risk models to IREP, as needed, for claims under EEOICPA

<sup>1</sup>NIOSH-IREP is available for public review on the NIOSH homepage at: [www.cdc.gov/niosh/ocas/ocasirep/html](http://www.cdc.gov/niosh/ocas/ocasirep/html).

<sup>1a</sup>Ron E, Lubin JH, Shore RE, et al. "Thyroid cancer after exposure to external radiation: a pooled analysis of seven studies." *Radiat. Res.* 141:259-277, 1995.

(e.g., malignant melanoma and other skin cancers)

(2) Modification of IREP risk models to incorporate radiation exposures unique to employees covered by EEOICPA (e.g., radon and low energy x rays from employer-required medical screening programs, adjustment of relative biological effectiveness distributions based on neutron energy).

(3) Modification of IREP risk models to incorporate new understanding of radiation-related cancer effects relevant to employees covered by EEOICPA (e.g., incorporation of inverse dose-rate relationship between high LET radiation exposures and cancer; adjustment of the low-dose effect reduction factor for acute exposures).

(4) Modification of IREP risk models to incorporate new understanding of the potential interaction between cancer risk associated with occupational exposures to chemical carcinogens and radiation-related cancer effects.

(5) Modification of IREP risk models to incorporate temporal, race and ethnicity-related differences in the frequency of certain cancers occurring generally among the U.S. population.

(6) Modifications of IREP to facilitate improved evaluation of the uncertainty distribution for the probability of causation for claims based on two or more primary cancers.

#### §81.11 Use of uncertainty analysis in NIOSH-IREP.

(a) EEOICPA requires use of the uncertainty associated with the probability of causation calculation, specifically requiring the use of the upper 99% confidence interval (credibility limit) estimate of the probability of causation estimate. As described in the NCI document,<sup>2</sup> uncertainty from several sources is incorporated into the probability of causation calculation performed by NIOSH-IREP. These sources include uncertainties in estimating: radiation dose incurred by the covered employee; the radiation dose-cancer relationship (statistical uncertainty in the specific cancer risk

<sup>2</sup>Draft Report of the NCI-CDC Working Group to Revise the 1985 NIH Radioepidemiological Tables, May 31, 2000, p. 17-18, p. 22-23.

model); the extrapolation of risk (risk transfer) from the Japanese to the U.S. population; differences in the amount of cancer effect caused by different radiation types (relative biological effectiveness or RBE); the relationship between the rate at which a radiation dose is incurred and the level of cancer risk produced (dose and dose rate effectiveness factor or DDREF); and, the role of non-radiation risk factors (such as smoking history).

(b) NIOSH-IREP will operate according to the same general protocol as IREP for the analysis of uncertainty. It will address the same possible sources of uncertainty affecting probability of causation estimates, and in most cases will apply the same assumptions incorporated in IREP risk models. Different procedures and assumptions will be incorporated into NIOSH-IREP as needed, according to the criteria outlined under § 81.10.

#### **§ 81.12 Procedure to update NIOSH-IREP.**

(a) NIOSH may periodically revise NIOSH-IREP to add, modify, or replace cancer risk models, improve the modeling of uncertainty, and improve the functionality and user-interface of NIOSH-IREP.

(b) Revisions to NIOSH-IREP may be recommended by the following sources:

- (1) NIOSH,
- (2) The Advisory Board on Radiation and Worker Health,
- (3) Independent reviews of NIOSH-IREP or elements thereof by scientific organizations (e.g., National Academy of Sciences),
- (4) DOL,
- (5) Public comment.

(c) NIOSH will submit substantive changes to NIOSH-IREP (changes that would substantially affect estimates of probability of causation calculated using NIOSH-IREP, including the addition of new cancer risk models) to the Advisory Board on Radiation and Worker Health for review. NIOSH will obtain such review and address any recommendations of the review before completing and implementing the change.

(d) NIOSH will inform the public of proposed changes provided to the Advisory Board for review. HHS will pro-

vide instructions for obtaining relevant materials and providing public comment in the notice announcing the Advisory Board meeting, published in the FEDERAL REGISTER.

(e) NIOSH will publish periodically a notice in the FEDERAL REGISTER informing the public of proposed substantive changes to NIOSH-IREP currently under development, the status of the proposed changes, and the expected completion dates.

(f) NIOSH will notify DOL and publish a notice in the FEDERAL REGISTER notifying the public of the completion and implementation of substantive changes to NIOSH-IREP. In the notice, NIOSH will explain the effect of the change on estimates of probability of causation and will summarize and address relevant comments received by NIOSH.

(g) NIOSH may take into account other factors and employ other procedures than those specified in this section, if circumstances arise that require NIOSH to implement a change more immediately than the procedures in this section allow.

### **Subpart E—Guidelines To Estimate Probability of Causation**

#### **§ 81.20 Required use of NIOSH-IREP.**

(a) NIOSH-IREP is an interactive software program for estimating probability of causation for covered employees seeking compensation for cancer under EEOICPA, other than as members of the Special Exposure Cohort seeking compensation for a specified cancer.

(b) DOL is required to use NIOSH-IREP to estimate probability of causation for all cancers, as identified under §§ 81.21 and 81.23.

#### **§ 81.21 Cancers requiring the use of NIOSH-IREP.**

(a) DOL will calculate probability of causation for all cancers, except chronic lymphocytic leukemia as provided under § 81.30, using NIOSH-IREP.

(b) Carcinoma in situ (ICD-9 codes 230–234), neoplasms of uncertain behavior (ICD-9 codes 235–238), and neoplasms of unspecified nature (ICD-9 code 239) are assumed to be malignant,