Appendix A to the Minutes for the
Nuclear Energy Research Advisory Committee Meeting
September 30 to October 1, 2002

Observations on *A Technology Roadmap for Generation IV Nuclear Energy Systems: Technical Roadmap Report*
October 3, 2002

The Roadmap Context

The development of advanced nuclear energy systems in the U.S. will depend greatly on the continued success of currently operating light water nuclear power plants and the ordering of new installations in the short term. DOE needs to give those immediate objectives the highest priority and any additional support they require to assure their success.

DOE is pursuing two initiatives to encourage a greater use of nuclear energy systems. The initiatives have been reviewed by NERAC Subcommittee on Generation IV Technology Planning (GRNS) and they are:

- A Near Term Development (NTD) Roadmap which is in the process of being implemented and which was approved by NERAC. NTD identifies six nuclear plant designs with the potential for commercial deployment in the U.S. by 2010. All will operate on the existing once-through fuel cycle. DOE, through its "Nuclear Power 2010 Initiative" has taken action to implement the NTD Roadmap, in cooperation with U.S. industry.

- A Technology Roadmap for Generation IV Nuclear Energy Systems which is described in a report distributed to NERAC and which is to serve as the framework to start to negotiate joint Research and Development (R&D) programs among the ten countries which have come together to form the Generation IV International Forum (GIF). The objective for Generation IV advanced nuclear energy systems is to have them available for international deployment before the year 2030.

DOE is getting ready to launch an Advanced Fuel Cycle Initiative. The purpose of this initiative is to develop highly effective and economical means to deal with nuclear waste management. GRNS did not participate in its formulation.

All three initiatives above need to be integrated to avoid overlaps and to define and modify their technological interrelationships as a function of time and progress.

Due to the significance of the Generation IV Technological Roadmap plans, a concerted effort needs to be made to communicate with other stakeholders including in the U.S.: the Congress, Administration, NRC, ACRS, environmental groups, anti-nuclear groups and

the general public about the nature, basis and substance behind the Roadmap recommendations to solicit support for the agreed upon R&D effort. The process should provide for a process that allows for changes in the Roadmap based on this dialogue.

DOE is to be commended for its efforts to reach an international consensus on the formulation of a GEN IV Roadmap. The bringing together of a diverse group of over 100 international experts with different backgrounds and experience from ten different countries is particularly noteworthy.

The Roadmap Content

Six systems were selected to Generation IV by the GIF: Gas Cooled Fast Reactor System (GFR), the Lead-Cooled Fast Reactor System (LFR), the Molten Salt Reactor (MSR), the Sodium-Cooled Fast Reactor (SFR); the Supercritical Water-Cooled Reactor System (SCWR) and the Very-High-Temperature Reactor System (VHTR). The Roadmap describes R&D programs required by all six concepts to reach the viability and performance stages.

This is too many concepts to be effectively pursued in the US GenIV R&D program. GRNS has provided preliminary advice to DOE on such a strategy and, for example, has recommended no participation on the Molten Salt Reactor, focus only on the key viability issues of the Supercritical Water-Cooled thermal spectrum Reactor and very targeted participation beyond fuel cycle work on both the Sodium-Cooled fast Reactor (i.e. capital cost reduction) and the Lead-Cooled Fast Reactor (i.e. corrosion control and polonium management).

The Roadmap R&D for the six concepts is limited to the viability and performance phases and did not include their demonstration. Developing specific demonstration needs to be accomplished for selected concepts in order to achieve the industrial participation required to assure actual use of the Generation IV systems. The US roadmap effort needs to recognize that the demonstration scope will require significant DOE investment and support.

The proposed R&D scope, schedules, and costs are not detailed enough to pass judgment on their merits. The GRNS notes that these are not the result of a detailed planning process and are highly uncertain and almost certainly highly optimistic. Further because of the long term nature of the proposed R&D, it is very difficult to anticipate the downstream R&D which will be needed based on the results of early R&D efforts. Necessary specific facilities are not identified and their schedules, capital and operating costs, and locations are not provided. The forthcoming discussions among GIF members need to address such details in order to be able to prioritize and schedule the Roadmap R&D appropriately and support DOE budgeting and planning activities.

Execution of the Roadmap

The hard task of determining the R&D tasks and their schedules, the degree of participation by each country and the agreed means to measure progress and make appropriate changes is just beginning. The success of the Roadmap will be very dependent upon the organization, selection, and conduct of the R&D projects.

NERAC should endorse the GEN IV Roadmap for use by DOE to develop joint R&D programs with GIF members and other interested countries. When agreement is reached on most joint R&D programs and a definitive U.S. strategy is developed with respect to Generation IV systems, NERAC should review the strategy and the implementing programs. NERAC should continue to periodically review the progress and resultant adjustments of the GEN IV R&D and the complementary NTD and AFCI R&D programs on an ongoing basis.

The currently scheduled evaluation of the progress on the Roadmap by GIF experts once a year is inadequate. Quarterly reviews of the U.S. program and progress may be more appropriate and they should involve reviewers independent from DOE contractors and participants.

There are R&D programs included in the Gen IV Roadmap, which are likely better funded by other DOE offices. For example, it is proposed to develop a non nuclear-coupled thermo chemical hydrogen closed loop experiment. This process is best evaluated by the appropriate office involved with the production of hydrogen. Similarly, there are programs to improve the handling, storage of spent fuel, which right now are the responsibilities of the power generators and the Yucca Mountain Project. DOE should review the Gen IV roadmap and make appropriate revisions.