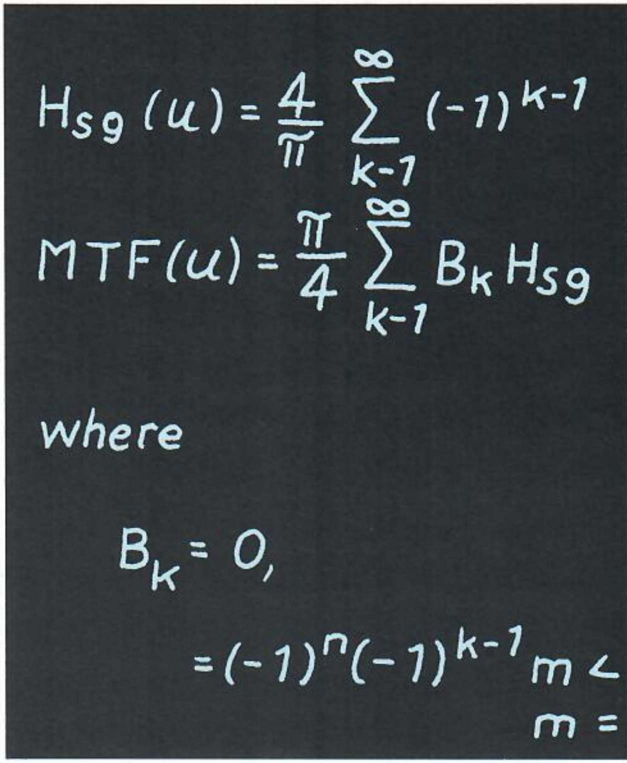
The International Commission on Radiation Units and Measurements

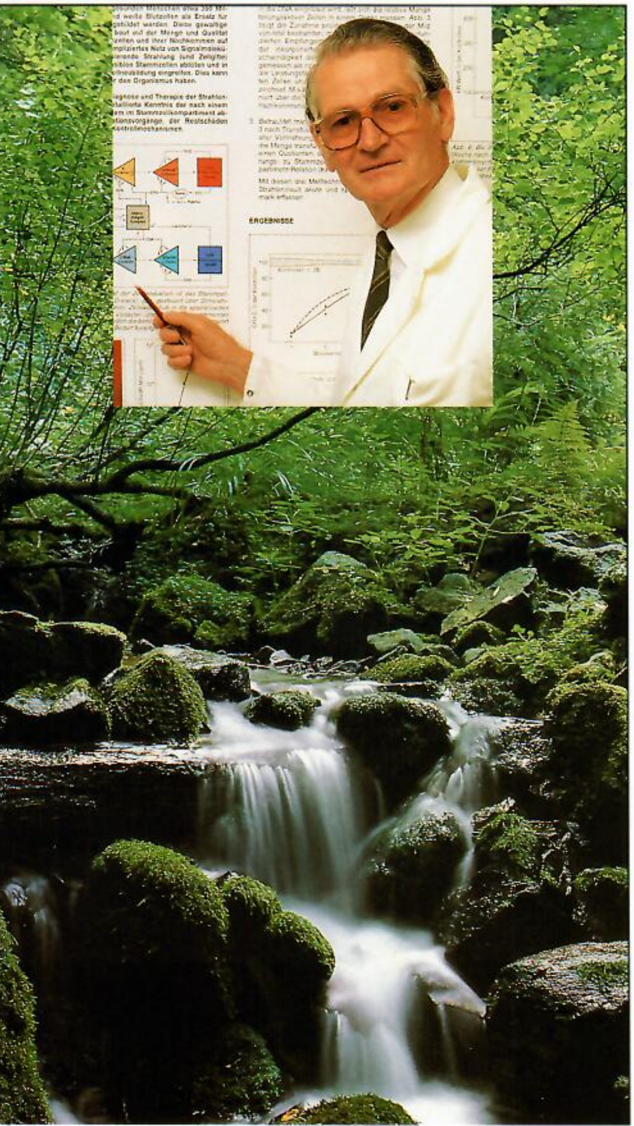
Its Accomplishments and Dynamics for the Future

ICRU

The Requirement

All of those who use or are concerned with ionizing radiation benefit from the work of the International Commission on Radiation Units and Measurements (ICRU). The doctor who uses x rays to diagnose or treat illness and his patient, the manufacturer who uses gamma rays in a process and his workers and customers, and the individual who uses his television set or smoke detector, rely on the measurements that have, at some point, been made of the radiation emitted by the devices they use. Further, the development of the devices and the methodology of their use depend on the ready interchange of information on radiation and its properties. All of these require a universally accepted set of definitions of radiation quantities and units, and rely on widely recognized guidance on radiation measurement techniques. The ICRU strives to provide these.





The International Commission on Radiation Units and Measurements

The International Commission on Radiation Units and Measurements was established in 1925 by the International Congress of Radiology. Since its inception it has had as its principal objective the development of a common framework of scientific concepts based on an international consensus on matters relevant to assessment of radiation for its safe and effective use. The breadth of its interests is evidenced by its concern with the following topics.

Health of Mankind

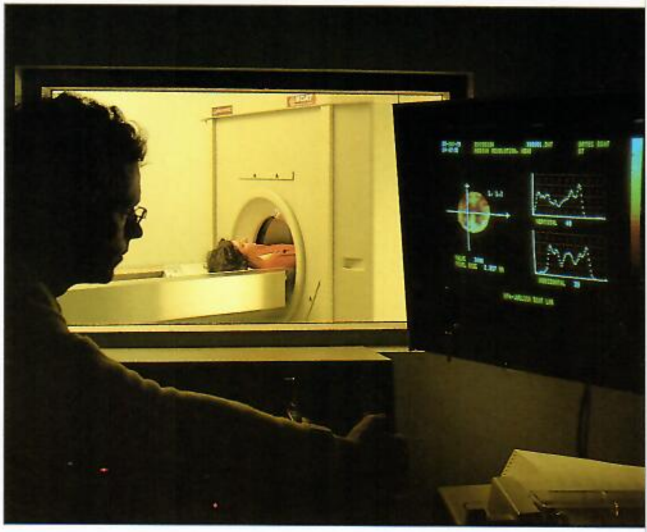
Radiation is essential in modern medicine for diagnosis of many kinds of illness and the treatment of cancer.

Diagnostic imaging has become increasingly complex and the manipulation of image information requires common concepts, terminology and measurement methodology. This is essential for the benefit of the patient to assure maximum diagnostic information with minimum potential risk.

Therapy depends vitally on the knowledge of the precise amount of radiation given to the patient and the possibility of the therapists interchanging information on the results attained. Progress in radiation therapy requires the ability to compare the clinical results achieved in different centers and using different modalities. Thus, a common language for reporting treatment schedules, doses and techniques is required to achieve optimum treatment.

Protection of Man and His Environment

Protection of those working with radiation relies on careful measurement and the protection of the public and environment depends on evaluation of radiation and radioactive materials in the environment. Because of the diversity in exposure conditions in both routine and accident circumstances, internationally accepted measurement conventions are required to assess irradiation of individuals and to monitor the environment. Specialized quantities and a substantial collection of reference data are needed to correlate individual exposures and associated risk.

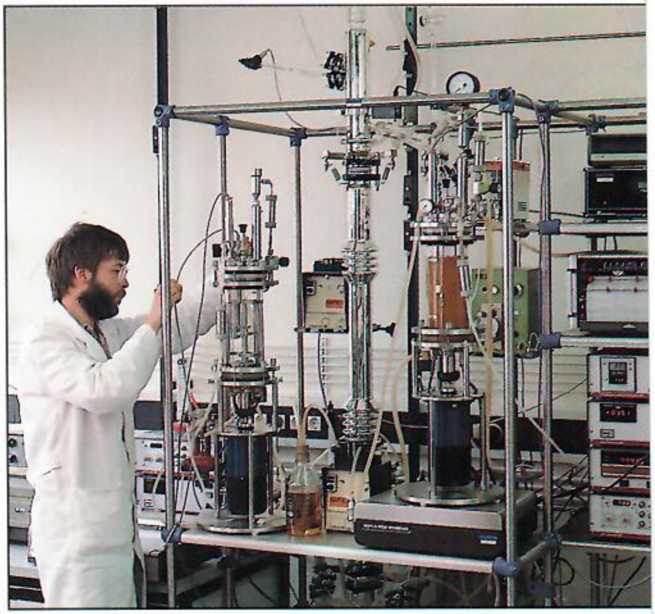


Use of Radiation in Science

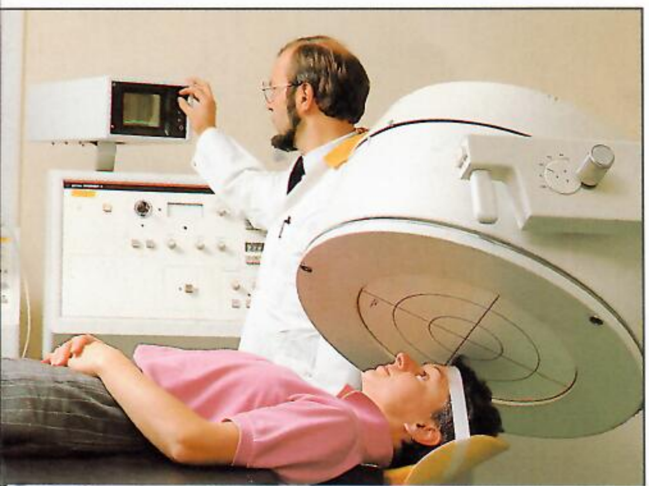
Quantities, units and measurement techniques common throughout all of radiation science are essential. They provide a basis for predicting the physical, chemical and biological changes instigated by radiation. Accepted values for fundamental and derived physical parameters are necessary in research, practical applications and industry.

Use of Radiation in Industry

Many industrial applications utilize radiation. These encompass great diversity and as a result a challenging set of measurement problems arise. Measurement methodology is vital in assuring that the radiation is used effectively, efficiently and safely.



The Commission utilizes the freely volunteered services of physicians, scientists and engineers who participate in its program through service on the Commission or on working groups engaged in the development of guidance and recommendations. They are drawn from the leading universities, laboratories and agencies throughout the world. These individuals, because of their training, talent and experience in radiation matters, constitute a resource of inestimable value. Their abilities are brought to bear on current problems in service of the public interest.

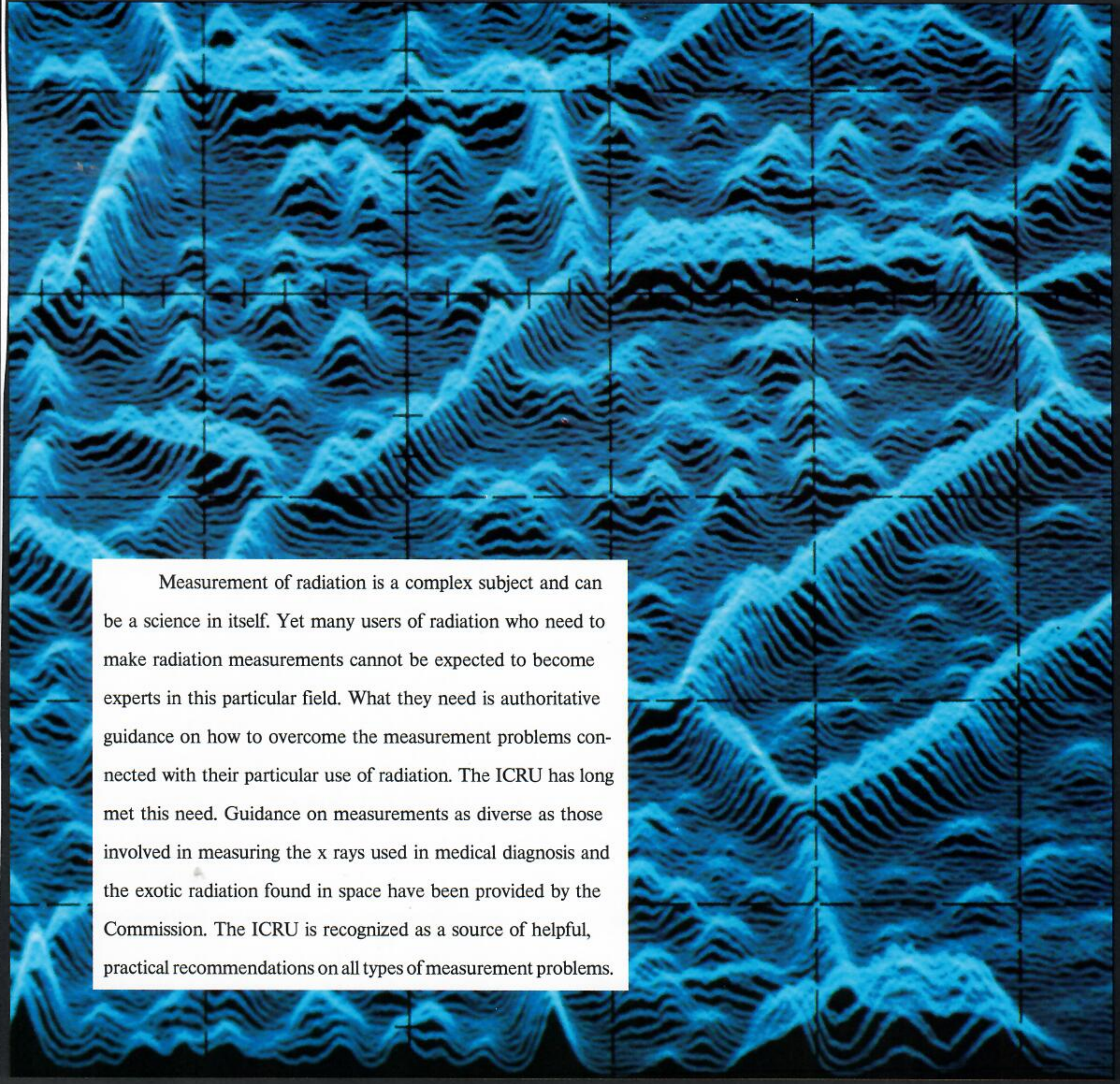


Its Accomplishments

The first task of the ICRU on its founding in 1925 was to devise a unit of radiation that would make it possible to develop cancer treatment. The Commission, at that time, provided a set of quantities and concepts that met the need and facilitated rapid development in medical applications. As therapeutic applications became more complex, additional requirements imposed the need for a more extensive set of quantities and units. This too was meet.

In recent times, the Commission has addressed the complex problems of assessing radiation exposure for protection purposes. A set of quantities and units has been developed which facilitates comparison of exposures with established limits.

Accepted values for certain parameters connected with radiation are essential in research work and in applications utilizing radiation. The ICRU has provided these and is recognized as the source for internationally accepted specifications. Evaluation and assembly of reference data meets the general requirement for commonality in values of physical parameters used in research and applications in all branches of radiation science.



Measurement of radiation is a complex subject and can be a science in itself. Yet many users of radiation who need to make radiation measurements cannot be expected to become experts in this particular field. What they need is authoritative guidance on how to overcome the measurement problems connected with their particular use of radiation. The ICRU has long met this need. Guidance on measurements as diverse as those involved in measuring the x rays used in medical diagnosis and the exotic radiation found in space have been provided by the Commission. The ICRU is recognized as a source of helpful, practical recommendations on all types of measurement problems.

Dynamics of Future Development

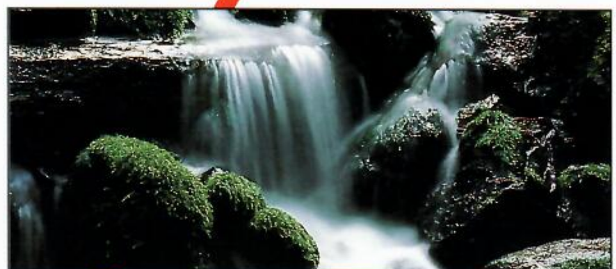
Much remains to be done in the area of internationally agreed radiation quantities, units and measurements. The field of radiation and its applications is a dynamic and expanding one.

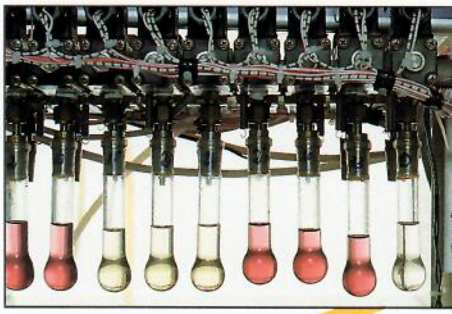
The need for internationally accepted recommendations and guidance relevant to medical application and protection grows. As our understanding of radiation, its interaction with matter, and the means for assessing its effects and impact evolve, the ability to quantify the parameters important to its understanding and use must be elaborated.

Even such fundamental matters as definition of basic quantities and units have to be revisited periodically to take advantage of new knowledge gained from research and analysis or to recognize new applications and approaches.

Radiation usage is becoming increasingly sophisticated and this brings about the need for better definition of parameters, the development of new measurement techniques and the provision of additional guidance on measurement.

The use of radiation is expanding into new environments and its utilization, for example in medicine, in combination with other agents is increasing. This imposes a requirement for increased understanding of the interaction of radiation with matter - living and inanimate - and quantities, units and measurements become a vital part of efforts focused on these problems.





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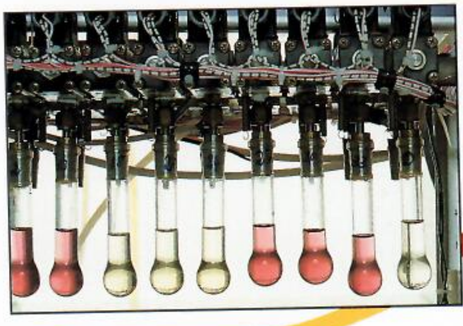
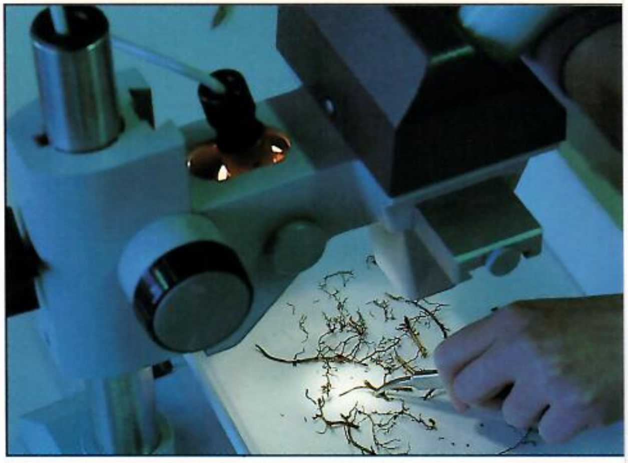


ITS POTENTIAL

The ICRU has the potential to meet the expanding needs in the area of radiation quantities, units and measurements. The Commission has the allegiance of a large group of dedicated scientists knowledgeable about all aspects of radiation who voluntarily contribute their services to accomplish the needed work. It has the mechanism to bring this talent to bear on major problems of national and international import. It has the capacity to identify areas where new work is needed and the ability to organize efforts to meet the needs. It can provide the user with the assurance that the information and recommendations generated by the ICRU represent the consensus of leading scientific thinking on the problem at hand.

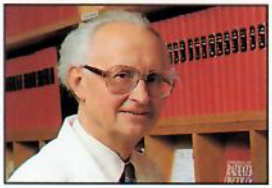
The ICRU presents the opportunity to attack important scientific problems with a proven system that utilizes the capabilities of a considerable body of scientists, physicians and engineers. What's more, the Commission provides the means to do this at minimal cost because the experts participating in its program provide their services voluntarily.



The Opportunity

A small investment in this unique scientific endeavor can pay big dividends in progress on problems important to human welfare, problems as diverse as quality medical diagnoses and effective physics research.

Thus, the opportunity is presented for all to participate in this enterprise aimed at furthering the public interest, and the means are at hand to succeed in this important endeavor.

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Report Committees of the ICRU

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Absorbed Dose Standards for Photon Irradiation and Their Dissemination

Chemical Dosimeters

Clinical Dosimetry for Neutrons (Physics)

Clinical Dosimetry for Neutrons (Dose Specification for Reporting)

Computer Uses in Radiotherapy

Dose Specification for Reporting External Beam Therapy with Photons and Electrons

Dose Specification for Reporting Interstitial Therapy

Fundamental Quantities and Units

Fundamentals of Particle Counting

Material Equivalents and Tissue Substitutes

Measurement of Dose Equivalent

Phantoms for Therapy, Diagnosis and Protection

Practical Determination of Dose Equivalent

Quality Assurance in Radiation Therapy

Quantitative Assessment of Image Representation

Secondary Electron Spectra Resulting from Charged Particle Interaction

Stopping Power for Heavy Ions

Stopping Power for Protons and Alpha Particles

INTERNATIONAL COMMISSION ON RADIATION UNITS AND MEASUREMENTS

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ICRU Publications

$B_k = 0 = (-1)^n(-1)^{k-1}, \; m<n \quad m=n \quad H_{sg}(u) = 4/\pi \sum (-1)k-1 \; MTF(2k-1)u/(2k$

ICRU Report No. Title

10 b *Physical Aspects of Irradiation (1964)*

10 c *Radioactivity (1963)*

10 f *Methods of Evaluating Radiological Equipment and Materials (1963)*

12 *Certification of Standardized Radioactive Sources (1968)*

13 *Neutron Fluence, Neutron Spectra and Kerma (1969)*

14 *Radiation Dosimetry: X Rays and Gamma Rays with Maximum Photon Energies Between 0.6 and 50 MeV (1969)*

15 *Cameras for Image Intensifier Fluorography (1969)*

16 *Linear Energy Transfer (1970)*

17 *Radiation Dosimetry: X Rays Generated at Potentials of 5 to 150 kV (1970)*

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20 *Radiation Protection Instrumentation and Its Application (1971)*

22 *Measurement of Low-Level Radioactivity (1972)*

23 *Measurement of Absorbed Dose in a Phantom Irradiated by a Single Beam of X or Gamma Rays (1973)*

24 *Determination of Absorbed Dose in a Patient Irradiated by Beams of X or Gamma Rays in Radiotherapy Procedures (1976)*

25 *Conceptual Basis for the Determination of Dose Equivalent (1976)*

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31 *Average Energy Required to Produce an Ion Pair (1979)*

32 *Methods of Assessment of Absorbed Dose in Clinical Use of Radionuclides (1979)*

33 *Radiation Quantities and Units (1980)*

I C R U P U B L I C A T I O N S

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36 *Microdosimetry (1983)*

37 *Stopping Powers for Electrons and Positrons (1984)*

38 *Dose and Volume Specification for Reporting Intracavitary Therapy in Gynecology (1985)*

39 *Determination of Dose Equivalents Resulting from External Radiation Sources (1985)*

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41 *Modulation Transfer Function of Screen-Film Systems (1986)*

42 *Use of Computers in External Beam Radiotherapy Procedures with High-Energy Photons and Electrons (1987)*

43 *Determination of Dose Equivalents from External Radiation Sources – Part 2 (1988)*

44 *Tissue Subsitutes in Radiation Dosimetry and Measurement (1988)*

45 *Clinical Neutron Dosimetry – Part 1: Determination of Absorbed Dose in a Patient Treated by External Beams of Fast Neutrons (1988)*

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GRAY
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