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QUALIFICATION AND CERTIFICATION --
THE USE OF DIFFERENT EXAMINATION METHODS

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In this paper I shall discuss the use of different examination methods for the purpose of qualifying or certifying individuals in medical physics. By way of introduction, it might be in order to discuss two certification programs in the United States which are available to medical physicists and describe the different examination methods used in these programs. These programs cover only a limited area of the broad field of medical physics. The certifying agencies concerned are the American Board of Health Physics and the American Board of Radiology, both of which are private, professional groups. The American Board of Health Physics is primarily concerned with all aspects of radiation protection, and serves as a certifying body for physicists in that field. The American Board of Radiology certifies physicians, but also has a program of certification for physicists in several areas.

American Board of Health Physics

The American Board of Health Physics was incorporated on December 1, 1960. The Board itself has seven members, five of whom are sponsored by the Health Physics Society, one by the American Association of Physicists in Medicine, and one by the American Public Health Association. Each member serves a 5-year term. An Examination Panel consisting of 16 Certified Health Physicists appointed by the Board prepares and grades the written examination under the guidance and approval of the Board.

The stated purposes of the Board are: "(1) to elevate the standards and advance the profession of health physics by encouraging its study and improving its practice; (2) to encourage and insist on the highest standards of professional ethics and integrity in the practice of health physics; (3) to determine the competence of specialists in health physics and to arrange, control, and conduct investigations and examinations to test the qualifications of voluntary candidates for certificates to be issued by the Board; (4) to grant and issue certificates in the field of health physics to voluntary applicants and to maintain a registry of such certification."

The certificate indicates that its holder has completed prescribed requirements of study and professional experience which the Board considers to constitute an adequate foundation in health physics, and has passed an

examination designed to test his competence in this field. The certificate awarded by the Board is not a license and, therefore, does not confer a legal qualification to practice health physics.

The general requirements for certification are, in brief, as follows:

1) Academic

The applicant must have a Bachelor's Degree in a physical science, or in a biological science with a minor in a physical science.

2) Age

The applicant must have passed his 28th birthday before the date of the examination.

3) Professional Experience

The applicant must have at least six years of responsible professional experience in health physics. At least three years of the experience must have been in applied radiation protection work. Additional education (course work, research) may be substituted for up to a maximum of 2 1/2 years of experience.

4) Written Examinations

Written examinations are mandatory. The examination has two parts:

Part I consists of 150 multiple choice questions dealing with four general categories: fundamental measurements, occupational and non-occupational health physics problems, and health physics administration. This is a three-hour examination and it is machine graded.

Part II of the examination generally consists of ten questions from which seven are selected according to the preference of the examinee. This also, is a three-hour paper.

The questions call for both numerical answers, in which substantial calculation may be involved, and short exposition of the essay type. The questions are designed to test judgment, ability to analyze complex problems, and organize and demonstrate practical skills at a high professional level.

After grading and evaluation of the examination, individuals fall into one of three categories: (1) those achieving a passing grade; (2) failures; and (3) questionable performances. The candidates

with questionable performances are required to pass an oral examination in the following year.

5) Oral Examination

Candidates for oral examination are selected using the average grade on the written examination as one of the principal guidelines. That is, the list of oral examinees will include some candidates who scored above the average and some who scored below it. In addition, the list will include those candidates who, for various reasons, had been preselected for oral examination. Examples of this latter group are (a) candidates who had previously failed the written examination, and (b) candidates who appear to be deficient in one or more areas in terms of their background training and/or experience. Preselected candidates for oral examination may also include individuals who have failed the written examination twice and have requested permission to take it a third time. In such cases, the primary purpose of the oral examination will be to determine their eligibility for readmission to the written examination rather than certification.

Candidates for the oral examination are questioned on basic principles, of which they will be expected to have a thorough understanding, as well as in those areas in which their application forms have indicated that they are particularly competent.

It is standard practise then for the candidate to be questioned by three Examining Groups, one of which is responsible for testing the candidate on health physics fundamentals while the other two are responsible for examining his areas of competence plus additional questions on other subjects to round out the examination. Each group spends a minimum of 30 minutes with each candidate.

Each Examining Group independently rates each candidate on the basis of a scale running from 0 through 10, the highest number being assigned to the best candidate. Candidates are also ranked in relative order to be certain that individual grades are consistent with the relative ability of the candidates as revealed by the examination. Each group independently also decides on a cut-off point for certification.

After all Examining Groups have completed their examinations, they meet jointly to total all scores and thus arrive at an overall grade for each candidate. A final cut-off point for certification is then selected

after discussion and all candidates whose total grade (written and oral) ranks above this point will be certified.

6) Written Report

The Board, after examination of a candidate's application for certification, may request reports on radiation protection evaluations made personally by or under the supervision of the applicant. Each applicant must be capable of making a satisfactory evaluation on several installations or operations, or operations involving possible radiation hazards of which those listed below are examples:

- a) Radiological installation-industrial or medical;
- b) Fluoroscopic installation;
- c) Therapeutic installation;
- d) Radionuclide laboratory;
- e) Air and water sampling and environmental survey;
- f) Nuclear fuel processing plant;
- g) Nuclear reactor;
- h) Major decontamination operation;
- i) Particle accelerator.

In actual practice, these reports are rarely requested by the American Board of Health Physics.

Let us now turn to the certification program of the American Board of Radiology.

American Board of Radiology

The Council on Medical Education of the American Medical Association and the American Board of Medical Specialties have now approved twenty examining and certifying boards on the basis of minimal standards governing accreditation of specialty boards as formulated by the Council.

The primary purposes of the boards are: (1) to conduct investigations and examinations to determine the competence of voluntary candidates; (2) to grant and issue certificates of qualifications to candidates successful in demonstrating their proficiency; (3) to stimulate the development of adequate training facilities; (4) to aid the Council on Medical Education of

the American Medical Association in evaluating medical residencies; and (5) to advise physicians desiring certification as to the course of study and training to be pursued.

The American Board of Radiology is one of the twenty boards referred to above. It is the only medical Board that offers certification to a professional person who is not a physician, namely: to a Radiological Physicist. The Board has adopted the following definitions:

1. Radiological Physics is that branch of medical physics which includes therapeutic radiological physics, diagnostic radiological physics, and medical nuclear physics.

2. Therapeutic Radiological Physics is that branch of radiological physics which deals with (a) the therapeutic applications of roentgen rays, of electron beams, of radium and other radionuclides used in a similar manner, of beta rays, of neutrons, and of radionuclides in teletherapy units and in all other therapeutic applications, and (b) the equipment associated with their production and use in these applications.

3. Diagnostic Radiological Physics is that branch of radiological physics which deals with (a) the diagnostic applications of roentgen rays, and (b) the equipment associated with their production and use.

4. Medical Nuclear Physics is that branch of radiological physics which deals with (a) the therapeutic and diagnostic applications of radionuclides (except those used in sealed sources for therapeutic purposes) and (b) the equipment associated with their production and use.

One of the requirements for a physician desiring to become a candidate for certification is that he attend an approved residency training program. There is, however, no mechanism for approving medical physics training programs in the United States by either a medical Board or any other organization. In consequence, the American Board of Radiology requires applicants to submit with their application for certification extensive supplementary material presenting personally made measurements and calculations as described below:

(a) Applicants for examination in therapeutic radiological physics shall submit a record of a calibration of a therapy apparatus, a record of a protection survey of an existing therapy facility, and a protection design study for a therapy facility. The therapy apparatus concerned in the above three submissions may be an orthovoltage unit, a super-

voltage unit, or a radionuclide teletherapy unit. A therapy facility comprises a room and apparatus for beam therapy or brachytherapy.

(b) Applicants for examination in diagnostic radiological physics shall submit a record of a calibration of a diagnostic roentgen-ray unit, a record of a protection survey of an existing diagnostic roentgen-ray unit, and a protection design study for a diagnostic roentgen-ray unit. These diagnostic roentgen-ray units may be radiographic units, fluoroscopic units, or a combination of both.

(c) Applicants for examination in medical nuclear physics shall submit records of a standardization of a radionuclide for clinical use and records of one protection survey for a radionuclide laboratory; and

(d) Applicants for examination in radiological physics shall submit records of all calibrations and surveys required of applicants for therapeutic radiological physics, diagnostic radiological physics and medical nuclear physics, EXCEPT that they need submit only one of the protection design studies required of applicants for therapeutic radiological physics and diagnostic radiological physics.

(e) Applicants for examination in any two of the subfields shall submit records of all calibrations and surveys required of applicants for each of the subfields, EXCEPT that applicants for examination in therapeutic radiological physics and diagnostic radiological physics need submit only one of the protection design studies.

These records constitute, in a sense, a thesis and must meet usual thesis standards. They must be accepted before the candidate can take the oral portion of his examination. The records may be rejected completely, or they may be returned for revision or additions, or they may be accepted as submitted. They are used as a basis for a part of the examination. The records will be judged on the basis of organization of material, neatness, clearness, techniques and methods described, completeness of data, accuracy of calculations, completeness of the calibration or survey, and results obtained.

The general educational requirements of a candidate are that he:

1. Holds a degree of Master of Science, Master of Arts, or a higher degree in an appropriate field. A Master's degree is to be considered

as a minimal requirement. Appropriate major fields include: radiological physics, biophysics, physics, health physics, and public health when the Bachelor's degree is in a physical field. The candidate shall furnish a list of graduate courses taken in fulfilling the requirements for his advanced degree and shall indicate the contents of these courses; and he also shall list any additional courses taken, seminars attended, and major reading related to the field of radiological physics. These courses, seminars, and readings must indicate that the fields of radiological physics have been thoroughly covered.

2. Has had some training in the biological sciences.

Although the applicant is primarily a physicist, he must know enough general biology, anatomy, physiology, oncology, and radiobiology to be able to understand the more common discussions in these fields. Some formal courses in these biological sciences are highly desirable. The candidate shall state what training he has had in these biological sciences.

Conclusion

In reviewing these two certification programs, we observe that:

1. A variety of examinations is used;
2. These include:
 - a) multiple choice, machine graded questions;
 - b) essay questions;
 - c) numerical problems;
 - d) oral, fundamental and applied problems;
 - e) practical demonstrations;
 - f) detailed written essays.

3. In developing a certification program for medical physics one should clearly identify the objectives of the program and choose the type or types of examinations which are appropriate for reaching these objectives.