The Future of Accreditation of Nuclear Engineering Programs

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While graduates of university nuclear engineering (NE) programs have continued to enjoy good employability during recent years, there have been declining enrollments in undergraduate nuclear engineering programs at U.S. universities. Such declines are symptomatic of the decline in engineering enrollment across all curricula during the past five years, but may also reflect the public perception that nuclear power is a dying technology. The reality is rather dramatically different, in that the U.S. presently produces over 20% of its electricity from nuclear power, and many countries around the world generate a much higher fraction. There has been no new nuclear plant ordered in the US during the past fifteen years, but by contrast the world demand for nuclear electric power is accelerating.

Utility production of nuclear electricity in the U.S. is under competitive pressure from alternative technologies, including coal and natural gas. The pressure from natural gas is especially intense due to the availability of inexpensive natural gas used to fuel high efficiency, combined cycle gas turbine generators. There is also competitive pressure due to the deregulation of the electric utility industry nation-wide. This will lead to a head-to-head competition in production costs of electricity, with only the most competitive technologies surviving. In preparation, utilities are down-sizing their staffs and minimizing the cost of operation and production at each of their facilities. This has led to a decrease in demand for new nuclear engineers in the nuclear utility industry. With the decrease in funding for the national nuclear weapons production complex since the end of the cold war, another avenue of employment for nuclear engineers has been curtailed. Finally, the lack of political will in this country to resolve the nuclear waste storage issue has left the public with the perception that there is no acceptable solution. While Europe and Japan are well on their way to the long term storage of spent nuclear fuel waste, the US vacillates on storage options and plans another in a long series of studies.

Under the pressure of declining enrollments and the opportunities offered by faculty retirements to reallocate faculty positions to more compelling technical areas, many nuclear engineering departments have in recent years been abolished. The nuclear engineering faculty have often been merged into larger departments and programs have usually been retained, but sometimes only at the graduate level. Some examples of universities with well-recognized nuclear engineering departments which have undergone such a transition during the past five years include the University of Arizona, Iowa State University, Georgia Tech, Kansas State University, University of Massachusetts at Lowell, University of Virginia, and Pennsylvania State University. A number of smaller nuclear engineering programs have simply been

abolished. Graduate nuclear engineering programs do not seem to have suffered the substantial recent enrollment declines of the undergraduate programs, perhaps because of better recognition by students of the continuing employment opportunities in the field. The number of ABET-accredited BS nuclear engineering programs available in the US has declined from about 40 ten years ago to about 20 today. Of those that are currently accredited, only one is accredited at an advanced level, that at the Air Force Institute of Technology, a graduate degree institution.

University Working Conferences

The American Nuclear Society (ANS) has co-sponsored with the ASEE Nuclear and Radiological Engineering Division two University Working Conferences (UWC) during the past two years. The first UWC was held in Philadelphia during 1995 and the second in Reno, Nevada during 1996. The goal of those meetings was the continuing exploration of issues related to the future success of nuclear engineering academic programs. An especially compelling issue is the ability of NE programs to obtain and retain accreditation following the substantial downsizing which seems to have become the norm.

Philadelphia, 1995

The first UWC [1] had about 80 attendees from academe and industry for a one and a half day meeting. There were four principal themes as the focus of that working conference: a broad definition of nuclear engineering, employability of NE's in diverse fields, importance of faculty research activities for a viable program, and the importance of strategic planning for a successful program. Following is some elaboration on each of these themes.

Nuclear engineering faculty members should espouse a broader definition of nuclear engineer than that traditionally associated with commercial nuclear power. The redefinition of nuclear engineering as "the application of nuclear forces for the betterment of humanity" captures the crux of these discussions. Applications as diverse as the applications of radioisotopes in medicine and industry, fusion energy, nuclear propulsion, accelerator technology, and commercial nuclear power should be included.

Employability of nuclear engineers should be promoted in diverse fields, including environmental remediation and waste management, industrial and medical applications of radiation. Substantial sponsored research by nuclear engineering faculty will be an essential continuing element of success for nuclear engineering programs. Interdisciplinary research involving teams of faculty members from other engineering and science disciplines should be encouraged. The "internationalization" of the nuclear power industry should be recognized, including the role U.S. and international corporations play in the development of commercial nuclear power around the world. Finally, effective strategic planning will be an element in the recipe for a successful nuclear engineering program, especially with respect to retention of viable, accredited programs.

Reno, 1996

The second UWC [2] was organized to follow-up on the recommendations of the first conference. In particular, the principal goal was the refinement of the recommendations from the first UWC, with additional industrial involvement to provide an improved perspective on marketplace forces related to nuclear engineering employment. About forty attendees at the one and a half day meeting focused on strategic planning, industry involvement, research collaboration, accreditation issues, profiles and employability of graduates, and the impact of new technologies. Future accreditation of nuclear engineering programs is the emphasis of this paper, thus accreditation recommendations and subsequent actions will be the focus of the remainder of this article.

Accreditation Recommendations

The accreditation session [3] of the second UWC emphasized the effect that the implementation of ABET Engineering Criteria 2000 [4] would have on the accreditation of nuclear engineering programs. The new criteria are "outcomes" oriented, rather than process oriented, and these changes respond to industry concerns about the purpose and value of accreditation. The most important features of the new criteria are the requirements that each program develop specific program objectives and establish processes for regular self assessment of the program's performance in achieving those objectives. This new flexibility is a welcome change for ABET, which has sometimes been accused of having a "bean-counting" mentality, rather than being concerned about measures of the real success of a program, such as employability of graduates and rewarding, life-long careers for graduates.

Nuclear engineering programs have an opportunity under the new ABET criteria to carefully craft objectives which are supported by the breadth of industries which currently employ graduates of the program. Self assessment measures must include tracking of the careers of graduates, both from the perspective of individuals and their employers. This opportunity for an improved dialogue with employers must be grasped for a program to be successful in this endeavor.

A final recommendation which emerged during university working conference discussions is that the faculty of nuclear or radiological engineering programs take the important step of seeking ABET accreditation for the first degree offered. Thus those who drop the undergraduate degree in favor of a graduate program are encouraged to seek ABET accreditation at the advanced level for the MS degree. The decreasing availability of basic level, baccalaureate nuclear and radiological engineering programs will lead to a loss of career opportunity in these discipline areas. This will be happening while opportunities in radiation applications in industry and medicine and other non-power applications of nuclear technology are growing. It is important to continue to have accredited nuclear and radiological engineering programs available within the U.S. for those students who plan careers in these areas.

Accreditation Actions

Accreditation matters within the ANS are coordinated by the Accreditation Policy and Procedures Committee (APPC). The APPC has taken a number of actions in recent months, both in response to ABET's Engineering Criteria 2000 and to recommendations from the ANS

university working conferences. The program criteria for "nuclear" programs has been broadened to include the radiological focus of some programs. In the July of 1996 meeting of the Engineering Accreditation Commission (EAC) of ABET, the EAC approved a change in the name of the "nuclear" program criteria to "nuclear and radiological." This title better reflects the breadth of interests and training of engineers in nuclear programs, as well as the breadth of employment opportunities. In addition, a new program criteria for "nuclear and radiological" engineering, consistent with Engineering Criteria 2000, has been developed by the APPC and forwarded to the EAC for final approval during the EAC meeting in summer of 1997. That new program criterion allows flexibility for nuclear and radiological engineering faculties to meet requirements for program accreditation within the full breadth of the nuclear and radiological engineering discipline.

Conclusions

This paper summarizes the conclusions of two recent university working conferences and reviews the implications for the future accreditation of nuclear engineering programs. It appears that the immediate future will support few stand-alone departments, rather the most likely model is a nuclear engineering faculty as part of a larger engineering faculty department. As this scenario develops, it is recommended that the university nuclear engineering faculties make a commitment to accreditation of the first nuclear engineering program offered, whether at the basic or advanced level. The retention of accredited nuclear and radiological engineering degrees is argued by the continued and growing value of nuclear and radiological technologies to society at large.

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