



# **Reducing Occupational Dose Limits**

**SECY-12-0064**

**Recommendations for Policy and Technical Direction to  
Revise Radiation Protection Regulations and Guidance**

*Advisory Committee on the Medical Uses of Isotopes  
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# Background

- NRC regulations based on national and international recommendations
  - NCRP, BEIR
  - ICRP, UNSCEAR
- 10 CFR Part 20 last major revision in 1991, based in ICRP Publication 26 from 1977
- Other portions of regulations still based on ICRP Publications 1 and 2, 1959 and 1960

# Background

- ICRP revised recommendations announced in December, 2007
- NRC staff analysis indicated areas warranting consideration for revisions – SECY-08-0197, December, 2008
- Commission approved staff recommendation to engage stakeholders and initiate development of technical basis materials on April 2, 2009
- Staff Recommendations – SECY-12-0064, April 25, 2012

# Outreach Activities

- Phase I of outreach included:
  - Presentations to numerous organizations and groups
  - FRN published inviting inputs (72 FR 32198)
- Phase II Workshops
  - FRN published with issues and questions (75 FR 59160)
  - Workshops in Washington, Los Angeles, and Houston
  - Comments accepted through January 31, 2011

# Outreach Activities

- Phase III
  - FRN published for lens of the eye (76 FR 53847)
  - FRN closed October 31, 2011

# Stakeholder Dialogue

- Total of 59 comments docketed
- General support for changes to reflect current dose calculation methodology and terminology
- Opposition to changes to dose limits and ALARA provisions
  - View that risk did not warrant changes
  - View that impacts would be unacceptable
  - View that sources and uses in US are different, and justify different limits

# Radiation Risk

- Current basis supporting NRC regulations is a mixture of risk information ranging from 1958 to 1990
- 10 CFR Part 20 based on assumed risk of  $1.25 \times 10^{-4}$  per rem cancer mortality and risk of heritable disease

# Radiation Risk

- Current radiation risk  $\approx 5 \times 10^{-4}$  per rem
  - Considered mortality, morbidity and hereditary effects
  - Comparable results from UNSCEAR, ICRP, BEIR, NCRP
  - EPA “Blue Book” values even higher
- LNT for practical purposes of radiation protection

# Methodology Basis

- 10 CFR Part 50, Appendix I based on ICRP 1 and 2 MPC critical organ approach
- 10 CFR Part 20
  - Generally based on ICRP 26 and 30 TEDE approach
  - Public Exposure aligned to newer recommendations and increased risk in final rule
  - Occupational Exposure not aligned in final rule

# Methodology Basis

- Licensees granted use of ICRP 60+ approach on case by case basis for internal dosimetry
- Effective dose recognized for external exposure

# Basis for Occupational Limits

- 1977
  - average annual risk of accidental death in industries generally accepted as safe working environment –  $1 \times 10^{-4}$
  - 5 rem value based on expectation that most individuals would be unlikely to exceed 1 rem

# Basis for Occupational Limits

- 1990
  - Multi-attribute approach
  - Objective to prevent cumulative exposure to less than 100 rem
  - Average and maximum values to provide flexibility for implementation

# Update Dose Assessment Methods

- General support for moving to consistently incorporate latest scientific information and modeling.
- Stakeholders supported delaying rulemaking until ICRP completes work on dose coefficients
- Staff Recommendation:
  - Adopt updated methodologies and models
  - Continue with Appendix B in rule for ALI and DAC
  - Use updated methods for 10 CFR Part 50, Appendix I, and other portions of the regulations to establish new consistent basis

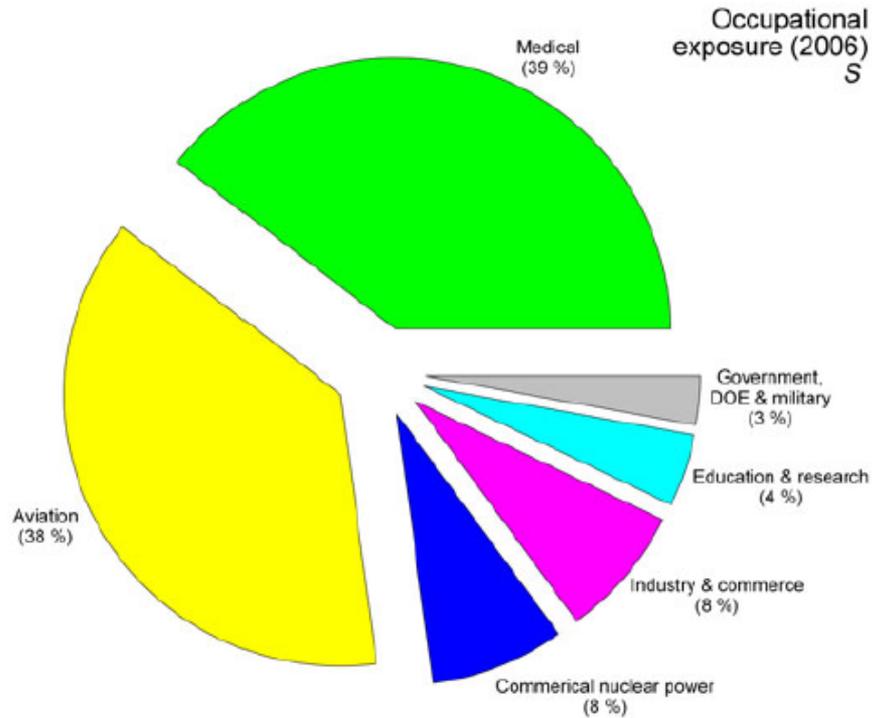
# Revise Terminology

- Changes in methodology resulted in changes in Terminology in 1990
- Stakeholders supported changes, but noted impacts in updating procedures, records, reports, and training
- Staff Recommendation:
  - Develop Regulatory Basis to incorporate updated terminology.
  - Explore options to provide flexibility during implementation

# Occupational TEDE Limit

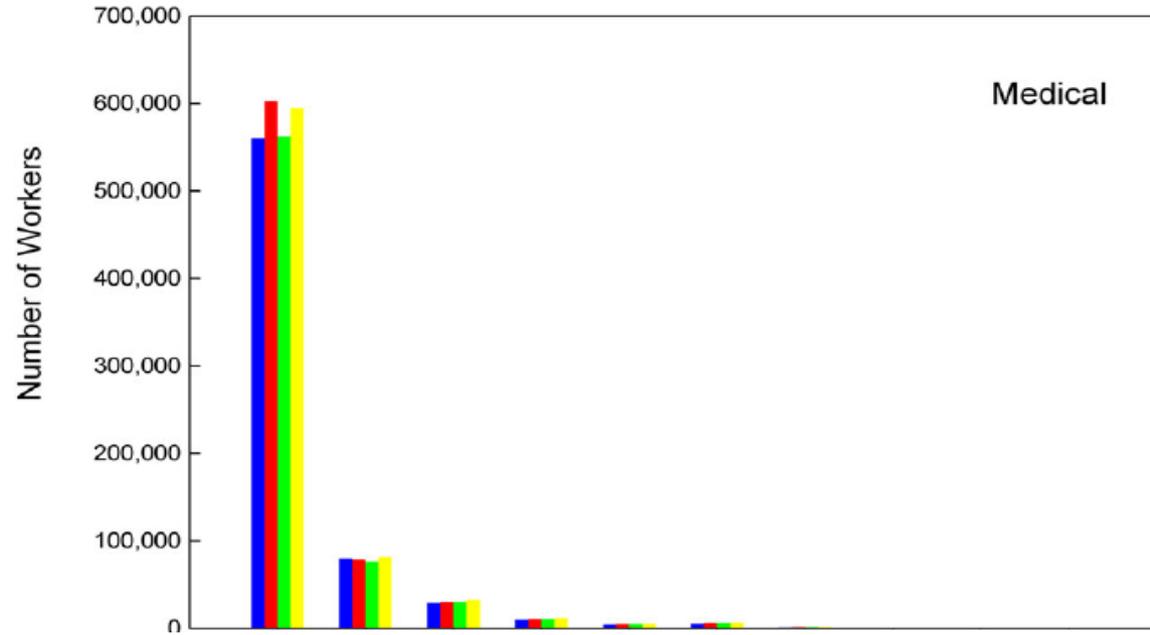
- **Conclusions**
  - Limit does not reflect current risk basis
  - Exposures near limit could exceed recommended cumulative total
  - 99.7% of individuals were below 2 rem in 2010
  - Flexibility needed – but only for some licensees and small groups of individuals
  - Differences between U.S. and other countries present complications to trans-boundary movement of workers

# Occupational Exposure Distribution



**Fig. 7.3.** Percent contribution of various sources to  $S$  for occupational exposure (1,400 person-Sv) for 2006. Percent values have been rounded to the nearest 1 % [see Table 7.3 for the values of  $S$  (person-sievert)].

# Medical Occupational Exposure



	Dose (mSv)	>0 - <1	1 - 2.5	2.5 - 5	5 - 7.5	7.5 - 10	10 - 20	20 - 30	30 - 40	40 - 50	>50
■	2003	560,203	79,768	28,889	9,764	4,278	5,245	1,343	527	246	398
■	2004	602,153	78,944	30,076	10,495	4,834	6,032	1,504	612	289	461
■	2005	562,323	76,247	30,251	10,737	4,970	6,254	1,630	678	320	531
■	2006	594,394	81,758	32,782	11,536	5,242	6,506	1,631	646	328	524

Fig. 7.5. Dose distribution for workers with recordable dose for the medical category, 2003 to 2006.

# Occupational TEDE Limit

- Stakeholder Feedback:
  - Little support for change to regulation
  - Suggestions of significant impact on licensed activities and delivery of health care
  - Suggestions that there could be an increase in the rate of non-compliance
  - Statements that sources and uses in U.S. are basis for having different dose limits

# Occupational TEDE Limit

- **Staff Recommendation:**
  - Develop regulatory basis for reducing limit to 2 rem (20 mSv/yr)
  - Explore mechanism for flexibility for those licensees who need it through specified approval process

# Lens of the Eye

- ICRP recommendation issued April, 2011
  - Reduced limit based on evidence that radiation induces cataracts at lower cumulative levels than previously estimated ( $\approx 50$  rem (500 mSv)).
  - TEDE and LDE similar in many situations except
    - Shielding of body
    - Lower energy  $\beta/\gamma$
  - Already incorporated into IAEA Basic Safety Standard
    - IAEA Technical Meeting to develop initial implementation guidance, October 2 – 4, 2012

# Lens of the Eye

- **Mixed Stakeholder Feedback:**
  - Scientific information questioned
  - Concern about numeric LDE value less than TEDE
  - Concern about type of effect
  - Significant impacts in interventional radiology and cardiology

# Lens of the Eye

- Staff Recommendation:
  - Develop regulatory basis for reducing limit
  - Consider single values of 5 rem (50 mSv) or 2 rem (20 mSv)
  - Continue dialogue on how prevention of cataracts should be viewed in comparison with the potential induction of cancer

# Embryo/Fetus

- ICRP recommendation of 100 mrem (1 mSv) applied after declaration
- Mixed feedback from stakeholders
  - In many cases, accommodation results in no additional exposure after declaration
  - Potential concern (medical) that lower value might result in decision to not declare

# Embryo/Fetus

- **Staff Recommendation:**
  - Develop regulatory basis for reducing limit to 100 mrem
  - Consider options of applying over entire gestation period, or only after declaration

# ALARA Planning

- ICRP added emphasis to consistent use of optimization and use of constraints
  - Proposals to add requirements for ALARA planning to reduce highest individual exposures, instead of changing limits
  - Opposition to term constraints
  - Opposition to numeric value because it would be perceived to be a limit

# ALARA Planning

- **Staff Recommendation:**
  - No significant change in rule text
  - Explore guidance to provide additional examples of acceptable mechanisms and programs



# Units of Exposure and Dose

- Issue raised by stakeholders to move to SI units (Becquerel, Gray, Sievert)
- HPS position statement in February, 2012
- Current metrication policy states preference for SI units first, with special units in parenthetical
- Staff Recommendation:
  - Explore implications, benefits, and costs of aligning with metrication policy
  - Close interactions needed with other Federal Agencies and States

# Reporting of Occupational Dose

- Seven categories required to report individual occupational doses
  - Licensees in Agreement States report as required by the State
  - Some categories of licensed use (e.g. medical) do not report
  - Database useful for assessment of impacts, inspection and enforcement, dose to an individual from multiple licensees.

# Reporting of Occupational Dose

- Staff Recommendation:
  - Explore implications, benefits, and costs of requiring additional categories to report
  - Explore mechanisms to increase sharing of data between NRC and States to move towards national database

# 10 CFR Part 50, Appendix I

- Methodology still based on ICRP 1 and 2
- Compliance calculations different for 10 CFR Part 20 and 10 CFR part 50
- Stakeholder encouragement to update and align dose calculation methodologies
- Staff Recommendation:
  - Initiate development of Regulatory basis for revision using updated methodology
  - Pursue rulemaking on parallel track with changes to 10 CFR Part 20

# Backfit Considerations

- 10 CFR Part 20 applies to all licensees, including those protected by various backfitting provisions
  - Previous revision in 1991 concluded final rule provided a substantial increase in overall protection of public health and safety based on both quantitative and qualitative grounds
  - Some provisions could be considered as redefinitions of adequate protection

# Backfit Considerations

## Continued

- Other provisions would require assessment of benefits and impacts
- Both Quantitative and Qualitative arguments will be important in analysis

# Staff Recommendation

- Staff recommends approval of option to continue development of regulatory basis using recommended direction for each technical issue
- Staff recommends stakeholder outreach and participation on possible rule text, guidance, benefits, and impacts
- Staff recommends parallel regulatory basis development for proposed rules for 10 CFR Part 20 and 10 CFR Part 50, Appendix I

# Questions? Questions?

