THIRTY YEARS OF EXPERIENCE IN HEALTH PHYSICS EDUCATION AT PURDUE UNIVERSITY AND PLANS FOR THE FUTURE

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INTRODUCTION

The formal education and training of health physicists at Purdue University began thirty years ago with the introduction of a Ph.D. program followed later by M.S. and B.S. degree offerings. During that period 82 Ph.D., 52 M.S. and 131 B.S. students have received degrees in health physics and embarked on careers in radiation protection. Included in these numbers are graduates who have entered the medical physics field, but not those who entered nuclear medicine, although some of the latter have found themselves performing many health physics duties.

EMPLOYMENT TRENDS

One way of anticipating areas of emphasis which health physics education should stress in the future is to study the employment trends of graduates. This study has been carried out by evaluating employment trends in six categories: medical, university (academic and radiation safety), federal laboratories, regulatory agencies, nuclear power and waste management/remedial action.

A break-out of employment areas for Ph.D. recipients, as shown in Table 1, indicates that in the early years of the program almost all took academic positions. In the early 1970s there was a sudden opening of Ph.D. level positions with state and federal regulatory agencies such as the Nuclear Regulatory Commission, and at Department of Energy laboratories. During the mid-1970s many Ph.D. recipients were hired by the nuclear power industry, but this opportunity for employment has diminished. Also, when the federal program of Radiological Health Fellowships was discontinued in the mid-1970s, a considerable reduction occurred in the number of health physics graduate students that could be supported at Purdue, as illustrated by the last three columns in Table 1.

During the late 1960s and early 1970s most graduate students elected to continue on for a Ph.D. after their M.S. But in the mid-1970s, as illustrated in Table 2, many elected to take employment after completing their M.S. because of improved job opportunities. This option was facilitated during this period by

a decision to offer a non-thesis M.S. degree. By taking additional coursework a student could receive an M.S. without doing a research project, which was often not a requirement for the types of M.S. level positions that were available, such as with the nuclear power industry or regulatory agencies. This trend has now reversed in the mid-1980s and students are now electing to continue on toward a Ph.D. after finishing their M.S. degree. The large number of M.S. graduates hired by the nuclear power industry in the early 1980s was a direct result of the impact that the Three-Mile Island accident had upon the demand for advanced degree health physicists for ALARA engineering and emergency planning programs.

TABLE 1

Types of Employment Accepted by Ph.D. Graduates

	1958-60	61-63	64-66	67-69	70-72	73-75	76-78	79-81	82-84	85-87
Nuclear Power					3	4	2		1	
Regulatory				1	4	5	2	1	2	2
Federal Laboratory					4	4	5	2		
Academic	3	2	2	6	2	2	4	1	2	
Medical			1	4	3	3	1	1	1	2

Throughout its history the Purdue health physics program has encouraged graduate study by students from other countries. Approximately half of these students have taken permanent employment in the U.S. after completion of their graduate degrees. The remainder have returned to their native lands and are practicing health physicists in Canada (1 Ph.D.), Taiwan (3 M.S.), Iran (1 Ph.D.), Brazil (1 Ph.D.), Korea (1 M.S.), Philippines (1 Ph.D.), and Puerto Rico (2 Ph.D.).

TABLE 2

Types of Employment Accepted by M.S. Graduates

	1967-69	70-72	73-75	76-78	79-81	82-84	85-87
Nuclear Power			1	1	6	8	
Regulatory				4	1		
Federal Laboratory			2	6	3	1	
University Radiation Safety			1	3	3		
Medical	1	1	1	6	2	1	

In the early 1970s, the nuclear power industry became more active in seeking B.S. degree graduates in health physics. Consequently, an undergraduate program was developed at Purdue with a considerable amount of input from neighboring nuclear power utilities on the design of the curriculum. Courses such as reactor health physics and nuclear engineering were required in addition to environmental health physics, radiation biology and radiation dosimetry. Table 3 illustrates how rapidly this program grew at Purdue. The enrollment in the program peaked in 1983, but remains strong. Again, there was a significant increase in hiring by the nuclear industry for B.S. graduates shortly after the Three-Mile Island accident. The decreasing enrollment in the B.S. program may be related to the fact that most U.S. nuclear plants are now completed and operating. However, the demand for qualified B.S. students in the nuclear power industry continues to exist. Table 3 also shows, however, that there is a relatively even distribution of B.S. recipients in the other five areas of employment. Of particular importance is the development of a job market for B.S. recipients in the waste management/remedial action area.

TABLE 3

Types of Employment Accepted by B.S. Graduates

	1973-75	76-78	79-81	82-84	85-87
Nuclear Power	2	4	14	31	16
Regulatory	1	2	2	3	2
Federal Laboratory			2	5	4
University Radiation Safety	1	4	1	2	1
Medical		2	3	6	8
Waste Management/Remedial Action			1	5	3

The School of Health Sciences also has a strong undergraduate program in industrial hygiene. In several instances students have completed a dual major in health physics and industrial hygiene by taking the required courses in both areas. This type of degree has provided the student with the ability to perform health physics and industrial hygiene tasks at the same location.

Strong efforts have been made in the B.S. program to provide students with applied health physics experience through a summer internship program which takes place between the junior and senior year. Since its inception, 91 students have participated at sites such as Fermilab, Mayo Clinic, Brookhaven National Laboratory, Department of Energy remedial action sites and several nuclear power plants. This hands-on experience has been invaluable in helping students to determine which area of health physics they wish to pursue as a career.

CONSIDERATIONS FOR THE FUTURE

The demand for well-educated health physicists is expected to remain high well into the next century, particularly in the nuclear power industry. When this fact is coupled with the fact that many of the university health physics programs which existed in the 1970s are no longer active, there exists a potential for a serious shortage of health physicists in the U.S. in the near future. To complicate matters, with the declining enrollment in Ph.D. programs in health physics, there will be a dwindling pool of qualified new professors to perform teaching and research roles at universities.

To help meet this challenge, several developments in the Purdue health physics program will be made.

(a) Efforts will be made to strengthen course content in (1) radon hazard evaluation, (2) reactor decommissioning, (3) waste management/remedial action, (4) and regulatory policies. The potential revision of the radiation protection parts of the Code of Federal Regulations will require a considerable amount of modifications in course content, if not necessitate a separate course entirely devoted to regulatory affairs.

(b) Nationwide, only a few graduate students are being supported by governmental health physics fellowships, and little, if any, additional help is on the horizon. Consequently, efforts must be made in the academic sector and, hopefully by the Health Physics Society, to establish industry supported fellowships and scholarships. In like manner, federal funding for basic research in the health physics area is difficult to obtain. Only by increased efforts to obtain fellowships and funding for research will it be possible to carry out thesis research in vital areas such as radon emanation and measurement, and low-level and high-level waste management technology.

(c) The increasing interaction between the U.S. and other countries in radiation related matters, particularly in the area of low-level and high-level waste management, suggests the need for an increased amount of faculty and possibly graduate student exchange programs. This could take the form of sabbaticals for professors and practicums for graduate students, via bilateral agreements.

(d) Declining enrollments, particularly in the B.S. program, indicate the need for vigorous recruiting efforts to be instituted. Plans are currently in progress to distribute recruiting brochures to state high schools and, for graduate programs, to distribute recruiting posters to college chemistry and physics departments nationwide. It is hoped that recruiting efforts by existing university programs will halt the decreasing enrollment trend and provide an adequate pool of health physicists entering the job market.