

NMMSS



2011

Users Annual Training Meeting

San Diego, CA  
May 17-19, 2011

Accountability

Accuracy

Compliance

# Applicability of NMMSS Data to Health Physics: Dose Reconstruction

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***Disclaimer:** the findings and conclusions in this presentation have not been formally reviewed by the National Institute for Occupational Safety and Health and should not be construed to represent agency determination or policy.*

# Agenda

- Genesis of the EEOICPA, Subtitle B
- The ways NMMSS Dosimetry is Used in Dose Reconstruction
- IREP Model and Availability
- Special Exposure Cohort (SEC)
- Status of Project

- Energy Employee Occupational Illness Compensation Program Act
- Enacted December 2000, amended multiple times
- Current Program contains 3 distinct parts.
  - Subpart B: Radiation-related Cancer
  - Subpart B: Beryllium Disease
  - Subpart E: Toxic Exposure



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# Executive Order

- EEOICPA established the program and gave the President the responsibility to carry it out.
- Executive Order 13179 delegated the authority of various departments within the Executive Branch
- DOL has overall responsibility
- HHS and DOE have specific functions



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# Subpart B – Radiation-related Cancer

- Administered by Department of Labor
- HHS/NIOSH/DCAS responsible for conducting dose reconstruction
- ORAU is the prime contractor
  - MJW Technical Services
  - Dade Moeller & Associates
  - Various Specialty Subcontractors



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# Radiation Related Cancer

- Open to employees who worked at DOE sites or AWEs (Atomic Weapons Employers) at specific time periods
- Claimant must establish employment and cancer
- Open to survivors of employees
- Two means of compensation
  - Special Exposure Cohort (SEC)
  - "At least as likely as not" (Dose Reconstruction)



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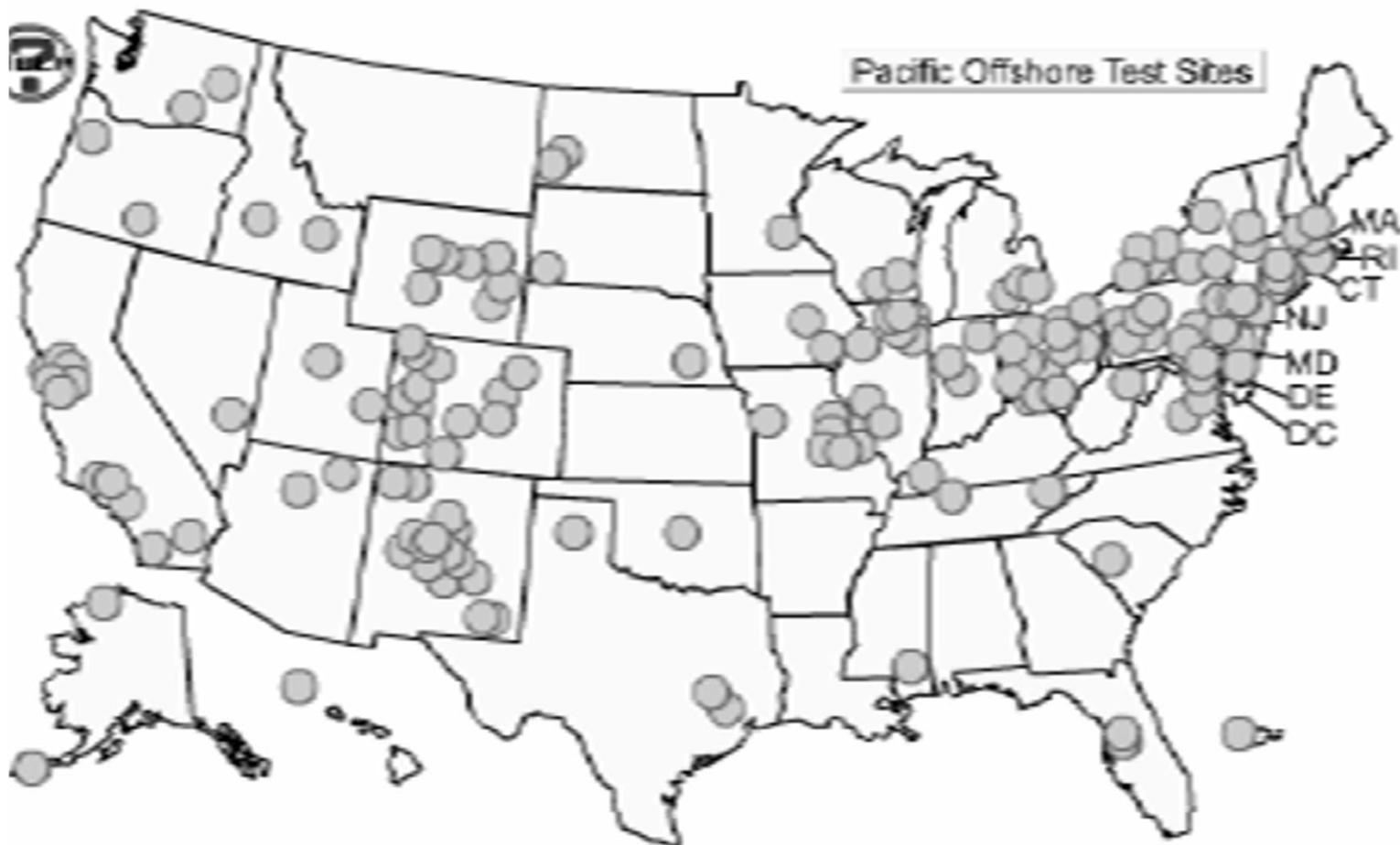
# Activities Covered

- Nuclear weapons programs of the U.S. Department of Energy
- Includes its predecessor agencies:
  - Manhattan Project
  - Atomic Energy Commission
  - Energy Research & Development Administration



# DOE Weapons Complex

(Circa Mid 1950s-Mid 1960s)



# Covered Cancers

- Leukemia, lung cancer, bone cancer, renal (kidney) cancer, multiple myeloma (spine), and lymphomas
- Cancers of thyroid, breast, esophagus, stomach, pharynx, small intestine, pancreas, bile duct, gall bladder, etc.
- Basically all cancers except Chronic lymphocytic leukemia (CLL) are considered for compensation

# Most Common EEOICPA Cancers

- The following types of cancer accounted for about 3/5 of all cancers reported by EEOICPA claimants:
  - Non-melanoma skin cancers (~36%)
  - Male genital cancers (~14%)
  - Lung cancer, incl. trachea & bronchus (~11%)

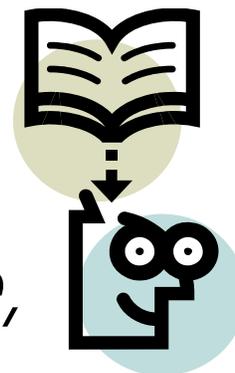


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# Ways that NMMSS Data are used in Dose Reconstruction

# SITE PROFILES

*A Site Profile describes the physical appearance and layout of a work site, the work processes used there, the types of materials used, potential sources of radiation, and other details important at that work site*





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# What Kind of Data do SITE PROFILES Include?

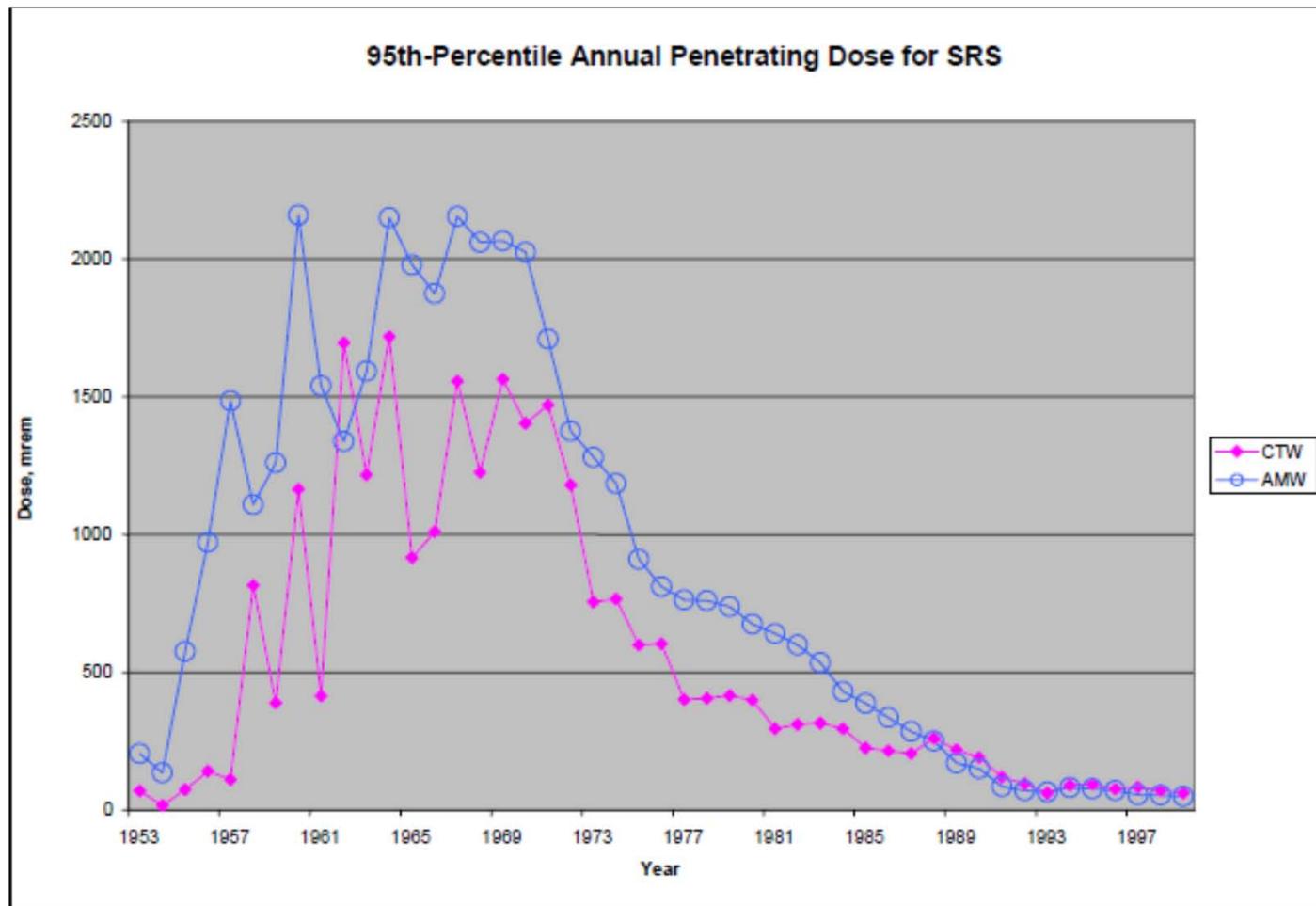
- Types of Radioactive Material Handled
- Nature of Site Exposures
- Applicable Protection Practices
- Applicable Dosimetry/Bioassay Practices
- Monitored Activities
- Time-Trend Changes
- Changes in Dosimetry Record Keeping Practices

# Types of Dosimetry Data used in SITE PROFILES

- Radiation Doses from:
  - Medical Examinations (required)
  - External Exposures
  - Internal Exposures
  - Environmental Exposures
  - Contamination Events and Releases
- Co-Worker Studies



# Co-Worker Data



- Integrated Modules for Bioassay Analysis
- Proprietary ICRP 68-based code
- Integrated calculation of IRFs, fitting of bioassay data, and calculation of doses into one GUI software package
- Intake analysis can be based on various measurements (urine, feces, lung and whole body counts, and more)
- Run on MS Windows



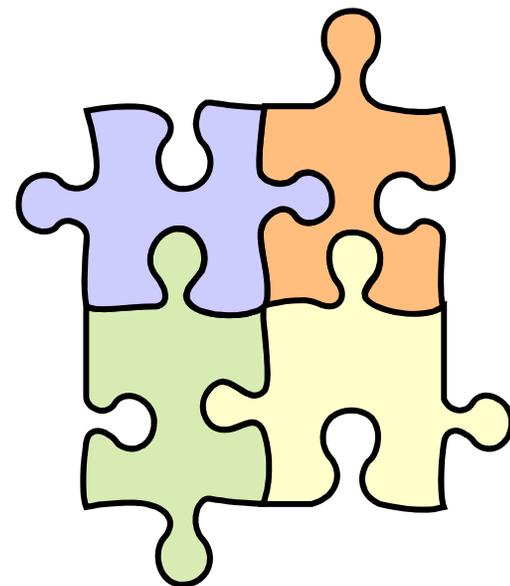
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# IMBA Output



# Hierarchy of Data

- Personal dosimetry data
- Personal monitors
- Co-worker data
- Surrogate data (?)
- Area monitoring data
- Source term data



# Dose Reconstruction

(Approved Methodologies)

- **Underestimates** (clearly COMP claims)
- **Overestimates** (clearly non-COMP claims)
- **Best Estimates** (typically used for claims between 45-52% PC)
- **Partial Dose Reconstructions** (Non-presumptive cancer claims that were part of an approved SEC class)



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# **Interactive Radio- Epidemiological Program (IREP)**



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# What Does NIOSH-IREP Do?

- Computes the statistical probability that a cancer was caused by occupational radiation exposure (Upper 99% confidence limit determines claim outcome)
- Uses epidemiological & mathematical cancer risk models
- Incorporates “uncertainties” (e.g., inexact data, assumptions, etc.) associated with risk modeling
- Calculates probability of causation and displays results on printable summary report

# Probability of Causation

(Calculation Formula)

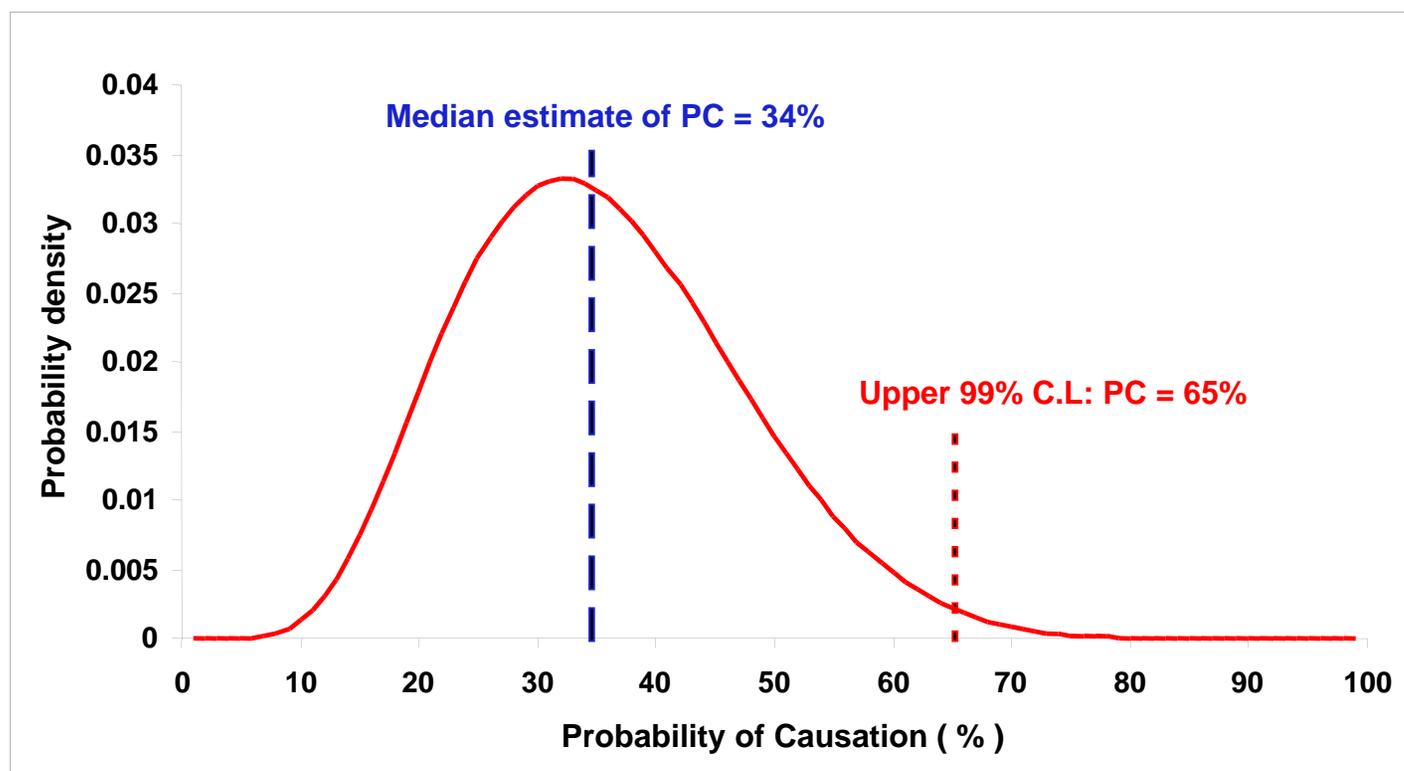
Probability of Causation (PoC) =

$$\frac{\text{Risk of cancer from occupational radiation exposure}}{\text{Total risk of cancer}^*}$$

\*Total risk of cancer = Risk from occupational radiation exposure + risk from all other sources

# Credibility Limits

Example: man exposed to 6 rem at age 40,  
diagnosed with leukemia at age 50



# IREP Results

Summary Report - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Home Search Favorites Media Print W

Address [http://www.niosh-irep.com/irep%5Fniosh/summ\\_report.asp](http://www.niosh-irep.com/irep%5Fniosh/summ_report.asp) Go Links SnagIt

1	1970	Triangular (2,4,8)	chronic	photons E>250keV
2	1971	Triangular (2,4,8)	chronic	photons E>250keV
3	1972	Triangular (2,4,8)	chronic	photons E>250keV

Radon Exposure Information:

Exposure #	Exposure Year	Exposure (wlm)
1	1970	Lognormal (0.4,2)
2	1971	Lognormal (0.4,2)
3	1972	Lognormal (0.4,2)

Probability of Causation (PC) \*

1st percentile	0.68 %
5th percentile	1.15 %
50th percentile	5.41 %
95th percentile	18.04 %
99th percentile	27.52 %

\* NIOSH-IREP is programmed with two different lung cancer risk models. Under current guidelines, each lung cancer claim is run separately using both risk models and the higher PC will determine the outcome of the claim. The results displayed above are derived from the **NIH-IREP lung model**, which is the model that produced the higher PC at the 99th percentile for this particular claim. The lower PC at the 99th percentile, derived from the **NIOSH-IREP lung model**, is 26.36 %. This lower PC value is reported here for information only and will have no bearing on the claim outcome.

Done Internet

# Use of Upper 99<sup>th</sup> Percentile C.L.

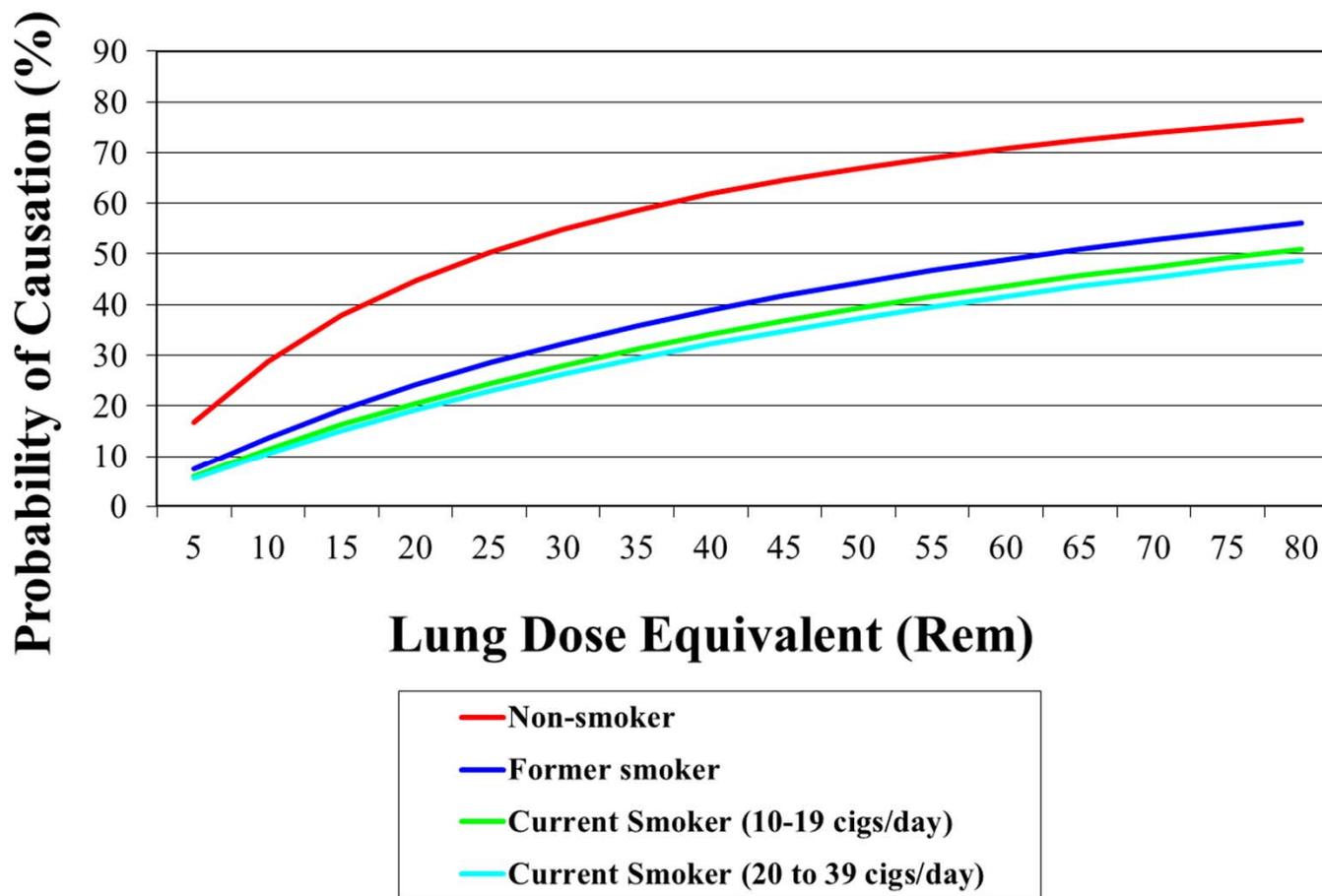
- Hypothetical example:
  - Male exposed to 6 rem at age 40
  - Diagnosed with leukemia at age 50
- Median value of PC, before placing credibility limits around estimate, is 34% (i.e., not compensable)
- Apply credibility limits: PC at upper 99<sup>th</sup> percentile C.L = 65% (claim is now compensable)

- Computerized update (introduced in 2002) of radio-epidemiological risk tables (1985)
- Web-based interactive software program; current version is v5.6
- Based on methods and risk models developed by the National Cancer Institute (NCI), adapted and modified by NIOSH/SENES for EEOICPA
- Maintained by NIOSH for operation by DOL
- Available to the public; requires no password

# Smoking History

- Applies only to cigarette smoking
- Adjusts ( $\uparrow$  or  $\downarrow$ ) the probability that lung cancer was induced by radiation exposure
- Usually based on claimant's self-report, but may also be derived from medical records
- Intended to be a snapshot of worker's smoking status at the time the cancer was diagnosed

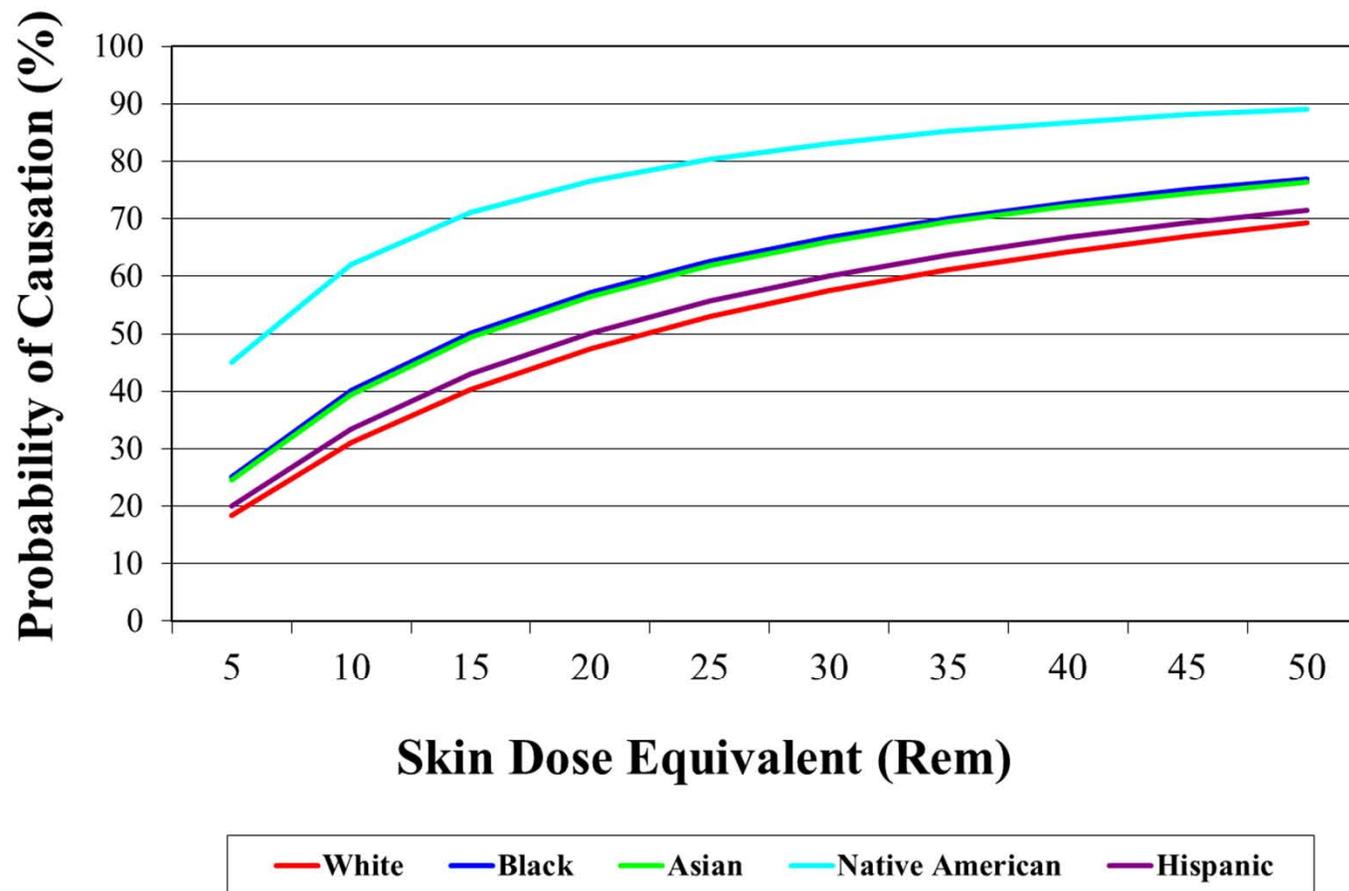
# Smoking History



- Applies only to skin cancer
- 5 ethnic categories in IREP:
  - American Indian or Alaska Native
  - Asian, Native Hawaiian, or other Pacific Islander
  - Black
  - White – Hispanic
  - White – Non-Hispanic
- Self-reported (multiple categories possible)

# MALIGNANT MELANOMA

## Race Specific





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# Multiple Primary Cancers

## How are PCs from Multiple Cancers Combined?

### **Probability of Causation (PC) for Multiple Primary Cancers**

This page shows the Total PC for claimants with multiple primary cancers. The following equation is used in accordance with 42 CFR Part 81, Guidelines for Determining the Probability of Causation Under the Energy Employees Occupational Illness Compensation Program Act of 2000; Final Rule, Department of Health and Human Services.

### **GENERAL EQUATION:**

$$PC_{\text{total}} = 1 - [(1-PC_1) \times (1-PC_2) \times \dots \times (1-PC_n)]$$

where,

$PC_{\text{total}}$  = total probability of causation

$PC_1$  = probability of causation for the first primary cancer

$PC_2$  = probability of causation for the second primary cancer

$PC_n$  = probability of causation for the  $n^{\text{th}}$  primary cancer



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# Probability of Causation: Summary

- NIOSH-IREP calculates PC according to each claimant's unique set of circumstances
- PC depends on cancer risk, dose & dose-response factors, personal data, and uncertainty"
- The role of workplace radiation exposure in causing a specific cancer is difficult to determine
- Use of credibility limits provides benefit of doubt
- Claim is considered compensable if  $PC \geq 50\%$  at the upper 99<sup>th</sup> percentile credibility limit

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# SPECIAL EXPOSURE COHORTS

“When Dose Reconstruction is not Possible”

# SPECIAL EXPOSURE COHORT

## SEC BY THE ACT:

- Employees at Gaseous Diffusion Plants at Oak Ridge, TN, Paducah, KY, and Portsmouth, OH
- Participants in Nuclear Tests on Amchitka Island, AK, Prior to 1/1/74

## All Other Exposure Cohorts:

- Dose reconstructions cannot be completed with sufficient accuracy  
**and**
- There is a reasonable likelihood that such radiation dose may have endangered the health of members of the class



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# Both SEC Petitions (83.13 and 83.14)

- NIOSH evaluates and recommends cohorts to the ABRWH
- ABRWH recommends establishing new cohorts
- HHS Secretary approves new cohorts
- HHS Secretary decision becomes final in 30 days, unless congress acts
- Compensation is \$150K plus medical costs incurred AFTER claim was filed



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# Project-Wide Summary

1. # DOE/AWE sites.....365
2. # of Cases Referred to NIOSH.....47,658
3. # of Cases Returned to DOL.....45,519
4. # of Cases to be completed.....2,139
5. Compensation Rate (%).....34%
6. SEC Petitions:
  - **83.13:** 149 Filed; 73 Qualified; 37 Approved by HHS
  - **83.14:** 37 Filed; 37 Qualified; 34 Approved by HHS



# Questions?

