Appendix E

BLUE RIBBON PANEL ON THE FUTURE of UNVERSITY NUCLEAR ENGINEERING PROGRAMS AND UNIVERSITY RESEARCH AND TRAINING REACTORS

Executive Summary

Nuclear engineering programs and departments with an initial emphasis in fission were formed in the late 1950's and 1960's from interdisciplinary efforts in many of the top research universities, providing the manpower for this technical discipline. In the same time period, for many of these programs, university nuclear reactors were constructed and began their operation, providing some of the facilities needed for research and training of students engaged in this profession. However, over the last decade, the U.S. nuclear science and engineering educational structure has not only stagnated but has reached a state of decline. The number of independent nuclear engineering programs and the number of operating university nuclear reactors have both fallen by about half since the mid-1980s. In contrast, the demand for nuclear-trained personnel is again on the rise. Workforce requirements at operating U.S. nuclear power plants are increasing and will undoubtedly remain high, given the plans for plant-life extension in the vast majority of operating light-water reactors in the U.S. Moreover, new initiatives have begun in applied radiation sciences in collaboration with industrial and medical researchers as well as new biotechnologists. Finally, nuclear science and engineering (NS&E) continues to be needed in national security as well as providing the US Navy with effective, safe nuclear propulsion. Thus, the future of nuclear science and engineering programs must be reevaluated and refocused as the new century begins.

In November 1999, DOE Office of Nuclear Energy, Science and Technology requested that NERAC establish an ad hoc panel to consider educational issues related to the future of nuclear science and engineering; i.e., address the future of nuclear engineering programs, establish a process toward support of university research and training reactors, and identify appropriate collaborations between DOE national laboratories and university programs. To this end the panel is making a series of recommendations to the NERAC and the DOE.

University Nuclear Engineering Programs: Our vision is have DOE assist universities as they refocus these programs to enhance advances in nuclear science and engineering as applied to security, power and medicine and to maintain the necessary human resource for continuing the discipline through the 21st century. These efforts would be to:

1. Enhance the graduate student pipeline to maintain the health of the discipline by increasing doctoral fellowships (~20) and masters scholarships (~40) with funds of $5 million/yr.
2. Assist universities in recruiting and retaining new faculty in nuclear science and engineering by establishing a Junior Faculty Research Initiation Grant program for peer-reviewed grants in basic research.
3. Expand research discoveries in nuclear science and engineering by increasing the Nuclear Engineering Educational Research program (NEER) to $20 million/yr (includes item 2).

4. Help improve the undergraduate nuclear science and engineering discipline and maintain a core competency in nuclear systems engineering and design.
5. Encourage and support a national activity of communication and outreach in nuclear science and engineering to identify its basic benefits for the country in the next century.

University Research and Training Reactors: University reactors are an important part of the nuclear science and engineering infrastructure that must be maintained, because experimental facilities (particularly facilities involving ionizing radiation and nuclear reactions) must be part of the educational basis of the discipline for undergraduate training and graduate research. To insure that such facilities are properly supported the panel recommends the following actions.

The panel proposes that a competitive peer-reviewed program augment current DOE financial support for these university reactors. This program would have the following elements:
1. Maintain the current base program for university reactor assistance program, which provides funds for reactor refueling, operational instrumentation, and reactor sharing at $4.3million/yr.
2. Institute a competitive peer-reviewed university reactors research and training award program, which would provide for reactor improvements as part of focused effort that emphasizes research, training and/or educational outreach, with the following elements:

- Specific award criteria which qualify university reactors for participation in the competition,
- Peer-reviewed competition for innovative research, training and/or outreach proposals,
- Multi-year grants that could involve multi-university, multi-disciplinary collaborative teams,
- Awards for research, training and/or outreach purposes with the total competitive program funds at a level of $15 million annually.

University - DOE Laboratory Interactions: The panel examined several approaches that could increase collaboration between universities and laboratories. Some of these strategies have the common theme that would require exercising some level of central authority within the DOE.

- Increased Nuclear Engineering and Health Physics Fellowships: These are an excellent means of interacting with top graduate students. The panel believes that for this and other reasons the funding for NE/HP Fellowship Program should be substantially increased.

- Increase personnel exchanges between Laboratories and Universities: Laboratories could create programs such as a "Distinguished Visitor Program," under which university faculty could spend extended periods (e.g. sabbaticals) at laboratories. Laboratories could encourage its staff to give seminars and/or spend time as visiting faculty at universities.

- Designated University Awards: Universities provide largely untapped resources that could participate more fully in DOE applied and basic research programs. To take more advantage of this resource, DOE could negotiate a certain percentage of the laboratory's

budget to be subcontracted to universities. Laboratory management could also require individual programs (or divisions or directorates) to subcontract a certain amount or percentage to universities each year.