Minutes
Nuclear Energy Advisory Committee Meeting
June 24, 2008
L'Enfant Plaza Hotel
Washington, D.C.

Committee Members Participating

John Ahearne, Vice Chair
Thomas Cochran
William Martin, Chair
Daniel Poneman
Burton Richter (by telephone)
Allen Sessoms
Kunihiko Uematsu

Committee Member Absent

Brew Barron
Michael Corradini
Marvin Fertel
Susan Ion
Neil Todreas

Other Participants:

John Boger, Designated Federal Official, Office of Nuclear Energy, USDOE
Nancy Carder, Medical University of South Carolina, NEAC Support Staff
Corey Hinderstein, Nuclear Threat Initiative
Shane Johnson, Principal Deputy Assistant Secretary, Office of Nuclear Energy, USDOE
Paul Kearns, Battelle Memorial Institute
Katie Manly, Chamber of Commerce, Galena, Alaska
Frederick O'Hara, Medical University of South Carolina, NEAC Recording Secretary
Dennis Spurgeon, Assistant Secretary for Nuclear Energy, USDOE

About 25 others were in attendance.

Chairman **William Martin** called the meeting to order at 9:05 a.m. Burton Richter joined the meeting by telephone. A motion to approve the agenda was made by Poneman and seconded by Richter. The motion was approved unanimously.

Martin introduced **Dennis Spurgeon**, who thanked the members for their service. The charter of this Committee is open-ended. The objective is to craft a sustainable program to increase nuclear power in the United States in a safe, economical, and sustainable way. Ahearne commented that another way to look at the Committee's role is to develop nuclear energy as part of the energy portfolio of the United States.

Daniel Poneman was asked to report on the Policy Subcommittee, which has had two meetings. Susan Eisenhower, Charlie Curtis, Corey Hinderstein, and Guy Caruso helped the Subcommittee in its deliberations.

Anything nuclear has to have wide consensus, which nuclear power had for many years but has lost. At this point, it is critical to step back and look ahead. This Subcommittee framed the question of nuclear power's future as a range of energy issues.

It realized that, more than 50 years since the launch of the Atoms for Peace initiative, the implications (in energy, environmental, and national-security terms) of the Nation's

nuclear policies are greater than ever. The next president will face fateful choices on energy.

Many models were reviewed. All of them showed mankind moving toward higher carbon prices and deteriorating environmental consequences. China is adding two coal-fired power plants a week. In the United States, the citizenry needs to think of nuclear energy not only as a source of baseload power but also as a source of process heat for hydrogen generation and industrial uses and as a source of off-grid power.

The Subcommittee looked at three cases:

- no new build,
- the existing situation [with no change in existing policy, 17 GW(e) added by 2030, and nuclear power sliding from 19% of total U.S. electricity production to 18%], and
- carbon constrained [with 45 GW(e) added by 2030].

Martin pointed out that the Energy Information Administration (EIA) projections used by the Subcommittee reflect several drivers, particularly fuel costs and increased coal usage. The carbon-constrained case would induce more nuclear power. These EIA numbers are as good as any projections of future energy use and demand.

The Subcommittee looked at eight issues:

- Discussions on waste management raised pertinent questions to be addressed.
- Discussions on R&D focused on priorities, consequences of deteriorating infrastructure, laboratory modernization, the role of government, and the role of industry.
- Discussions on human resources identified the current talent pool and projected requirements.
- Discussions on security identified the elements of security, the objects of security concern, and policy priorities.
- Discussions on safety identified elements of safety, the facilities to be covered, and policy priorities.
- Discussions about supply-chain management questioned how capable the United States is to support all the links in the nuclear-power and fuel-cycle supply chains. It considered what steps would be needed to fill gaps in the chain and how much the United States can depend on foreign partners.
- Discussions on reactor licensing focused on the current Nuclear Regulatory Commission (NRC) practices and how that agency can better fulfill its responsibilities.
- Discussions on the policy environment focused on long-term sustainability.

The new-build process is already under way outside the United States. Safety, the environment, and security are universal issues for nuclear power.

Nuclear energy has to consider nuclear proliferation. If nuclear power plant expansion is accompanied by a linear expansion of countries engaged in enrichment and reprocessing, there will be an unacceptable increased risk of proliferation. It is important to institutionalize fuel-cycle mechanisms to reduce that risk (e.g., through multilateral arrangements, fuel assurances, leasing, and/or a fuel bank). It is urgent to finalize these mechanisms before individual countries make decisions that pre-empt a regime of restraint in fuel-cycle proliferation. Life-cycle guarantees may relieve barriers, such as lack of technology or of security capabilities.

Without the United States' providing leadership, the Nation cannot get to where it wants to be in these international arrangements.

A number of proliferation issues need to be addressed: the modernization of U.S. and multilateral export controls, the development of discrete threat-reduction strategies for state vs. nonstate actors, deciding the appropriate U.S. policy toward cooperation with key nations (e.g., Russia and India), and coordinating U.S. domestic nuclear policies with foreign and multilateral policies and efforts. A full array of players needs to be engaged in nonproliferation.

Nuclear power *can* play a significant role in efforts to limit greenhouse-gas emissions. The United States has a lot of work to do to prepare domestically before nuclear power can play that role. It is critical that domestic and international implications be analyzed and addressed if nuclear expansion is to be a viable option for the United States and other countries. If the United States does not expand its nuclear fleet but other nations expand theirs, it will become increasingly difficult for the United States to carry significant weight in international efforts to manage global nuclear expansion. Given the stakes to the United States and the high U.S. standards in safety, it is in United States' national interest to play a leadership role in global efforts to address the safety, security, environmental, and proliferation implications of nuclear power.

Hinderstein added that there has been debate on how U.S. decisions can influence international decisions. This country must consider how domestic decisions will be read overseas. Consistency is important here.

Spurgeon noted that the Department of State's International Security Advisory Board **(**ISAB) just issued a report that reached a similar set of conclusions. It raised the question, how do you make the rules if you are not a player in the game? The need for consistency is seen in Global Nuclear Energy Partnership (GNEP). Other countries want the United States to provide international leadership. Someone has to be on point, and the assumption of that responsibility has to be done in a practical way.

Cochran commented that the comments made about the U.S. role on the international front apply to all of the scenarios considered. However, the analysis ignored the plants that are going to be terminated, about the same number (although smaller) than the ones coming online. Somewhere around 2030, 3.8 GW of capacity will be retired annually, and 12 GW of capacity will be added each year. The carbon offset could be calculated, and a real number would be appreciated there. The economic models are not very good for projecting energy production. One needs to get the *policy* right in order to make realistic projections. The problem is the carbon, and the policy must constrain it. The economic ramifications of that carbon policy will drive how the energy industry proceeds, and the economy will pick the winners. One should not just set a number of plants to be built.

Poneman agreed that U.S. domestic policies certainly will not influence build/no-build decisions in other countries. Costs of carbon should be internalized; that would be a powerful influence on the economy, and it would favor nuclear power. *All* externalities need to be internalized. One has to be honest about *all* the pluses and minuses.

Sessoms commented that this Committee needs to focus on concrete numbers for guidance to the Office of Nuclear Energy (NE) and on numbers for facilities. This Committee is not in a position to cap carbon.

Richter suggested that, on the first scenario, the Subcommittee is not being sufficiently apocalyptic. That scenario would have the United States on the sidelines, being just a user of nuclear power. The French, the Japanese, and a joint United States/Japanese venture are the ones who would build any new nuclear plants in the United States. Renewable-energy sources are getting subsidies. Should the report refer to non-carbon energy subsidies? Congress needs to get involved in these decisions. It abolished the Office of Technology Assessment (OTA) and does not have an appropriate committee structure for long-range planning. The new administration has to get Congress to participate in the decision processes. The French have a joint policy organization that leads to sustainable and adoptable policy.

Poneman said that the Subcommittee had not grappled with that last issue and should have.

Ahearne noted that Poneman had been involved in many decisions by several administrations. He asked what barriers would be encountered. Poneman replied that people do not understand the magnitude of the problem or the range of options available for addressing that problem. There is a huge educational job to be done. In addition, if the nation does not proceed with construction, it will be farther and farther out in left field with little voice in international discussions.

Spurgeon noted that such a system had existed before, the Joint Committee on Nuclear Energy, and it worked well. Perhaps a joint committee on energy would help.

Cochran countered that the Joint Committee left the United States with a terrible legacy in Savannah River, Hanford, and Navajo Country.

A break was declared at 10:00 a.m., and the meeting was called back into session at 10:32 a.m.

John Ahearne was asked to report on the R&D Facility Requirements Subcommittee. That Subcommittee has produced a draft report, which was distributed to the NEAC Committee and Advanced Nuclear Transformation Technology Subcommittee members. The Subcommittee has been inundated with comments on the draft report and hopes to have a final draft by the end of June.

Paul Kearns was asked to report on the study being conducted by Battelle Memorial Institute (BMI), which is being conducted in a three-step process: (1) BMI will develop an industry- and university-supported list of capabilities and facilities necessary to conduct a comprehensive nuclear R&D program. (2) Idaho National Laboratory (INL) will assess the current facilities and their conditions and availability to support the next 20 years of nuclear R&D. (3) Recommendations will be made on priorities and facilities to be constructed, maintained, or otherwise supported. Kearns led a discussion of the draft of the BMI report and how it fits into the overall study of the Subcommittee.

This study is seen as a top-down/bottom-up process employing multiple opportunities for input: a working group, an interview of industry and academic leaders, focus group discussions, a university Internet collaboration, a focus group review of the draft report, and a comment period for the final draft report.

Industry has been generally supportive of the government's making investments in R&D facilities. There has been a strong emphasis on safety, economics, and cost-effectiveness as business drivers, and there has been a concern about the work force (including knowledge retention, the number of workers required, and the need to fill the pipeline of future scientists and engineers). Industry is starting to recognize the need for

its investment in workforce development. There is also a concern about regulatory and construction delays and a strong interest in new licensing applications. Academia stressed that multiyear R&D investments are essential and expressed a desire for more DOE/industry collaborative opportunities.

The title of the report is being changed to *An Industry Perspective on Nuclear Energy R&D Capability Requirements*.

The steps taken during the analysis were to define the 2010−2050 goals, to define and prioritize required capabilities, to identify "nuclear-unique" required capabilities, to identify the "nuclear-unique" required facilities, and to develop recommendations.

Six priority areas were identified:

- Existing light-water reactors (LWRs) and advanced light-water reactors (ALWRs) (considered program-specific)
- Workforce development (considered cross-cutting)
- Sustainable fuel cycle (considered program-specific)
- Next-generation reactors (considered program-specific)
- Regulatory requirements (considered cross-cutting)
- Safeguards and security (considered cross-cutting)

A long list of needs was developed for each focus area, and those listings were prioritized. In the category of existing LWRs and ALWRs, a major priority was to enhance manufacturing and construction methods for plant-life-extension upgrades and construction of new plants. In workforce development, a major priority was to adopt knowledge-management methods and techniques to enhance cross-generational knowledge retention, workforce development, and effective use of lessons learned.

Sessoms commented that a long-term investment in academic programs and facilities was needed. Richter added that industry might think about a graduate fellowship program Cochran observed that the Navy runs its own reactor schools and suggested that industry do something similar; maybe NuStart could be a place to start. Sessoms asked how DOE interacts with the Navy training process. Spurgeon replied that it is run by the Navy totally by themselves. It is consistently managed and funded. It is a great success story. He asked what the academic response would be if there were a civilian training program. Sessoms replied that it would be positive. Brookhaven National Laboratory and Argonne National Laboratory are great models of government-university collaboration. Ahearne noted that the Institute of Nuclear Power Operations (INPO) had a great influence on increasing the safety and reliability of nuclear power plants.

In next-generation reactors, major priorities were to develop fuels and materials. In regulatory requirements, the major priority was improving the NRC license application and review process. In safeguards and security, major priorities included the use of technology to optimize the use of guns, guards, and gates and the enhancement of cybersecurity capabilities to ensure plant safety and security.

Not all of these capabilities would be provided by NE. In some cases, co-development with another industry may be possible. And capabilities were assessed as (1) available from other industries, (2) can be codeveloped, or (3) are nuclear specific.

The next step was to identify the required R&D facilities, of which there were 11:

- Nuclear education facilities
- Thermal irradiation facilities
- Fast irradiation capabilities

- Radiochemistry laboratories
- Hot cells for separations
- Hot cells for post-irradiation examination
- Thermal transport
- Fuel development laboratories
- Licensing demonstration – high-temperature reactor
- Licensing demonstration – fast reactor
- Specialized engineering development laboratories

Not all of these have to be government owned, and not all have to be located in the United States.

The top facility priorities were in existing LWRs and ALWRs (where existing facilities will provide the needed capabilities as long as they are maintained and appropriately upgraded) and workforce development (where further evaluation of education and training needs is required; an American Physical Society report on this topic was just issued and should be studied). The second-level priorities were in next-generation reactors (where a high-temperature-reactor licensing demonstration is needed to develop and demonstrate new applications for nuclear energy and which requires an engineering-development and component-test facility) and in establishing a sustainable fuel cycle (where additional fuel-cycle R&D facilities are needed and where existing facilities provide needed capabilities through *laboratory-scale* research in the near term; beyond laboratory scale, added investment is needed). The third-level priority is a fast-reactor licensing demonstration (which requires an engineering-development and component-test facility).

Richter pointed out that thermal-reactor fuel recycling is not a big deal; fast-reactor fuel recycling *is* a big deal because new technology and licensing requirements are needed.

Martin suggested that the table of facility priorities be appended with a column on international partnerships.

Cochran said that, in 2007, 107,000 tons of U_3O_8 was mined in Australia, Canada, and Kazakhstan. A program focused on uranium supply would be needed. Stockpiling uranium would be cheaper than developing a new technology (like a Strategic Petroleum Reserve Office). Richter quickly calculated that, at $2000/kg, a 1-GW reactor would need a $2.4 billion stockpile for the reactor's lifetime.

The recommendations made by the BMI study are to

- Establish a Strategic Nuclear Energy Capability Initiative, which would be integrated, time-phased, and user-driven;
- Strengthen international collaboration;
- Define a "living" process for facility consolidation, retirement of old facilities, and replacement, when appropriate; and
- Define a process to ensure the maintenance of "balance of plant."

Industry would be interested in co-investing in research facilities and user facilities.

The Subcommittee concluded that

- A robust, fully trained workforce is essential.
- The nuclear-energy industry has established meaningful goals.
- The establishment of a Strategic Nuclear Energy Capability Initiative is needed to provide essential R&D capabilities and facilities.

- The foundation provided through the Strategic Nuclear Energy Capability Initiative should be leveraged to build public–private partnerships and international collaboration.

Richter expressed approval of the change in title to reflect the industry perspective and noted that the Facility Subcommittee's interaction with the Battelle study had been helpful.

Regarding the NEAC Facilities Subcommittee, Ahearne had drafted a response to the charge given to NEAC by Assistant Secretary Spurgeon. A final draft report will be forthcoming after reviews. The Subcommittee reviewed the Battelle and INL assessments. Ahearne summarized the draft report. The GNEP program has produced a list of needs that includes where those needs may be met. That list was well developed and should be incorporated into the INL effort. The Battelle effort did not address radioactive waste or interaction with the National Nuclear Security Administration, which is responsible for safeguards. GNEP's budget was just zeroed out by the House of Representatives. A fast-spectrum reactor will be needed. Collaboration with Japan would help here. Collaboration is also needed on fuel recycling. There is concern about starts and stops in R&D programs, which are devastating and which are caused by the Office of Management and Budget and by Congress.

University programs have to be strengthened in radiochemistry and other nonpower efforts as well as in nuclear engineering.

The two tasks that DOE has started are good but only potential. The Subcommittee on Facilities needs to build on the recommendations of the Policy Subcommittee and is awaiting that subcommittee's recommendations.

The needs of small reactors (grid-appropriate reactors) also need to be investigated.

Richter, the cochair of the Facilities Subcommittee, noted that the Subcommittee has more work to do before the final report. Some needs cannot be met in the United States. The United States is not capable of providing leadership at the present time. It needs to rebuild the program, bolstered by international deals and supporting foreign facilities. There may be export-control hurdles to get over.

Uematsu noted that the world is entering a new era with new countries trying to become nuclear powers. The United States is looked at as a star. It is the only one to operate 104 reactors, and it has a good safety record. The United States needs to ensure the safety of its nuclear power operations. Many facilities are available worldwide that should be exploited to cut the costs of GNEP. The United States should focus on establishing international cooperation.

Poneman noted that these small reactors go into a country with fuel and come out with the fuel, which has nonproliferation benefits. He asked if it would be possible to go back to the U.S. naval reactor program for the design of small reactors. Spurgeon responded, yes and no. Small reactors can be looked at. The Japanese have one, and Westinghouse has another.

Ahearne commented that there are other designs. The problem is funding to carry these paper designs to actual reactors. In addition, there is a question about the need for them.

Sessoms stated that the United States should grasp the international opportunity. It failed to do that with the Fast-Flux Test Facility (FFTF). Episodic funding does not succeed in international programs. A 5-year funding block is needed. Ahearne pointed

out that the Navy has always been successful in getting 5- to 6-year funding for an aircraft carrier. Sessoms commented that one has to be *permitted* to do that. DOE needs to forge some alliances with Congress.

Martin noted that the country's international partners will look carefully at this report because of the broad-based, nonpartisan makeup of the contributors. This Committee can do a better job on assessing the program's R&D needs and direction between now and October than any transition team can do between October and January 21, 2009. This effort has been an immense task. He asked about the timing and purpose of this product.

Poneman stated that it is important to emphasize the educational component of getting people to accept the policy component. The broad-based approach used here is a robust, sensible approach to nonproliferation, safety, and nuclear-energy policy.

Martin opened the floor to public comment.

Katie Manly from the Chamber of Commerce of Galena, Alaska, stated that her city recently passed a resolution supporting small nuclear reactors and it looks forward to a small reactor being built in Galena by Toshiba. Cochran asked if Galena would be receptive to a Russian-designed reactor. Manly replied that it would, but the Toshiba reactor is the train on the tracks now.

Cochran encouraged that a nuclear training operation be framed not just as benefiting nuclear power but also benefiting the government-wide needs for nuclear workers. Today, nuclear plants cost too much. The economic issues need to be focused on rather than the fuel-cycle issues. If carbon is not capped, a fuel cycle beyond that of the current fleet will not be needed.

Sessoms commented that DOE does not do economics. This Committee needs to give DOE advice on facilities and provide various scenarios so that the Department can make judgments, not bets. DOE should not invest too much in capital-cost estimations.

Martin noted that the EIA was more pessimistic about nuclear power 5 to 6 years ago. The high cost of natural gas has changed the EIA's assessments.

Ahearne noted that the Policy Subcommittee needs to put together a report before the Facilities Subcommittee can complete its deliberations. Another Facilities Subcommittee task, the production of plutonium-238 for space applications, is being investigated by Michael Corradini and Ahearne.

Poneman stated that the Policy Subcommittee is struggling with how detailed to make its report. Martin said that Eisenhower had told him that Poneman would make an excellent drafter of that report.

Cochran called attention to the fact that both of these reports have to come back to this Committee for approval and that comments and concerns may be raised by the Committee. Ahearne stated that the Facilities Subcommittee has a lot of work to do before it will have anything for people to look at. Cochran pointed out that Battelle will have another draft of its report in a week. Martin suggested that another draft be produced by October and that a NEAC meeting be scheduled then. Ahearne said that it should be done in August. The window is going to close. Poneman assured them that the Policy Subcommittee could finish its report by August. Spurgeon observed that September is a very busy month and that the Committee will want to get universal comments and contributions in order to get ownership from professional societies and the national academies, well beyond just NEAC's membership. Richter stated that the Academy

operates at glacial speeds; one might be able to get a senior person there to review the reports and comment on them.

Uematsu said that the international community would not have any difficulty reviewing the reports in a timely fashion.

Boger reaffirmed that the two subcommittees report to NEAC and that their reports must be reviewed by that committee.

Spurgeon suggested that these should be reports to DOE, not NE. Nothing should be excluded from the reports because it does not fall within the purview of NE. Terms have also been confused. There is no GNEP budget or technology. GNEP is an umbrella organization under which many activities occur. There *is* an Advanced Fuel Cycle Initiative (AFCI) budget. The writers of these reports must be careful about how the terms are defined. The same problem occurs with bilateral and trilateral agreements. What needs to be rebuilt includes the whole NE program and its institutional credibility. NE lives year to year now, and that perspective has to be lengthened. This assessment has to be independent to have credibility. It has to come from people who believe in the Nation's energy future. These reports need to be socially vetted and approved by September.

The meeting was adjourned at 1:05 p.m.

Respectfully submitted,
Frederick M. O'Hara, Jr.
Recording Secretary
June 30, 2008

Corrected by Ahearne
July 2, 2008