

A BRIEF HISTORY OF FEDERAL SUPPORT FOR HEALTH PHYSICS EDUCATION AND TRAINING IN THE UNITED STATES

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INTRODUCTION

Since the formation of health physics as a profession following the end of World War II, the federal government of the United States has played an active role in the support of education and training of health physicists. The purpose of this paper is to review the types of federal support that have been available from the federal government in the past and to examine the current status of support. Individuals trained in health physics through the nuclear navy programs have not been included in this discussion.

THE FIRST 25 YEARS (1948-1973)

In January 1947, following passage of the Atomic Energy Act of 1946 by Congress, The Atomic Energy Commission (AEC) assumed the responsibility for the nuclear energy program of the United States. The AEC recognized immediately that it could only meet its objectives if a cadre of qualified individuals were available with the needed levels of education and training to deal with the new science and technology. Consequently, the AEC began developing a number of programs to meet this anticipated need. In 1948, the National Research Council selected 20 students as the first group to receive Atomic Energy Commission fellowships in radiological physics (1). Ten were sent to the Oak Ridge National Laboratory, and ten went to the University of Rochester.

In October 1946, the organization now known as Oak Ridge Associated Universities (ORAU) was incorporated under the name Oak Ridge Institute of Nuclear Studies (ORINS). ORINS became a prime contractor to the AEC and began to develop a variety of activities involving faculty and graduate students. One of the AEC's most significant educational activities, carried out through ORINS, was the graduate fellowship program in health physics. In 1949, the AEC requested ORINS to organize and administer a program of special graduate fellowships that would provide one year of graduate study in health physics at Vanderbilt University or at the University of Rochester, followed by a three-month field experience at either the Oak Ridge or Brookhaven National Laboratory. The first group of fellows in the program were appointed for the 1950-51 academic year. The program was designated as the *AEC Radiological Physics Fellowships* for the period 1950 to 1959. Additional universities where added to the program, eventually reaching 18, and other AEC laboratories were selected for the summer rotations with 2 labs used each year (beyond Oak Ridge and Brookhaven) from a list of 7 participating labs.

The 18 universities that participated in the AEC fellowship program between 1950 and 1973 [and the numbers of fellows trained] were as follows (2): Georgia Institute of Technology [9]; Harvard Univ. [16]; New York Univ. Medical Center [4]; Purdue Univ. [8]; Rutgers Univ. [5]; Texas A & M Univ. [3]; Univ. of California at Berkeley [56]; Univ. of Illinois [14]; Univ. of Kansas [66]; Univ. of Kentucky [5]; Univ. of Michigan [40]; Univ. of Minnesota [7]; Univ. of Pittsburgh [4]; Univ. of Puerto Rico [3]; Univ. of Rochester [208]; Univ. of Tennessee [48]; Univ. of Washington [95]; and Vanderbilt Univ. [347]. The total number of fellows participating in this AEC program between 1950 and 1973 was 940, trained at a total program cost of \$6,078,000.

In 1959, the program was expanded to permit three years of support leading to the doctoral degree. It was designated as *AEC Special Fellowships in Health Physics*, a title which continued to 1970. In 1970, the name was changed to *AEC Special Fellowships in Radiation Science and Protection*.

In 1960 the AEC established a special fellowship program for individuals already working in the health physics field who had at least two years of experience. The program operated through 1967 and supported some 30 health physicists at a program cost of \$597,000.

The Public Health Service (PHS) Radiological Health Training Grant Program was created in 1961 to provide a training mechanism to meet the national need for "radiological health specialists" as projected by the National Advisory Committee on Radiation in a 1959 report to the Surgeon General (3). As a result, the Department of Health, Education, and Welfare through the PHS was assigned the task of training professional and technical workers in the area of radiological health. A 1960 symposium at Princeton University on "University Curricula in Radiological Health" recommended a core curriculum for participating universities. The training was to operate at

two academic levels, Radiological Health Specialists at the graduate level and Radiological Health Technicians at the undergraduate level.

In 1961, the Division of Radiological Health of the PHS was authorized to administer the institutional training grants. By 1964 some 35 universities were participating in the specialist program and 10 in the technician program. Annual appropriations for the program reached \$2.5 million per year. A total of \$23,584,928 was appropriated to support this program over its 14-year lifetime. The annual reports (4, 5, 6) of the Public Health Service's Division of Radiological Health (later called the Bureau of Radiological Health) identify some 39 Universities that participated in the Specialist (graduate) program. The PHS Technician Training program was typically a two-year Associate of Arts or Associate of Science degree program. As many as 10 institutions participated in this training.

Ingraham (7) indicated that the PHS program goal was to train approximately 1200 individuals. It is unclear from the literature how many individuals were trained through the PHS Training Grants. The numbers should be included in the annual report on radiation protection enrollments compiled by the DOE (8), but the PHS component can not be identified. As an approximation, if the cost per trainee is assumed to be \$12,000 to 15,000 as estimated by Moeller and Eliassen (9), then as many as 1800 radiological health specialists would have been trained through the PHS programs.

THE PAST TWENTY YEARS (1974 - 1994)

Following the 1975 reorganization that split the AEC into the Nuclear Regulatory Commission (NRC) and the Energy Research and Development Administration (ERDA), the former AEC Health Physics Fellowship program was continued by ERDA and, later, by the Department of Energy (DOE). During the ERDA years, the program was initially designated as "Traineeships for Graduate Students in Energy Engineering, Industrial Safety and Hygiene, and Environmental Fields", and was later identified as "Graduate Traineeships in Energy Related Fields". With the formation of the DOE in January, 1978, the program emerged as the "Nuclear Science and Engineering and Health Physics Fellowship Program". As before, the program was administered by Oak Ridge Associated Universities. There was an interruption in the program shortly after the DOE was formed when in 1978, DOE announced the suspension of graduate traineeship programs for Fiscal Year (FY) 1979 because of budgetary restraints and reassessment of priorities. In FY-1981, planning money was provided to reinstate the graduate fellowship programs and fellowship awards resumed in FY-1982. The number of fellows supported has been modest compared to the earlier AEC fellowship program. The numbers of new fellows in health physics portion of the DOE program were as follows: 8 in 1982, 5 in 1983, 7 in 1984, 4 in 1985, 1 in 1986, and 1 in 1987. The values for 1988-1993 remained modest at about 5 per year. In FY-1995 the program was on "maintenance funding" for the 5 fellows already in the program. No new health physics fellowships were awarded for the 1994-95 school year.

In 1990, the DOE's Office of Environment, Safety, and Health launched a new "Operational Health Physics Fellowship Program" which supplemented the existing health physics fellowship program (10). The "operational" program (now called the "Applied Health Physics Fellowship Program") is primarily a master's level program and is intended to prepare participants to move directly into mission oriented health physics work rather than pursuing the doctorate for research oriented careers. The program includes a practicum experience and DOE has designated 20 practicum sites within the DOE laboratory system.

The first fellowship period for this program began in the fall of 1990. Thirteen Universities were initially designated by the DOE as qualified participants. Four were later added and three of the original ones are no longer participants. These 17 institutions are (10, 11): Univ. of Cincinnati, Colorado State Univ., Univ. of Florida, Georgetown Univ., Georgia Institute of Technology, Massachusetts Institute of Technology, Univ. of Massachusetts at Lowell, Univ. of Michigan, Univ. of Missouri-Columbia, Univ. of N. Carolina, Ohio State Univ., Univ. of Pittsburgh, Purdue Univ., Rutgers Univ., San Diego State Univ., Univ. of Tennessee, and Texas A & M Univ.

The program is budgeted to support approximately 20 new graduate students per year. For FY 1993 there were 20 new students and 14 returning students for a total of 34 participants. The FY 1993 budget for the program was \$919,000. The previous year's budget (FY 1992) had been \$ 750,000.

A related fellowship program that could provide training opportunities for individuals interested in health physics has been the DOE's Environmental Restoration and Waste Management Fellowship Program which began in January, 1990. At present, the fate of this program for future health physics support is uncertain.

For more than a decade the U.S. Nuclear Regulatory Commission has had concerns about the availability of trained personnel to meet their own agency needs. In 1990, the NRC began its "Graduate Fellowship Program" which was administered by ORAU (12). The program is a 24-month M.S. curriculum designed to produce professionals in the areas of nuclear engineering, health physics or specialty engineering. Participants receive a

stipend of \$ 20,400 per year, and participating universities receive an institutional allowance of \$ 5000/yr. Unlike the DOE fellowships, the NRC fellowships entail a service obligation. This includes a 9-month pre-fellowship orientation during which the individual is employed at the GS-7 government level, and a post-fellowship obligation of 2 years of service for each year of graduate support as an employee at the GS-9 level. In 1991, there were 4 NRC fellowships awarded, two of which were in health physics (13). In 1992 there were 2 new awards, one of which was in health physics. In 1993, three awards were made. Clearly this program is supplying a very modest number of health physicists.

PROGRAM SUPPORT AND THE ACADEMIC INFRASTRUCTURE

The annual costs for training health physicists through the academic programs can be estimated from past budgets and numbers of students trained. Moeller and Eliassen (9) had made an estimate for the PHS trainees that were in programs during the 1960's. Training costs for the AEC/ERDA/DOE programs have likewise been estimated. Based on information received from Williamson (13, 14) the annual cost for trainees was about \$5000 in 1957 and had risen to about \$30,000 by 1995.

Historically, the AEC fellowship programs provided "institutional allowances" to assist the universities with costs associated with the programs. In the case of the PHS training grants, each institution was provided not only the funds for the student stipends, but also funds for faculty salaries, equipment and supplies. Over the past 20 years, with the termination of the PHS grants and the reliance on rather meager institutional allowances from the ERDA/DOE programs to support the infrastructure, the number and strength of many programs has diminished. An important step in reversing this situation was taken by the DOE in 1992 with the initiation of the "Health Physics Faculty Research Award Program". The program had a total budget in FY 1992 of \$336,000 and provided awards of about \$50,000 to each of 4 faculty members. In FY 1993, the program budget was \$576,000 and a total of 8 awards (4 new and 4 renewal) were made. These awards include funds for student support, faculty salaries, and research supplies. The FY-1994 budget was similar.

The development of trained health physicists in the United States over the past 45 years has been closely linked to and dependent upon federal support, particularly at the graduate level. In recent years, such support is decreasing. The support for education and training that occurred in the early decades of the profession has resulted in today's strong cadre highly qualified health physicists. As federal support for advanced training erodes, we may expect some adverse impacts to appear in the future. Although private support and increases in short-course offerings may assist in meeting future needs, there will be an ongoing need for federal support of health physics training if we expect to maintain the overall quality of our professional work force into the 21st century.

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