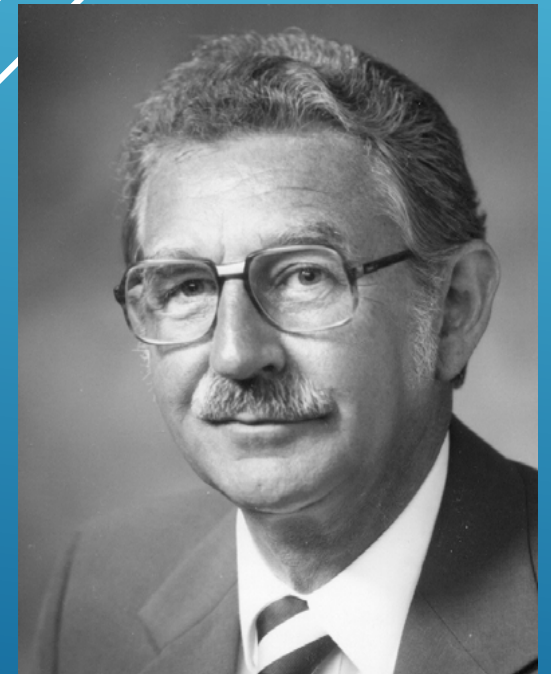


# THE INFLUENCE OF NCRP ON RADIATION PROTECTION IN THE U.S.: REGULATION AND GUIDANCE

Twelfth Annual Warren K. Sinclair Keynote  
Address

Kenneth R. Kase  
Annual Meeting of NCRP

16 March 2015



# OUTLINE

- ▶ Introduction
- ▶ U.S. Advisory Committee on X-ray and Radium Protection 1929 – 1946
- ▶ National Committee on Radiation Protection 1946 – 1964
- ▶ National Council on Radiation Protection and Measurements 1964 – 2014
  - ▶ AEC to NRC
  - ▶ FRC to EPA
  - ▶ FEMA to DHS
  - ▶ AEC to DOE
  - ▶ NASA
  - ▶ States – CRCPD
  - ▶ Non-Regulatory Bodies
- ▶ Future

# INTRODUCTION

- ▶ Representatives from several countries met before the Second International Congress of Radiology in Stockholm in July 1928 to discuss radiation protection problems and possibly prepare some initial x-ray protection recommendations.
- ▶ For the United States, Lauriston S. Taylor was designated as representative from the National Bureau of Standards.
- ▶ The responsibility fell to Taylor to organize a national committee to deal with the protection problems faced at that time in the U. S.
- ▶ In 1929, the Advisory Committee on X-ray and Radium Protection was established with L. S. Taylor acting as chairman.
- ▶ There were 7 members in addition to Taylor from the American Roentgen Ray Society, the Radiological Society of North America, the American Medical Association, and X-ray Equipment Manufacturers.

# U.S. ADVISORY COMMITTEE ON X-RAY AND RADIUM PROTECTION 1929 – 1946

- ▶ The Committee provided guidance for protection of persons exposed to radiation in the research and medical communities.
- ▶ In 1931, the Advisory Committee proposed the first formal standard for protecting people from radiation sources, NBS Handbook 15.
  - ▶ The recommended limit on dose rate was expressed as 0.1 roentgen per day.
- ▶ Over the next 12 years several handbooks were published that determined radiological protection in the U. S.
- ▶ Prior to 1946 there was no Federal agency with responsibility for radiation protection.

# U.S. ADVISORY COMMITTEE ON X-RAY AND RADIUM PROTECTION 1929 – 1946

NCRP Report No (NBS HB No.)	Title	Date
1 (15)	X-ray protection (Superseded by HB 20)	1931
2 (18)	Radium protection for amounts up to 300 mg (Superseded by HB 23)	1934
3 (20)	X-ray protection (Superseded by HB 41)	1936
4 (23)	Radium protection (Superseded by HB54)	1938
5	Safe handling of radioactive luminous compounds	1941

# NATIONAL COMMITTEE ON RADIATION PROTECTION: 1946 – 1964

- ▶ In 1946 the Advisory Committee was expanded and renamed National Committee on Radiation Protection.
- ▶ Dr. Taylor was approved as Chairman and seven sub-committees were established to develop reports which would continue to be published as NBS Handbooks.
- ▶ Fifteen reports were published between 1946 and 1958.



# NATIONAL COMMITTEE ON RADIATION PROTECTION 1946 – 1964

NCRP Report No (NBS HB No.)	Title	Date	NCRP Report No (NBS HB No.)	Title	Date
6 (41)	Medical X-ray protection up to two million volts (Superseded by HB 60)	1949	13 (54)	Protection against radiations from radium, cobalt-60, and cesium-137	1954
7 (42)	Safe handling of radioactive isotopes	1949	14 (55)	Protection against betatron-synchrotron radiations up to 100 million electron volts	1954
8 (48)	Control and removal of radioactive contamination in laboratories	1951	15 (56)	Safe handling of cadavers containing radioactive isotopes	1953
9 (49)	Recommendations for waste disposal of phosphorus-32 and iodine-131 for medical users	1951	16 (58)	Radioactive-waste disposal in the ocean	1954
10 (51)	Radiological monitoring methods and instruments	1952	17 (59)	Permissible dose from external sources of ionizing radiation	1954
11 (52)	Maximum permissible amounts of radioisotopes in the human body and maximum permissible concentrations in air and water	1953	18 (60)	X-ray protection	1955
12 (53)	Recommendations for the disposal of carbon-14 wastes	1953	19 (61)	Regulation of radiation exposure by legislative means	1955
			20 (63)	Protection against neutron radiation up to 30 MeV	1957
			21	Safe handling of bodies containing radioactive isotopes	1958

# U. S. ATOMIC ENERGY COMMISSION



- ▶ Title 10, Atomic Energy, Part 20 (10 CFR Part 20), Standards for Protection Against Radiation (AEC 1957).
  - ▶ NCRP Report No. 11 (NBS Handbook 52, 1953), Maximum Permissible Amounts of Radioisotopes in the Human Body and Maximum Permissible Concentrations in Air and Water;
  - ▶ NCRP Report No. 17 (NBS Handbook 59, 1954), Permissible Dose from External Sources of Ionizing Radiation;
  - ▶ Included the insert to accompany NBS Handbook 59 (1957) that added recommendations on cumulative occupational and population exposure limits.
    - ▶  $5 \text{ X (age - 18) rem y}^{-1}$  and 3 rem per 13 wk for head, trunk, active blood forming organs, lens, and gonads;
    - ▶  $10 \text{ X (age - 18) rem y}^{-1}$  and 6 rem per 13 wk for skin:  
25 rem per 13 wk for the extremities;
    - ▶  $15 \text{ rem y}^{-1}$  for internal exposure of individual organs;
    - ▶ Population limit of 5 rem in 30 y in addition to background and medical exposure;
      - ▶ Small groups of the public, a limit of  $0.5 \text{ rem y}^{-1}$ .
- ▶ Adopted by ICRP and published in ICRP Publ. 1 (1959).





# FEDERAL RADIATION COUNCIL

- ▶ Formed in 1959 (Public Law 86-373) to provide a Federal policy on human radiation exposure.
- ▶ Report No. 1 of the Federal Radiation Council was published in May 1960 to provide a Federal policy on human radiation exposure:
  - ▶ “The recommendations of the NCRP have received wide acceptance in the United States.”
  - ▶ NCRP Report. Nos. 13 (1954), 17 (1954), 18 (1955) and 22 (1959) are cited as forming the basis for the FRC Radiation Protection Guide (RPG) and Radioactivity Concentration Guides (RCG) and subsequent Protective Action Guides (PAG).

# NCRP REPORTS 1959-1964

NCRP Report No. (NBS HB No.)	Title	Date
22 (69)	Maximum permissible body burdens and maximum permissible concentrations of radionuclides in air and in water for occupational exposure	1959
23	Measurement of neutron flux and spectra for physical and biological applications	1960
24	Protection against radiations from sealed gamma sources	1960
25 (75)	Measurement of absorbed dose of neutrons and of mixtures of neutrons and gamma rays	1961

NCRP Report No. (NBS HB No.)	Title	Date
26	Medical x-ray protection up to three million volts	1961
27 (79)	Stopping powers for use with cavity chambers	1961
28	A manual of radioactivity procedures	1961
29	Exposure to radiation in an emergency	1962
30 (92)	Safe handling of radioactive materials	1964
31	Shielding for High Energy Accelerator Installations	1964

# NATIONAL COUNCIL ON RADIATION PROTECTION AND MEASUREMENTS: 1964

- ▶ Director of NBS recommended that the Committee seek a means for completely independent establishment and operation.
- ▶ Joint Committee on Atomic Energy: "U. S. Government was dependent upon an unofficial and independent committee, the NCRP, to establish the protection standards."
- ▶ Proposal that the NCRP be established under a Congressional Charter.
- ▶ Charter under Public Law 88-376, 1964, set out its organization and objectives and established its independence from government control.
  - ▶ Report No, 39 (1971): Relatively minor changes from the recommendations of Report No. 17 (1954 and its insert (1957).
  - ▶ Radiation protection recommendations published in FRC Report No.1 remained in effect until 1987.

# NATIONAL COUNCIL ON RADIATION PROTECTION AND MEASUREMENTS: THE FIRST 25 YEARS

- ▶ Reports published in the early years of the Council were influential in the practice of radiation protection and led to the safe use of radioactive materials and radiation producing devices. These included recommendations for protection in:
  - ▶ Research and Educational Institutions,
  - ▶ Medical Practices, and
  - ▶ Shielding Specification and Design for Accelerator, X-ray and Gamma-ray Facilities.

# NATIONAL COUNCIL ON RADIATION PROTECTION AND MEASUREMENTS: THE FIRST 25 YEARS







# NATIONAL COUNCIL ON RADIATION PROTECTION AND MEASUREMENTS: THE FIRST 25 YEARS

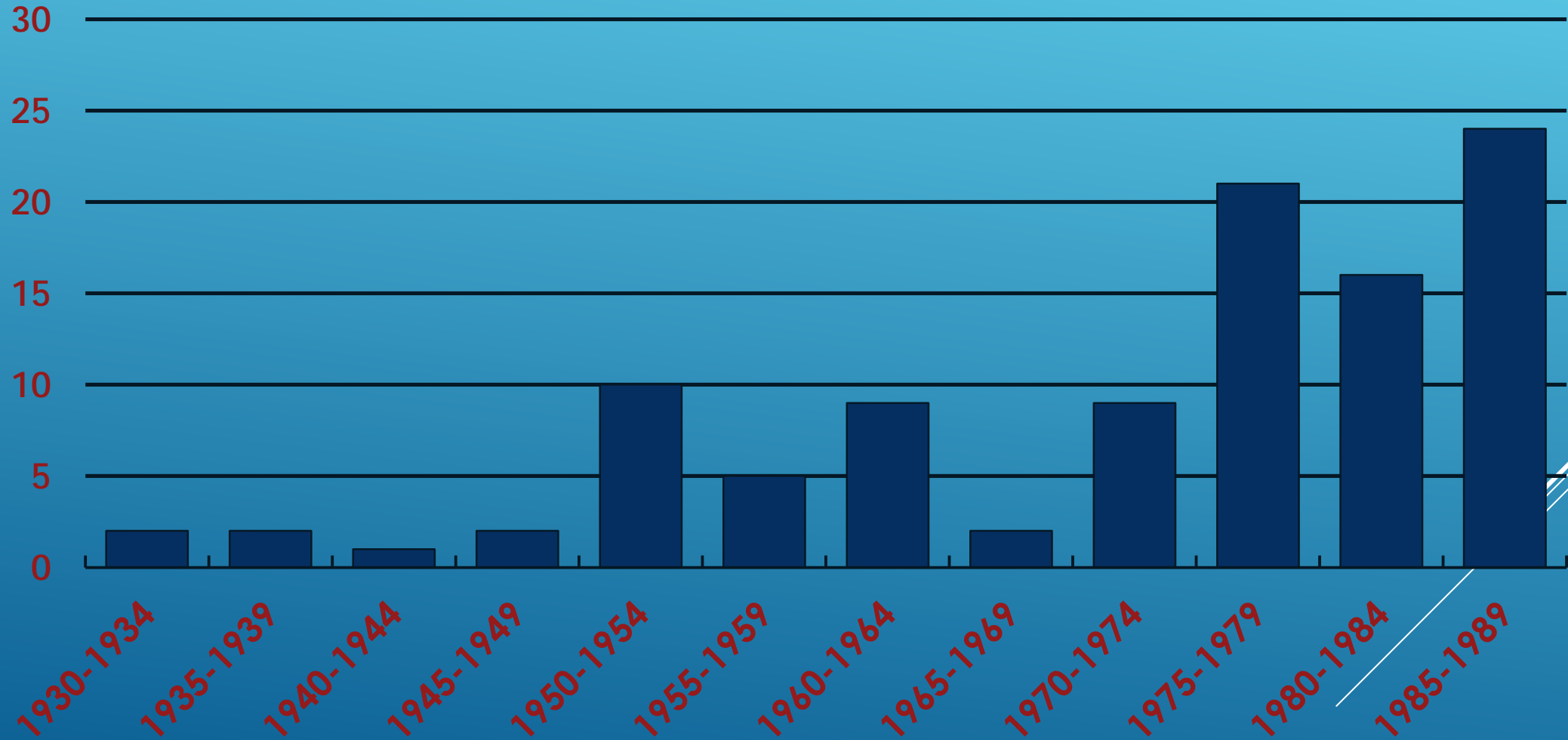
- ▶ Changes in U. S. Regulatory Structure:
  - ▶ In December 1970, the FRC and its functions were transferred to the new Environmental Protection Agency (EPA).
  - ▶ By 1977 the Atomic Energy Commission responsibilities had been divided and assigned to the Nuclear Regulatory Commission (NRC) and the Department of Energy (DOE).

# NATIONAL COUNCIL ON RADIATION PROTECTION AND MEASUREMENTS: THE FIRST 25 YEARS

- ▶ In 1975 NCRP reviewed its recommendations in Report No. 39 and determined that no changes were necessary: Report No. 43, 1975.
- ▶ Recommendations of ICRP, Publ. No. 26, 1977 were used by EPA, NRC and DOE to establish the radiation protection regulations that are currently in effect in the U. S.
- ▶ Although NCRP issued its updated recommendations in Report No. 91 in 1987, the report appeared too late to be used in the further development of the regulations issued by the EPA, NRC and DOE.
- ▶ By its 25<sup>th</sup> anniversary in 1989, the NCRP report number had reached 103.

# NCRP REPORTS: 1930-1990

## Number of NCRP Reports



- ▶ Radiation protection recommendations of ICRP (1991) and NCRP (1993) have yet to be fully implemented in the United States.
- ▶ NRC in 10 CFR 35 Medical Use of Byproduct Material (2002 and 2012) relies upon information provided in several NCRP reports:
  - ▶ No. 102, 1989: Medical radiation equipment design, performance and use;
  - ▶ No. 105, 1989: Protection for allied health personnel;
  - ▶ No. 107, 1990: ALARA;
  - ▶ No. 111, 1991: Emergency plans;
  - ▶ No. 123, 1996: Assessment of radiation exposure; and
  - ▶ No. 134, 2000: Training.

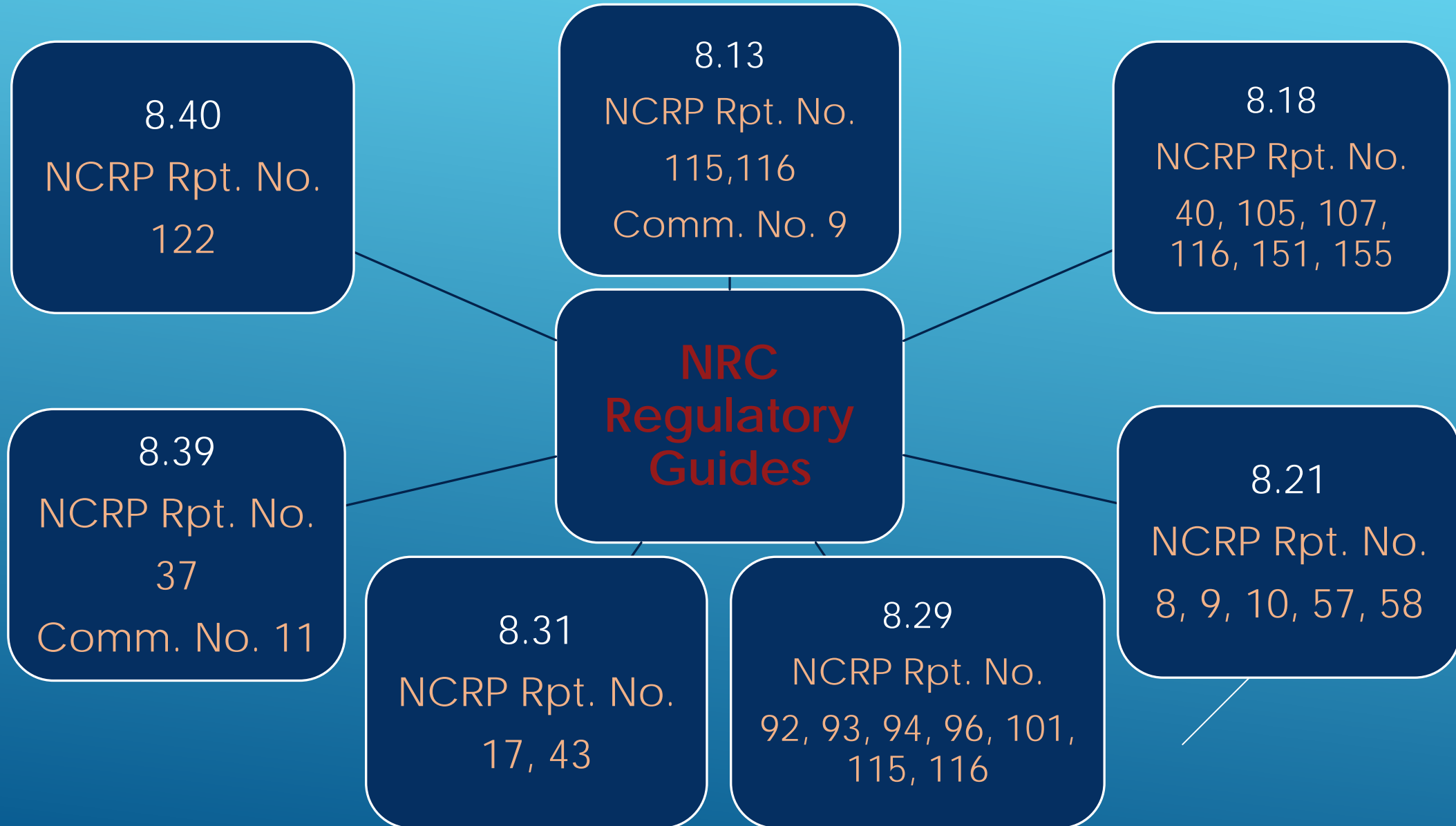
- ▶ NRC in the Federal Register (2002) specified a revision in the skin dose limit based on NCRP documents:
  - ▶ Report No. 106, 1989: Limit for Exposure to “Hot Particles” on the Skin;
  - ▶ Report No. 130, 1999: Biological Effects and Exposure Limits for ‘Hot Particles’; and
  - ▶ Statement No. 9, 2001: Extension of the Skin Exposure Limit for Hot Particles to Other Sources of Skin Irradiation.



# U.S. NRC REGULATORY GUIDES

- ▶ Guide 8.13, 1999, Prenatal Exposure
- ▶ Guide 8.18, 2011, ALARA at medical institutions
- ▶ Guide 8.21, 1979, Surveys at processing & manufacturing plants
- ▶ Guide 8.29, 1996, Risks from occupational exposure:
- ▶ Guide 8.31, 2002, ALARA at uranium facilities
- ▶ Guide 8.39, 1997, Release of Patients Administered Radioactive Materials
- ▶ Guide 8.40, 2010, Measuring effective dose equivalent

# U.S. NRC REGULATORY GUIDES



# U.S. EPA



- ▶ EPA was given responsibility for:
  - ▶ The promulgation of environmental standards, and
  - ▶ The development of national radiation protection guidance for Federal and State agencies.
- ▶ First revision of the 1960 Federal guidance for occupational exposure was published in January 1987:
  - ▶ ICRP Publ. 26 (1977), but also
  - ▶ ALARA, both ICRP and NCRP in Report No. 43, 1975.
- ▶ EPA has issued standards and guidance documents that rely on NCRP recommendations.

# U.S. EPA



- ▶ 1991 – Manual of Protective Action Guides and Protective Actions for Nuclear Incidents:
  - ▶ NCRP Report No. 22, 1959: Maximum permissible body burdens and concentrations of radionuclides.
  - ▶ NCRP Report No. 39, 1971: Basic radiation protection criteria, and
  - ▶ NCRP Report No. 52, 1977 Cs – 137: from the environment to man.
- ▶ 2013 – DRAFT Protective Action Guides and Planning Guidance for Radiological Incidents:
  - ▶ NCRP Report No. 138, 2001: Terrorist events involving radioactive material and
  - ▶ NCRP Report No. 165, 2010: Responding to a radiological or nuclear terrorism incident.
- ▶ 2014 – Second edition of its guide to population monitoring in radiation emergencies.
  - ▶ NCRP Report No. 161, 2008: Management of contaminated persons;
  - ▶ NCRP Report No. 160, 2009: Ionizing radiation exposure of the U.S. population;
  - ▶ NCRP Report No. 165, 2010: Responding to a radiological or nuclear terrorism incident;
  - ▶ NCRP Report No. 166, 2010: Population monitoring and radionuclide decorporation, and
  - ▶ NCRP Comm. No. 19, 2005: Preparing emergency responders for nuclear and radiological terrorism.

## 2014 –Federal Guidance Report No. 14, Radiation Protection Guidance for Diagnostic and Interventional X-ray Procedures. Motivated by NCRP Report No. 160:

- ▶ NCRP Report No. 99, 1988: Quality assurance;
- ▶ NCRP Report No. 100, 1989: Exposure of the U.S. population from diagnostic medical radiation;
- ▶ NCRP Report No. 102, 1989: Medical x-ray protection;
- ▶ NCRP Report No. 116, 1993: Limitation of Exposure to Ionizing Radiation;
- ▶ NCRP Report No. 122, 1995: Estimating effective dose equivalent;
- ▶ NCRP Report No. 133, 2000: Procedures performed outside the radiology department;
- ▶ NCRP Report No. 145, 2003: Radiation protection in dentistry;
- ▶ NCRP Report No. 147, 2004: Structural shielding design for medical x-ray imaging facilities;
- ▶ NCRP Report No. 148, 2004: Radiation protection in veterinary medicine; and
- ▶ NCRP Report No. 168, 2010: Dose management for fluoroscopically guided procedures.
- ▶ NCRP Report No. 172, 2012: Reference levels and achievable doses in medical and dental imaging: recommendations for the United States;
- ▶ NCRP Report No. 174, 2013: Preconception and Prenatal Radiation Exposure: Health Effects and Protective Guidance.





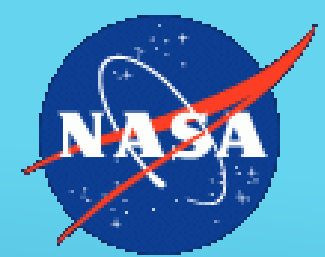
- ▶ 2003: The responsibilities of the Federal Emergency Management Agency (FEMA) transferred to Department of Homeland Security (DHS).
- ▶ 2008: Planning guidance for protection and recovery following radiological dispersal device (RDD) and improvised nuclear device (IND).
  - ▶ NCRP Report No. 111, 1991: Radiation emergency plans;
  - ▶ NCRP Report No. 116, 1993: Limitations of exposure;
  - ▶ NCRP Report No. 138, 2001: Terrorist events involving radioactive material; and
  - ▶ NCRP Commentary No. 19, 2005: Preparing emergency responders for nuclear and radiological terrorism.
- ▶ 2010: Planning guidance for a response to a nuclear detonation added two additional reports.
  - ▶ NCRP Report No. 161, 2008: Management of contaminated persons;
  - ▶ NCRP Report No. 165, 2010: Responding to a radiological or nuclear terrorism incident.

# U.S. DOE

- ▶ 1981: DOE Order 5480.11, Radiation Protection for Occupational Workers.
- ▶ 1993: 10 CFR part 835, Occupational Radiation Protection.
- ▶ 1998: Current version of 10 CFR 835, which continues to be based on recommendations of ICRP (1977).
- ▶ 1988: Example of DOE guidance document: Health physics manual of good practices for accelerator facilities, which included references to NCRP.
  - ▶ NCRP Report No. 47, 1976: Structural shielding design;
  - ▶ NCRP Report No. 51, 1977: Radiation protection design guidance;
  - ▶ NCRP Report No. 79, 1984: Neutron radiation;
  - ▶ NCRP Report No. 58 (2<sup>nd</sup> Ed.), 1985: Radioactivity measurements;
  - ▶ NCRP Report No. 81, 1985: Radionuclide contamination;
  - ▶ NCRP Report No. 88, 1986: Radiation alarms and access control; and
  - ▶ NCRP Report No. 91, 1987: Limits for exposure.

## ▶ 1994: Radiological Control Manual

- ▶ NCRP Report No. 53, 1977: Dose limits for the embryo and fetus;
- ▶ NCRP Report No. 59, 1978: Operational radiation safety program;
- ▶ NCRP Report No. 61, 1978: Training for radiographers;
- ▶ NCRP Report No. 65, 1980: Management of persons contaminated with radionuclides;
- ▶ NCRP Report No. 71, 1983: Operational radiation safety training;
- ▶ NCRP Report No. 91, 1987: Limits for exposure;
- ▶ NCRP Report No. 106, 1989: Limit for exposure to hot particles' on the skin;
- ▶ NCRP Report No. 112, 1991: Calibration of survey instruments; and
- ▶ NCRP Report No. 116, 1993: Limitation of exposure to ionizing radiation.



- ▶ 1989: Radiation protection program for space exploration
  - ▶ NCRP Report No. 98, 1989: Radiation received in space activities;
  - ▶ NCRP Report No. 104, 1990: RBE of radiations of different quality.
- ▶ Guidance for activities in low earth orbit
  - ▶ NCRP Report No. 132, 2000: Radiation protection guidance for low-earth orbit;
  - ▶ NCRP Report No. ,142, 2002: Operational radiation safety program for astronauts in low-Earth orbit; and
  - ▶ NCRP Commentary No. 23, 2014: Radiation protection for space activities.
- ▶ Extending space missions beyond low Earth orbit
  - ▶ NCRP Report No. 153, 2006: Radiation protection recommendations for space missions beyond low-Earth orbit.
- ▶ NCRP addressed the specific topic of the potential effect of individual genetic susceptibility on risk to astronauts from radiation exposure
  - ▶ NCRP Report No. 167, 2010: Potential impact of individual genetic susceptibility.

# STATES: CRCPD



- ▶ Formed as part of the implementation of Public law 90-602, "Radiation Control for Health and Safety Act of 1968".
- ▶ Suggested State Regulations for the Control of Radiation, most recent publication 2014.
  - ▶ Part D: Standards for protection against ionizing radiation
    - ▶ NCRP Report No. 91, 1987: Limits on exposure.
  - ▶ Part X: Therapeutic radiation machines
    - ▶ NCRP Report No. 49, 1976: Structural shielding design for x-ray equipment;
    - ▶ NCRP Report No. 69, 1981: Dosimetry of x-ray and gamma ray beams for radiation therapy;
    - ▶ NCRP Report No. 79, 1984: Neutron contamination from electron accelerators;
    - ▶ NCRP Report No. 144, 2003: Radiation protection for particle accelerators; and
    - ▶ NCRP Report No. 151, 2005: Structural shielding design for megavoltage accelerator facilities.



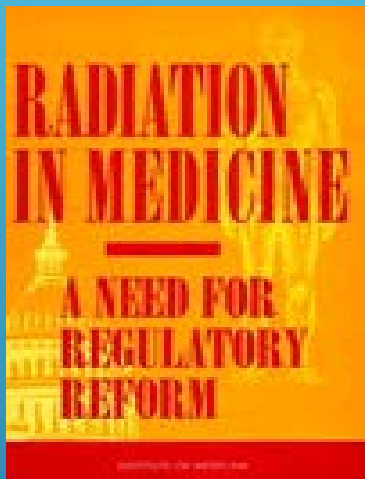
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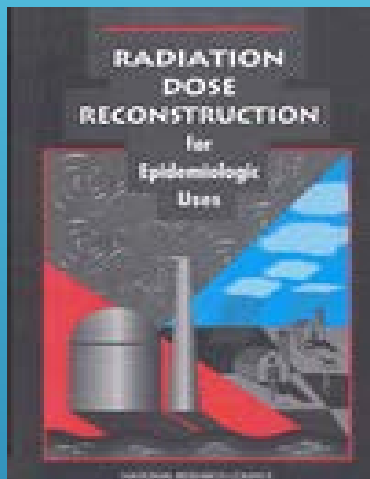
## Guidance Documents:

- ▶ 2001: Quality Control Recommendations for Diagnostic Radiography.
  - ▶ NCRP Report No. 100, 1989: Exposure of the population from diagnostic medical radiation.
- ▶ 2004: Implementation Guidance for Regulation and Licensing of TENORM.
  - ▶ NCRP Report No. 94, 1987: Exposure of the population from natural radiation.
  - ▶ NCRP Report No. 116, 1993: Limitation of exposure.
  - ▶ NCRP Report No. 123, 1996: Screening models for releases of radionuclides.
- ▶ 2006: Handbook for Responding to a Radiological Dispersal Device.
  - ▶ NCRP Report No. 138, 2001: Terrorist events involving radioactive material.
  - ▶ NCRP Commentary No. 19, 2005: Preparing emergency responders.
- ▶ 2010 : Planning Guidance for the Response to a Nuclear Detonation.
  - ▶ NCRP Report No. 116, NCRP Report No. 138, NCRP Commentary No. 19; and
  - ▶ NCRP Report No. 165, 2010: Responding to a radiological or nuclear terrorism incident.

# NON-REGULATORY BODIES NATIONAL ACADEMY OF SCIENCES



K-L. D. Gottfried & G. Penn, Editors  
NCRP Report Nos. 3, 1936; 17, 1954; 93, 1987; 100, 1989; 116, 1993.



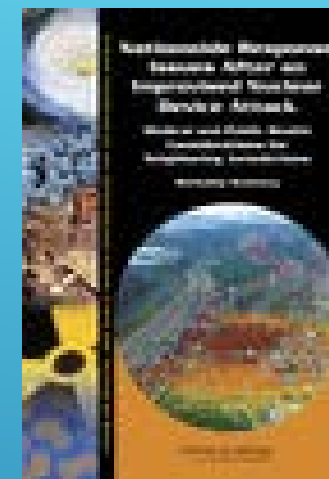
Committee on an Assessment of CDC Radiation Studies.  
NCRP Report Nos. 64, 1980; 82, 1985; 115, 1993.



Committee to Assess Health Risks from Exposure to Low Levels of Ionizing Radiation.  
NCRP Report Nos. 63, 1979; 64, 1980; 104, 1989; 116, 1993; 126, 1997; Comm. No. 12, 1995



Committee for Evaluation of Space Radiation Cancer Risk Model.  
NCRP Report Nos. 115, 1993; 126, 1997; 132, 2000; 137, 2001; 142, 2002; 153, 2006.



Board on Health Sciences Policy.  
NCRP Report Nos. 138, 2001; 165, 2010; Comm. No. 19, 2005.

## American Association of Physicists in Medicine (AAPM)

- ▶ Report No.18 A Primer on Low Level Ionizing Radiation and Its Biological Effects (1986).
- ▶ Report No. 25 Protocols for the Radiation Surveys of Diagnostic Radiological Equipment (1988).
- ▶ Report No. 39 Specification and Acceptance Testing of Computed Tomography Scanners (1993).
- ▶ Report No. 58 Managing the Use of Fluoroscopy in Medical Institutions (1998).
- ▶ Report No. 92 Intraoperative Radiation Therapy Using Mobile Linear Electron Accelerators (2006).
- ▶ Report No. 95 The Management of Imaging Dose During Image Guided Radiotherapy (2007).
- ▶ Report No. 108 PET and PET/CT Shielding Requirements (2005).
- ▶ Report No. 217 Radiation Dose from Airport Scanners (2013).

# NON-REGULATORY BODIES



## American College of Radiology

- ▶ ACR Practice Parameter For The Performance Of Screening And Diagnostic Mammography (2013).
  - ▶ NCRP Report No. 172, 2012: Reference levels and achievable doses in medical and dental imaging.
- ▶ Practice Guidelines And Technical Standards Handbook (2013-2014).
  - ▶ NCRP Report No. 172, 2012.
- ▶ ACR–SPR Practice Parameter For General Radiography (2014).
  - ▶ NCRP Report No. 172, 2012.
- ▶ ACR–AAPM Practice Parameter For Diagnostic Reference Levels And Achievable Doses In Medical X-Ray Imaging (2014).
  - ▶ NCRP Report No. 168, 2010: Fluoroscopically-guided interventional medical procedures; and
  - ▶ NCRP Report No. 172, 2012.



# NON-REGULATORY BODIES

## AMERICAN ACADEMY OF HEALTH PHYSICS



### Nonionizing Radiation

NCRP Report No.  
74, 86, 119

### Basic science

NCRP Report No.  
82, 92, 100, 101, 104,  
115, 121, 128, 130, 136

### Physics

NCRP Report No.  
57, 97

## Examination Preparation Guide

### Environmental studies

NCRP Report No.  
50, 62, 93, 94, 103

### Emergency planning

NCRP Report No.  
65, 138

### Radiation protection

NCRP Report No.  
88, 105, 116, 117,  
120, 127, 144, 145



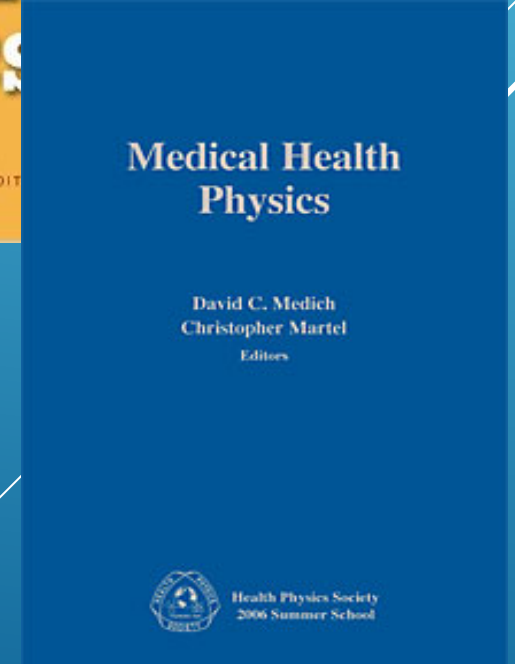
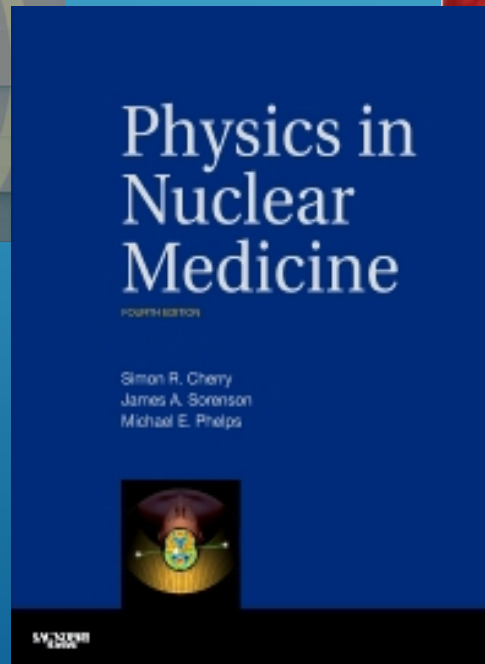
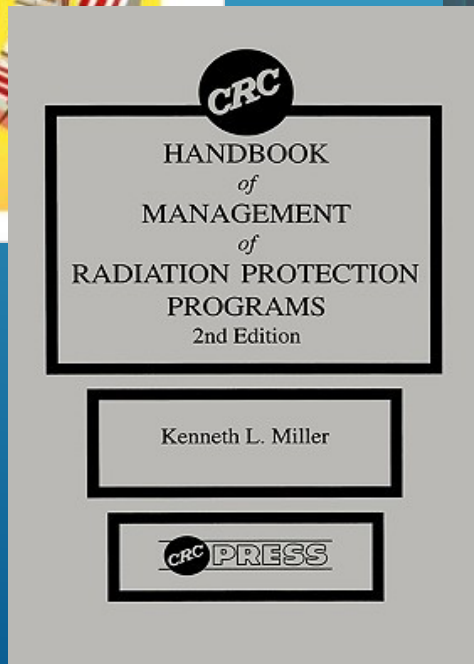
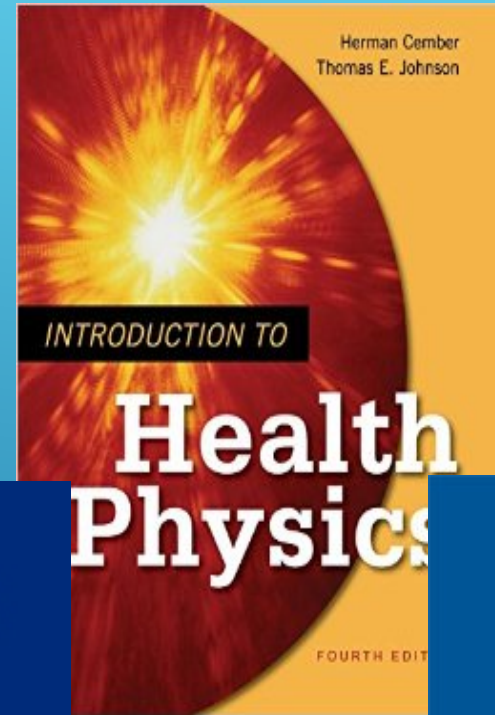
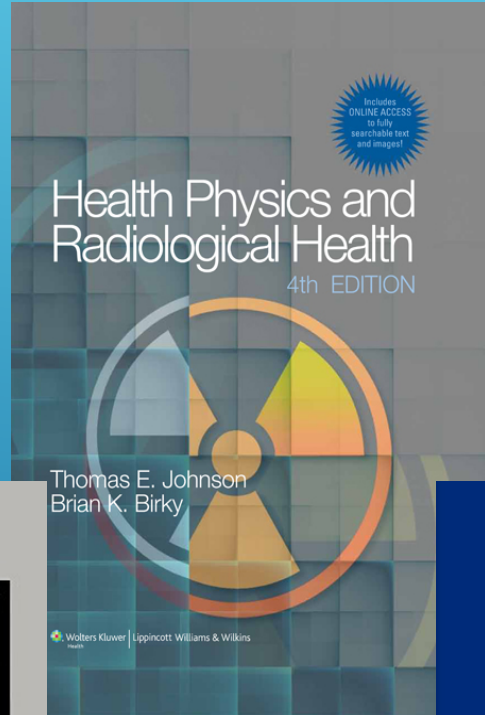
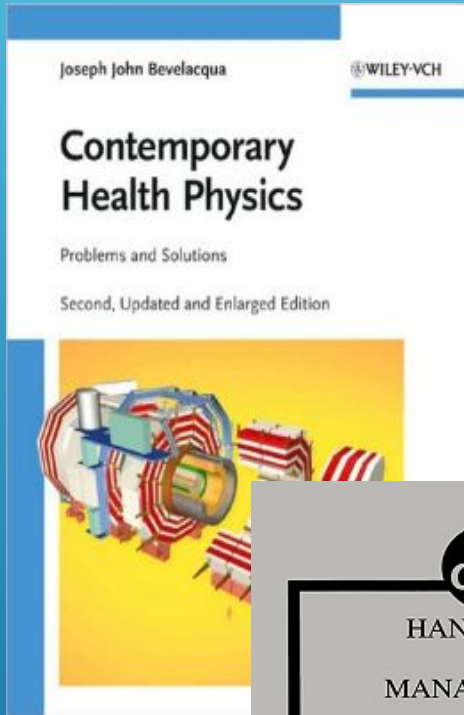
# NON-REGULATORY BODIES

## Health Physics Society - Position Statements



- ▶ Guidance for Protective Actions Following a Radiological Terrorist Event (2004).
  - ▶ NCRP Report No. 138, 2001
- ▶ Low-Level Radioactive Waste Management Needs a Complete and Coordinated Overhaul (2005).
  - ▶ NCRP Report No. 139, 2002
- ▶ Ionizing Radiation Safety Standards for the General Public (2009).
  - ▶ NCRP Report No. 116, 1993
- ▶ Update on Perspectives and Recommendations on Indoor Radon (2009).
  - ▶ NCRP Report No. 160, 2009
- ▶ Occupational Radiation Safety Standards and Regulations Are Sound (2010).
  - ▶ NCRP Report No. 93, 1987
  - ▶ NCRP Report No. 116, 1993
- ▶ Radiation Risk In Perspective Position Statement of the Health Physics Society (2010).
  - ▶ NCRP Report No. 126, 1997
- ▶ Exclusive Use Of SI Units To Express Radiological Quantities (2012) .
  - ▶ NCRP Report No.82, 1985
- ▶ Uncertainty In Risk Assessment (2013).
  - ▶ NCRP Report No. 171, 2012

# RADIATION PROTECTION AND HEALTH PHYSICS BOOKS



# SUMMARY

- ▶ Common theme: *Radiation protection must be based on the principals of justification, dose limitation and the application of ALARA.*
- ▶ The effectiveness of operating under the basic principles of radiation protection is demonstrated across all occupations in the U.S. in which exposure to radiation is possible. (NCRP Report No. 160).
- ▶ NCRP recommendations and guidance documents have had a great influence on the application and implementation of these principles, and protection of the population while permitting the beneficial use of technologies that may lead to radiation exposure.

# NCRP – THE FUTURE

- ▶ NCRP Council Committee 1 (CC-1): update the bases of the System of Protection against Radiation for the United States, and the fundamental recommendations to limit exposures and their subsequent consequences.
  - ▶ inform about all sources of ionizing radiation exposure;
  - ▶ include sources and exposures that were not specifically addressed in previous recommendations;
    - ▶ patients exposed in diagnostic and interventional medical procedures,
    - ▶ caregivers for patients treated with radioactive materials,
    - ▶ voluntary participants who may be exposed to ionizing radiation in medical research,
    - ▶ workers and the general public exposed to naturally occurring radiation sources including those enhanced by technology, and
    - ▶ exposure to non-human species in the environment.





