Draft Minutes
Nuclear Energy Research Advisory Committee Meeting
February 20-21, 2007
Bennion Student Union
Idaho State University/University of Idaho
Idaho Falls, Idaho

Committee Members Participating

John Ahearne, Vice Chair, via telephone, Wednesday morning only
Michael Corradini, all day Tuesday and Wednesday morning only
Jose Luis Cortez, all day Tuesday and Wednesday morning only
Robert Long
William Martin, Chair
Sekazi Mtingwa, via telephone, Tuesday only
Harold Ray
Alan Sessoms, via telephone, all day Tuesday and Wednesday morning only
Neil Todreas

Committee Members Absent

Thomas Cochran
Marvin Fertel
Steve Fetter
Marilyn Kray
Michael B. Sellman

Other Participants:

John Boger, Designated Federal Official, Office of Nuclear Energy, USDOE
Nancy Carder, Medical University of South Carolina, Support Staff
Phillip Finck, Associate Director, Idaho National Laboratory
Jared Fuhriman, Mayor of Idaho Falls
John Grossenbacher, Director, Idaho National Laboratory
Phil Hildebrandt, Director, Next-Generation Nuclear Plant Project, Idaho National Laboratory
David Hill, Deputy Laboratory Director, Idaho National Laboratory
Paul Lisowski, GNEP Deputy Program Manager, Office of Nuclear Energy, USDOE
Dennis Miotla, Deputy Assistant Secretary for Nuclear Power Deployment, USDOE
Frederick O'Hara, Medical University of South Carolina, NERAC Recording Secretary
Buzz Savage, Director of Fuel Cycle R&D, Office of Nuclear Energy, USDOE
Rebecca Smith-Kevern, Office of Nuclear Energy, USDOE
Dennis Spurgeon, Assistant Secretary for Nuclear Energy, USDOE
Joy Rempe, Principal Investigator, Idaho National Laboratory
Craig Williamson, Medical University of South Carolina, Support Staff

About 35 others were in attendance in the course of the two-day meeting.

Tuesday Afternoon, February 20, 2007

Chairman **William Martin** called the meeting to order at 3:05 p.m. Designated Federal Officer **John Boger** introduced himself and reviewed the procedures of the meeting.

Martin welcomed the NERAC members, Assistant Secretary Spurgeon, and the Idaho National Laboratory (INL) staff and asked for approval of the agenda. Corradini moved and Cortez seconded to approve the agenda. The motion carried unanimously.

Martin asked Todreas to give an introduction to NERAC. Todreas noted the advisory nature of the Committee and described the establishment of the Generation-IV (Gen-IV) and Nuclear Power 2010 (NP-2010) programs in consultation with NERAC, which also developed the roadmaps for these programs. Out of those programs came AFCI (the Advanced Fuel Cycle Initiative) and gas-reactor activities. Evolved versions of these activities are still in existence. Other important subcommittees have contributed to the advice given to the Department. Martin added that NERAC is interested in the economics of nuclear power and stressed the importance of nuclear energy. The Global Nuclear Energy Partnership (GNEP) puts the United States back in the business of recycling and the fuel cycle.

Martin introduced Dennis Spurgeon, Assistant Secretary of Energy for Nuclear Energy, to give introductory comments. Spurgeon said that he believed actual progress in a physical sense is at hand. The symbolism of the groundbreaking for the Center for Advanced Energy Studies (CAES) is important. There has been a hiatus in meetings of this Committee. The role of Assistant Secretary demonstrates the importance attributed to and the commitment to nuclear power by Congress and the administration. GNEP is a Department, not an Office of Nuclear Energy (NE), function. It has contributions from other DOE offices. Nuclear is back and is reclaiming staff.

Getting GNEP off the ground has been interesting because of the number of players. It has a steering committee. There have been positive responses. Twelve responses were received from institutions interested in hosting GNEP facilities. A generic environmental impact statement for GNEP is being developed, and the United States has entered into a relationship with Russia and likely will have such relationships with Japan and France soon.

Many companies have expressed interest in combined operating licenses (COLs), and there are two applications for site permits.

The bottom line is that the United States is rebuilding its nuclear-energy program. The tag line is that, although $875 million is an improvement, there is still a long way to go to fund the role of nuclear energy to achieve energy security.

Martin said the nuclear renaissance is going forward with or without the United States. Nuclear energy helps both the environment and energy security. The United States is challenged by other countries' developing fuel cycles and by having to explain such concepts as "fuel banks." If one goes from the macro to the micro, GNEP is seen as essential. The global partnerships showed this is not just a U.S. concern. Ensuring a culture of safety internationally requires that the United States be at the table. Otherwise, other countries will pass the United States by.

Martin had each member present introduce himself. A break was declared at 3:52 p.m. to set up for the presentations. The meeting was called back into session at 3:55 p.m.

to hear **John Grossenbacher** review the status of INL, which is operated by the Battelle Energy Alliance.

The nuclear renaissance needs an institution like Idaho National Laboratory. This fact was pointed out by President Bush in the state of the union address, by Speaker Pelosi in hearings before the House Science and Technology Committee, and by Assistant Secretary Spurgeon at the American Nuclear Society winter meeting. INL is building on a solid foundation that is grounded in scientific and engineering capability, focused on mission, committed to transforming the culture, and meeting challenges and opportunities.

INL is tasked with becoming the preeminent, internationally recognized nuclear-energy research, development, and demonstration (RD&D) laboratory and becoming a major center for national and homeland security technology development and demonstration. It is also to foster education, research, industry, government, and international collaborations to produce the needed investment, programs, and expertise. The vision concludes with INL becoming a multi-program national laboratory with world-class nuclear capabilities and a leading clean-energy R&D laboratory and regional resource. It does substantial work on cellulosic ethanol and has a legacy of environmental achievements.

In nuclear programs, INL is assisting in integrating GNEP with an R&D focus on issues relevant to the 2008 decision on how GNEP will go forward. It is supporting an international collaborative framework and making continued progress on the Next-Generation Nuclear Plant (NGNP) R&D and industrialization.

In national and homeland security, it is building business and critical infrastructure protection, cybersecurity, nuclear nonproliferation, and defense technologies. It is assisting National Nuclear Security Administration (NNSA) in detecting and analyzing illicit and declared fuel-cycle activities. Critical infrastructure protection is the core of its business, and it has established a Grid Reliability Center of Excellence.

In science and technology, it is supporting the nuclear energy mission through five signature-science capabilities. It is positioning INL as a regional energy center, optimizing energy resources in the western inland energy corridor, and building on leadership capabilities in biofuels and synfuels technology.

With CAES, it is making a major investment in and integration with the Idaho universities, building collaborations with the National University Consortium, and introducing a new Technician Training Associates Degree Program.

INL has experienced business growth. Its $686 million of business volume in FY06 represents a growth of 28% from the previous year. It is the third or fourth largest employer in Idaho, offering employment opportunities and local investment.

INL has conducted strategic recruitments in computation and modeling, national and homeland security, and leadership. In 2005, it consolidated its organizations and activities; in 2006 it underwent transformation; in 2007 it will produce work of real substance with the establishment of CAES; and in 2008 it will pursue continuous improvement. The employees have done a wonderful job stepping up to the challenges they face; this is now a far different institution.

For INL to succeed, it will take intellectual capital from across the country. Facilities are also important. GNEP will need an Actinide Chemistry and Separations Laboratory and an Advanced Fuel Cycle Facility. The science and technology campus needs a

national and homeland security laboratory, a science and technology laboratory, and the new CAES. The reactor technology complex needs to make the Advanced Test Reactor (ATR) a user facility and it needs analytical laboratories and hot cells. The Idaho Nuclear Technology and Engineering Center needs second-generation reprocessing facilities to be brought into play to support GNEP recycling.

The roles of DOE are to develop, demonstrate, and promote. The role of the Nuclear Regulatory Commission (NRC) is to regulate. And the role of the commercial nuclear industry is to deploy needed energy resources. The role of INL is to facilitate these other roles. INL's vision is to employ a collaborative model to deliver capability using a nuclear-industry network, university network, and a national-laboratory network.

GNEP provides the opportunity for the United States to lead the global nuclear expansion and to site significant facilities at INL. The president's 2008 budget moves the nuclear agenda forward significantly. The 38% increase in the nuclear-energy budget needs to be sustained. The challenge is to secure nuclear-energy support and funding. Locally, the INL physical infrastructure needs are a challenge, and establishing ATR as a user facility is vital. DOE, the State, and the Laboratory are all committed to mutual support and cooperation in making progress on this mission.

Martin asked where INL was today in terms of the Committee's past recommendations. He asked if the United States' vision of GNEP is consistent with where INL is going. Spurgeon replied that the Laboratory is a multiplier of the Department's views and efforts. It is coordinating the national laboratories, universities, and industries. It is going from what industry needs to figure out how to meet those needs. It is absolutely consistent. The industrial pieces are falling in place nationally and internationally.

Long noted that the physical infrastructure is a challenge. NERAC's task force calculated that multiple hundreds of millions of dollars would be required to update the facilities and asked if those numbers had changed. Grossenbacher replied that there is an enormous need for resources and human-capital investment. That has not happened except incrementally. Work at other national laboratories needs to be supported. Resources and investments are needed to make INL a world-class influence in nuclear energy.

Ray commented that "the industry" is not in the United States anymore. He asked if there was any effort to bring that technology back into the country. Grossenbacher said that one has to distinguish between the utilities and vendors. The vendors are no longer available. DOE has a responsibility to develop national and international partners as well as to create opportunities for U.S. industry, and it hopes to do that.

Mtingwa pointed out that U.S. researchers do not have access to the fast-neutron spectrum. Savage responded that the department has a proposal from Los Alamos National Laboratory (LANL) and the ATR to fulfill those needs. There is no hope of restarting the Fast-Flux Test Facility (FFTF). One needs to go overseas to Phenix in France and Joyo (and perhaps Monju) in Japan. There is a possibility of using the BOR-60 reactor in Russia for advanced fuel and recycling studies.

Todreas noted that one has to build the people as well as facilities. He asked what was being done at the scientist/engineer and entry levels to develop these resources. Hill replied that this is a problem for the whole industry: to restock the human-resources pool. That needs to be done across the spectrum of experience. Finck added that INL is

working hard to develop that restocking. People in graduate school are being mentored and then brought on board when they graduate. Those mentorships are being cultivated. Hill added that the last part of the process is retention.

Cortez noted that, years ago, the facilities needed upgrading and some shutdowns. One way to impress the world with our seriousness is to upgrade facilities and build new ones. That will take a lot of money.

Corradini asked if the international cooperation and coordination among laboratory leaders has been started so that GNEP can take on an international role. Grossenbacher responded that a program is needed to effectively get into the game. INL's relationship with Nexia Solutions is a good starting point. INL is identifying the key people and the work that they need to do.

Martin commended Grossenbacher on his excellent relations with the community leadership. Grossenbacher said in closing that INL takes NERAC's world-class report very seriously. It is consistent with the vision for the Laboratory and where the management team wants to take it.

Spurgeon introduced **Paul Lisowski** to present an update on GNEP.

Global energy demand is expected to more than double by 2050, driven by world population and per capita energy use. The Human Development Index is drawn from life expectancy, education, and gross domestic product; 80% of the world's population is below 0.8 on this index. All of the industrialized countries have a per capita energy use greater than 4000 kWh per year. There is an international expansion of nuclear power to help meet the demand as more countries become industrialized. Therefore, more fuel-cycle states can be expected.

The key international elements of the US nuclear energy strategy are to

- Establish supply arrangements among nations to provide reliable fuel services worldwide for generating nuclear energy by providing nuclear fuel and taking back spent fuel for recycling without spreading enrichment and reprocessing technologies;
- Develop, demonstrate, and deploy advanced, proliferation-resistant nuclear power reactors appropriate for the power grids of developing countries and regions; and
- Develop enhanced nuclear safeguards to effectively and efficiently monitor nuclear materials and facilities, to ensure commercial nuclear-energy systems are used only for peaceful purposes.

Under GNEP, suppliers would operate reactors, lease out fuel, and receive returned fuel, perhaps through the International Atomic Energy Agency (IAEA) to provide safeguards and fuel assurances. These activities would be backed up with a reserve of nuclear fuel for states that do not pursue enrichment and reprocessing. This scheme is purely speculative at this point. The key pathways are policy engagement, developing a framework development that includes fuel leasing and fuel banks, and developing technical collaboration for advanced fuel-cycle cooperation and grid-appropriate reactors.

The GNEP statement of principles tells what countries have to do to participate in GNEP. They would not have to give up any rights.

A General Conference and Infrastructure Workshop has been held. International technical cooperation is under way or being worked on with Russia, Japan, France, China, Great Britain, and others. Workshops and deliverables have been planned with the Russians, and subworking-group topics have been set up.

Major meetings have been held, and activities have been carried out to prepare for cooperation. The AFCI established joint cooperation in 2001 and continues today. Two agreements have been signed and new activities are under way with France. Initial meetings have been held with Great Britain and China, and a statement of principles is under discussion with those countries. The next steps are

- Completing joint action plans with Japan and France,
- Holding the first United States/Russia technical cooperation workshop,
- Establishing a statement of principles with P-5 (the five permanent members of the United Nations Security Council) and Japan, and
- Engaging China.

Until the technical people work together, these agreements are not meaningful. The United States will place people in Russia and other countries to work with them.

Domestically, the United States must expand nuclear power to help meet growing energy demand in an environmentally sustainable manner. It must also develop, demonstrate, and deploy advanced technologies for recycling spent nuclear fuel that do not separate plutonium, with the goal over time of ceasing separation of plutonium and eventually eliminating excess stocks of civilian plutonium. This goal will require new facilities, technology development, and R&D.

The United States is currently committed to sending spent fuel to geologic disposal. In GNEP, the United States would move fuel to process storage with advanced separation, put the first-reactor fuel in an advanced recycling reactor, and recycle its products. This effort needs to be industry led. Support activities will be DOE-laboratory led with NRC, university, industry, and international partnerships developing fast-reactor fuel and recycling processes.

An engineering-scale demonstration was recognized as a necessary long-term activity, so a decision was made to engage with industry at a commercial scale. That engagement is going on now, and the National Environmental Policy Act (NEPA) process is being carried out simultaneously.

For the initial GNEP operation, three supporting activities are envisioned: a nuclear fuel recycling center, an advanced recycling reactor, and an advanced fuel cycle facility. The Consolidated Fuel Treatment Center project is preparing for engineering alternative studies, industry engagement, and addressing key areas of risk (separations technology, uncertainty in the regulatory framework, sharing sensitive spent-fuel separations technology among foreign nationals, and waste-management product qualification and disposition).

A Funding Opportunity Availability (FOA) has been issued, and awards were made in January 2007. A NEPA Notice of Intent was issued in January 2007 with the Environmental Impact Statement Record of Decision expected in summer 2008. The engineering alternative studies contract was awarded through INL to Washington Savannah River Company (WSRC) to support the Secretarial decision due in June 2008.

The Advanced Burner Reactor (ABR) is a sodium-cooled fast reactor designed to demonstrate closure of the fuel cycle, consume transuranic elements, reduce the burden on the geologic repository, and generate electricity for the grid. The ABR will be a prototype for future fast reactors for safeguards and passive safety features and cost-reducing design features. The stakeholder community has recommended proceeding with a commercial-scale prototype. A preconceptual design has been completed. There is

interest from potential host communities to site the ABR, and the Environmental Impact Statement (EIS) is under way. Addressing potential risk areas requires working with the NRC, completing the NEPA process, developing a strategy for industry engagement, and providing input to support the Secretarial decision.

The Advanced Fuel Cycle Facility (AFCF) is a large research and technology development facility for advanced recycling technologies. It will become the world's most advanced facility for developing advanced recycle technologies. Its design will be determined by national laboratories. The 30% conceptual design review has been successfully completed. The objective is to provide a reliable cost and schedule estimate for the Secretarial decision.

GNEP has a strategic plan that calls for

- Input from U.S. and international industries on how to bring the GNEP facilities into being,
- Developing a technology roadmap,
- Getting industry participation in the development of conceptual designs that support both a nuclear fuel recycling center and an advanced recycling reactor, and
- Finishing the GNEP EIS.

This plan requires closing the fuel cycle. Building commercial-scale prototypes of recycle and fast-reactor facilities will require industry design and construction, operation, and national-laboratory-led work to close technology gaps. INL will coordinate all this work.

DOE has established a functional structure to manage GNEP across organizational boundaries. That structure has an executive committee, a steering committee, and a system of working groups. NE has a GNEP program organizational structure supporting the strategic plan. It has a steering group, strategic planning group, and three projects.

DOE's near-term actions have increased emphasis on work to inform the 2008 Secretarial decision to potentially move from AFCI to GNEP. That work must secure the President's budget request, develop and implement GNEP technology, engage the international community, and develop adequate information to inform the Secretarial decision. An Advance Notice of Intent and a Notice of Intent have been published. Public scoping meetings are being held. A Draft Preliminary EIS is expected to be issued in summer 2007. A record of decision is expected to be obtained in summer 2008. The zeal of the sites wanting to host GNEP facilities is impressive.

In summary, there is a rapidly expanding global demand for nuclear power. Without some global regime to manage this expansion, many more "Iranian" situations will likely appear. The United States, through GNEP, is leading the formation of this global regime; but unfortunately, it does not have the means to participate in its execution. Unless the United States implements the domestic aspects of the GNEP program, it will suffer significant consequences in its energy security, industrial competitiveness, and national security. There are potential repository benefits, but the international need for GNEP is compelling. The United States must act decisively and quickly to implement GNEP or face the real possibility of having no influence over the certain future global expansion of nuclear energy.

Spurgeon asked the Committee to read the strategic plan and to offer comments at the dinner later that evening. Lisowski stated that the Department has made enormous progress internationally and cut across stovepipes in the Department.

Todreas stated that the key benefits of GNEP are proliferation resistance and waste reduction. Lisowski agreed that GNEP is going to drive things for a long time and that the nonproliferation aspects are key. Spurgeon noted that the world is moving forward with nuclear power. A way to make a fuel-leasing program available to developing countries and to guarantee a reliable fuel supply is needed. The United States' offer to convert low-enriched uranium (LEU) to fuel is one step. The back-end problems need to be solved: What do you do with the fuel coming out of these reactors? He places more weight on waste disposal. A waste bill is needed to deal with domestic nuclear wastes. Yucca Mountain might not open until 2017 or even later. If hundreds of nuclear reactors are to be started up, a plan is needed for the spent fuel. The nation needs to act faster rather than slower on that problem.

Lisowski observed that both of these issues are important. At an IAEA meeting, all the countries look to the United States for leadership.

Martin asked rhetorically what would happen if GNEP were not done. That scenario can be projected. One has to make the case analytically. GNEP has put the United States on the map, although many countries are skeptical about the availability of funding. He asked to what extent international and domestic companies would be involved. Spurgeon replied that the United States does not have a domestic industry. The companies are all international. The work will be done by these international companies. The fuel cycle will be internationalized. The question is whether the United States will be an influence in how this process progresses.

Martin asked what NERAC can do to help on the technical side. In addition, Corradini asked what the roles of the Department of State and the IAEA were in this. Spurgeon replied that they are definitely involved. It is a collaborative relationship with DOE. The Department of State has country interests besides nuclear energy. It gets tied to other issues that the United States has with Russia. DOE has to coordinate and interface with the Department of State. The plan was vetted through an interagency group; this is not a Lone Ranger operation. How to manage and coordinate it is the big question. GNEP is new and old. Concepts are coming back from decades ago. Many of these tasks have been done before. NERAC can bring perspective. The Assistant Secretary's office needs advice on how to structure the program. There is too little time to think in leadership positions.

Ray noted that it is easy to get expressions of interest and hard to get contracts. These are opportunities.

Lisowski said that this Committee can offer third-party validation. Congress wants independent reviews. It would be good to have a Committee report.

Cortez noted that, when one talks of international cooperation, the schedule is very tight and will be extremely difficult. INL is not cited for any roles. LANL and Oak Ridge National Laboratory (ORNL) cannot handle what they now have. Lisowski replied that these places have to be considered under the NEPA. Cortez said that he would like to see the prototype designed here at INL. Lisowski said that, over the next day, the Committee will see many of those details.

Corradini was intrigued with the industry connection. The acceptance of the risk associated with getting into this enterprise might be aided by this Committee.

Long pointed out that the World-Class Laboratories Subcommittee also found that other countries feel that the United States has to step up and be a leader. Also, the top-

down process is hard. A lot of work has to be done to get the lower levels to buy into the plan.

Todreas commented that, in the strategic plan, the industrial lead is well done. The fuel going into the ABR is coming from a national laboratory and going into a commercial reactor. That transition is going to be difficult. Lisowski pointed out that one will start the reactor on a startup fuel and transition into recycled fuel.

Martin congratulated Spurgeon on how far along he had brought the budget. The meeting was adjourned for the day at 6:10 p.m.

Wednesday Morning
February 21, 2007

Martin called the meeting to order at 8:32 a.m. and introduced **Dennis Miotla** to discuss the FY08 NE budget. The FY08 budget has been presented to Congress, and the FY07 budget is not being acted on by Congress. The FY06 budget is being used to guide the FY07 budget, and there are FY06 carryover funds.

Nuclear Power 2010 is NE's program to encourage the construction of new reactors. It includes early site permit work and COL work, which is cost-shared with industry to facilitate this new regulatory process. Its FY07 request was $54 million, which was low for the baseline; some carryover funds will be added. Its FY08 request is $114 million, which is in line with the baseline. Industry will likely lobby for that amount to be increased. The Gen-IV funds include the NGNP (an Energy Policy Act of 2005 milestone) and the R&D program of the Gen-IV International Forum (GIF). Its FY07 request was $31.4 million, which is a level of progress that DOE feels comfortable with to produce the information needed for the 2011 decision point.

The Nuclear Hydrogen Initiative pursues processes for hydrogen production (e.g., high-temperature hydrolysis); this R&D is important for industrial as well as transportation needs. Its FY07 request was $18.7 million, and its FY08 request is $22.6 million.

The AFCI funds GNEP. Its FY07 request was $243 million, an ambitious goal (FY06 was $80 million); carryover funds will be added. Its FY08 request of $395 million is similarly aggressive.

The radiological facilities management funding includes the university research reactors, space program, and medical radioisotope program. The space program is running off inventory stock of plutonium-238 and Russian sources; it needs about $30 million to run a plutonium-238 program. The medical radioisotope program is struggling; it has no central source; many radioisotopes are bought on the international market. The FY07 request was $49.7 million; the FY08 request is $53 million.

Idaho Facilities Management funds the Idaho site; it is hoped that the level of funding will be increased. The role of the Laboratory is expanding; after the transition is the time to upgrade the infrastructure. Investments are needed in the ATR to make it a user facility as well as the materials testing facility. The FY07 request was $95.3 million; the FY08 request is $104.7 million.

$75.9 million is requested annually for the Idaho site-wide safeguards and security. The site has a lot of special nuclear materials, and there are pressures to improve security.

INL has a superior safeguards and security workforce and program. An annual credit of $3 million will be claimed for security charges for reimbursable work at the INL site.

In FY06, the university programs were zeroed out. NE got slapped around on the Hill for that. The goals that had been set for the program had been met, so the program ended. Flat funding was requested for FY07, paying off all the mortgages previously created. The research reactor infrastructure will continue at $2.9 million per year. Funding for R&D program-funded research has been requested at the rates of $24.4 million for FY06, $34.9 million for FY07, and $58.6 billion for FY08. These are directly competed research grants. The goal is to get all this money out to the universities as quickly as possible. The solicitation will be modeled after that of the Nuclear Energy Research Initiative (NERI) program. It is desirable to maintain the level of funding but shifting emphasis to NERI grants directly to universities.

Todreas asked if the $34.9 million for R&D is mostly NERI grants. Miotla responded, yes, and it includes the laboratory-directed and noncompetitive university work. The long-term goal is full competition, but it is not desirable for a couple of universities to take all the funding. Todreas asked what the sodium work was. Miotla responded, the Gen-IV work.

Martin asked how the Department found the new Congress. Spurgeon replied that they are now in the early stages of working with the new Congress; the first authorization hearings are in a couple of weeks, and appropriation hearings start in late March. There is a greater appreciation forming for the role of nuclear energy. It is well accepted that power generation needs to be increased 50% in the next 25 years. Can it be done? Not for some sources of energy (e.g., hydropower and natural gas). Wind can be increased, but tripling or quadrupling wind is not a lot of new power. France built 55 nuclear plants in 15 years. That type of accomplishment needs consistent policy and public support.

Martin said that he foresaw a greater nationalization of energy sources. The government has a price to pay on the research, but after that, it is up to the private sector. Ray added that what was missing was the role of state government in this process. Reactors will be built where the state government supports nuclear power.

Joy Rempe was introduced to give a status report on the Advanced Nuclear Transformation Technology (ANTT) Subcommittee.

Two Subcommittee meetings were held and status reports issued to NERAC in 2006. Funding of at least $120 million was announced in February 2007. The next Subcommittee meeting is planned on March 5-6, 2007, in Washington, D.C.

GNEP was initially rolled out in the summer of 2006. It altered the course of AFCI R&D. The Engineering-Scale Demonstration Facility and the Advanced Burner Test Reactor were eliminated; additional reprocessing scenarios were considered; and research was altered to support the change in course. The GNEP concept evolved during 2006. Currently, there are two commercial facilities and one government laboratory facility and industry participation in commercial facilities.

The Subcommittee is primarily focused on AFCI R&D. It reviewed the FY06 technical progress and tries to identify inconsistencies and gaps in proposed research to support the evolving GNEP. Its latest report had seven key recommendations that included those recommendations submitted in prior reports and some that had already been implemented. Those recommendations were

1. A mission statement is needed for each of the three major GNEP facilities [ABR for reduction of transuranics, the Consolidated Fuel Treatment Center (CFTC) for light-water-reactor spent-fuel treatment, and AFCF for long-range R&D]. Multiple and possibly inconsistent facility objectives are currently under consideration, and many mission-related facility parameters have not been specified (e.g., the ABR power rating and initial fuel type, the AFCF fuel-fabrication rate, and the CFTC separation process). These objectives are important because some of them lead to specific design selections.
2. An integrated GNEP program timeline is needed that includes demonstration of multiple transmutation recycles, including qualification of the required fuels. It should also expand the current use of the technology-readiness-level approach to assess research performed and additional research needed to accomplish the GNEP objectives.
3. There should be a review of the availability of necessary test facilities because the development and qualification of transmutation fuel is a long-term process requiring irradiation facilities and because research programs require fuel and material irradiations in thermal, fast, and pulsed reactors. There are limited facilities available in the United States and abroad. Currently, INL's ATR and the French Phenix reactor are being used. The fuel type (metal or oxide) proposed by industry will need to be qualified by DOE. And TRU qualification will require significantly more testing in INL's ATR, Sandia National Laboratories' Annular Core Research Reactor (ACRR), Phenix, Joyo, BOR-60, unavailable facilities [e.g., INL's Transient Reactor Facility (TREAT)], and new facilities [e.g., additions or modifications to the ATR and/or the Los Alamos Neutron Science Center (LANSCE)].
4. Various transmutation scenarios should be considered. The current technology base supports ABRs with conversion ratios of 0.5 to 0.6. Lower conversion ratios require more highly enriched fuel, but they reduce the required number of fast reactors. However, the more highly enriched fuels may have undesirable effects in terms of reactivity, thermal cycling, and proliferation risk. Transmutation scenarios beyond 2050 should include the possibility that breeder reactors will be the main type of reactor deployed for power production.
5. Support for several reprocessing technologies (UREX+, COEX, and pyroprocess) should be continued. The technology-readiness-level-approach should be increasingly used to prioritize additional required research.
6. The program should ensure that universities are sufficiently supported. GNEP will require actinide chemists, nuclear engineers, nuclear physicists, computational scientists, and material scientists. NERAC should develop a long-range plan for university funding that ensures a sufficient GNEP workforce.
7. The program should establish an NE, Office of Civilian Radioactive Waste Management (RW), NNSA, and Office of Science (SC) coordinating committee because GNEP will affect the need for additional repository space, require basic research, and be subject to requirements for controlling nuclear material. NE should create and share a high-level coordinating committee that includes representatives from these other offices.

GNEP offers a unique and much needed opportunity to begin the reduction of separated plutonium, eliminate the need for a second repository, plan a path forward for power production, and slow or perhaps stop the growth of fuel-cycle countries. Funding and this opportunity should not be wasted. NERAC should recommend that NE develop an achievable path and stick to it. The international community is watching to see if the United States is serious.

Cortez stated that Rempe had hit a lot of points that needed to be addressed. Now a lot of planning is needed.

Todreas said that the Committee should note favorably the recommendations and pass them on to DOE *as stated in the slide presentation*. The report is more succinct and telegraphic than the slide presentation; it is too focused on breeder reactors.

Long agreed that the Committee needed to commend this report to DOE management.

Sessoms said that the report was good. Some funding is needed for GNEP research, but how much? Rempe said that that number has changed since last August, when the report was written. Lisowski said that about $25 million will be available; when it is given out depends on how the budgets developed. Spurgeon noted that NE was coordinating with SC and RW and with NNSA. SC is providing support of scientific work (e.g., advanced computing in simulation and modeling) with an eye toward GNEP's future needs.

Sessoms agreed with the need to forward these recommendations to DOE.

Cortez said that the Committee should endorse these recommendations and forward them to DOE.

Todreas asked Rempe whether, when she spoke of breeder reactors, she meant internal or external breeding. Rempe replied that the Subcommittee considered anything with a conversion ratio greater than 1 a breeder.

Todreas phrased a motion for consideration: The Committee should accept, endorse, and forward the Subcommittee's report to DOE for its review and use and that the recommendations in the report should be supplemented by the slides presented today to complete the content and context of the recommendations. Cortez seconded the motion. The motion was sent to the remote participants by e-mail. A vote was held that included the members present in person and via telephone. All eight participating Committee members (Todreas, Ray, Martin, Long, Cortez, Corradini, Ahearne, and Sessoms) voted for the motion.

Martin thanked Rempe for the presentation and introduced **Phillip Finck** to speak on systems analysis and integration in GNEP.

Supporting the GNEP strategy requires facilities and capabilities that largely do not exist at the present. Moreover, those facilities and capabilities will need to be linked closely. To affect that linkage, the GNEP objectives will need to be understood. Technologies are highly interdependent, and things do not always work together well. Many material forms are envisioned, and management will need to last for centuries. Economic and deployment strategies are needed in order to understand the global benefits of GNEP. Technological risk needs to be managed, and some of those risks make the whole thing work.

Options for managing spent nuclear fuel include (1) higher efficiency reactors; (2) limited recycle, which carries the need to study effects on proliferation and repository

issues; and (3) fuel-recycle technologies that eliminate weapons isotopes and increase the lifetime of repositories by factors of 10 to 100.

One must reduce heat production in order to benefit repositories like Yucca Mountain. System-analysis investigations have demonstrated that:

- Achieving repository benefits (capacity, dose) requires the management of uranium, transuranics, and certain short- and long-lived fission products. The UREX+1a process provides a proof of existence of such schemes.
- Losses of transuranics must be controlled during separations and fuels fabrication stages to achieve these benefits.
- Significant transmutation of transuranics is not practical in current commercial reactors; fast reactors provide a more efficient solution.
- Transuranic elements should be kept together as much as practical to reduce proliferation risk.
- Systems analysis must address the entire fuel cycle.
- Transition to a closed fuel cycle will take several decades to complete.
- To reduce proliferation risk in the international fuel cycle, it is critical to discourage the spread of enrichment and separation capabilities and to eliminate excess stocks of separated plutonium.

Issues that need further attention include the evaluation of alternative options (e.g., heterogeneous recycle), domestic and international deployment scenarios, economics, and the GNEP waste-management strategy.

The current choice of reference technologies provides a proof of existence, but the performance might not be optimized, the economics might not be optimized, and implementation will need to progress incrementally. The key alternates that need to be evaluated are separation schemes that provide a transition from existing technologies to complete waste management and transmutation schemes that are adapted to that transition, and the GNEP waste-management strategy that incorporates both technical and regulatory requirements.

The economics are very important. The impacts and benefits of a wide range of nuclear energy deployment options are being evaluated to (1) understand the issues and opportunities related to keeping nuclear power an economically competitive option (via greater participation by industry), (2) evaluate the elements that dominate nuclear fuel-cycle costs (via modeling and sensitivity analysis), and (3) help develop creative solutions that can make future nuclear reactors and their fuel cycles internationally viable (via international participation). The costing database continues to be reviewed by independent industry experts. The goal is to provide a balanced analysis with consistent cost data, credible design basis, and peer-reviewed methods and accounting practices.

Recycling rather than storing spent nuclear fuel makes a huge difference in the amount of material stored in a repository.

Once developed, scenario analyses provide important information on coordination and timing of facilities, requirements for separation efficiencies, technology cost estimates for market penetration, technology development needs, repository/waste-form acceptance criteria, licensing/regulatory process requirements, the evaluation of options and optimization, transportation-infrastructure needs, industry-infrastructure needs, national and international laws and policies, and program risk.

How GNEP could work in a European context is being studied. The Nuclear Energy Agency/Organisation for Economic Cooperation and Development (NEA/OECD) Working Party on Scientific Issues of the Fuel Cycle is coming out with a report soon. It will be very useful to inform the U.S. decisions.

Input to the Secretarial decision in June 2008 requires an understanding of

- Deployment options and a comparison of those deployment options with those of partner states,
- Economic and business payoffs,
- The effect of uncertainties in technology development,
- Input to the business plan,
- The role of nuclear in the global energy picture (including global warming),
- Integrated waste management strategy, and
- The required input to the NEPA and Preliminary EIS.

The path forward on technical integration requires a focused product-driven structure; the integration of technology development, engineering research, modeling and simulation, and scientific research; and driving the transformation of the research process. There are six potential campaigns: systems analyses, fuels, separations, fast-reactor technologies, safeguards, and waste forms. A Technical Integration Office is being established to provide technical coordination and program coordination. Technical coordination will be provided between campaigns, between campaigns and projects, and between U.S. campaigns and foreign partners. This Technical Integration Office will drive the systems analyses and will have cost-cutting activities. Program coordination will provide integrated schedules, controls, quality assurance, information management, and communication.

Under the GNEP initiative, the systems-analysis effort is now focused on definition and assessment of a closed fuel cycle. Dynamic scenario analyses are being used to integrate program information and to inform program decisions. The systems-analysis effort will assist in informing both domestic and international policy.

Finck then turned his attention to the topic of program integration at the national laboratories.

A successful GNEP program requires an integrated program with a clear vision and measurable goals and participation of industry, laboratories, and universities. INL was asked to integrate the early GNEP-related activities employing technology-development requirements based on a systematic systems analysis, involving the foremost national and international expertise, and using a requirements-driven process to systematically organize and execute the GNEP.

Integration has several challenges:

- U.S. nuclear resources are dispersed and aging.
- There is a diversity of technical alternatives.
- The nuclear R&D approach needs to be transformed.
- Collaboration with industry needs to be enabled.
- The regulatory approach needs to be supported and regulatory expertise needs to be rebuilt.

Ten national laboratories put together a GNEP Technology Demonstration Program Preliminary Plan that assumes the development model described in the FY07 budget request. A red-team review was conducted by seven senior outside experts representing

industry, national laboratories, universities, and the NRC. That review provided external validation of the plan's content.

The multilaboratory effort provided three insights for improved program execution: the need for basis documents to document the technical underpinnings of GNEP, the need for an integrated waste strategy, and the need for involving nontraditional (AFCI) elements crucial for success.

The critical technology issues will be (1) process scale-up or adaptation, (2) making the reactors economical to build and operate, (3) transuranic fuel development, (4) identifying where the process losses are, and (5) integrated waste strategy.

Program information undergoes a multilevel review and validation process, including internal review, independent review at other laboratories, Richter Subcommittee review, and National Academy of Sciences (NAS) review.

The established requirements-driven process will drive execution. Peer review is being emphasized. The technology-development plan will continue evolving to account for programmatic and strategy changes, to incorporate alternatives, and to account for industry involvement. The transformation of the R&D process will acquire multilevel coordination.

Long asked what the Secretary's decision was. Spurgeon replied that GNEP was established as a vision for the fuel cycle for the international regime. There will be decision milestones about the direction to be followed. Also, the budgeting support will have to be established. The information needed to make those technical and budgetary decisions will have to be produced. The top-down vision would have to be adopted in a bottom-up manner. What are being asked for from Congress are resources to get to the point where those decisions could be made by the Secretary of Energy.

Todreas asked what questions are to be answered by the campaigns and when would they be adopted by the laboratory activities and be reviewed by NERAC. Finck replied that they had been asked to organize these campaigns just three weeks ago. Gaps in the campaigns have been looked for, and *how* the campaigns are going to be carried out is now being looked at. Tools to integrate the campaigns can be provided. There will be several reviews; it is hoped that the review process will be finished by April 1.

Buzz Savage was asked to describe the GNEP R&D program.

The advanced fuel cycle R&D program started with the 1999 roadmap for the Accelerator Transmutation of Waste (ATW) with proton accelerators used to destroy actinides and spent fuel. A research program was funded in 2000, and the Advanced Accelerator Applications (AAA) program was launched in 2001. In 2002, AAA morphed into a reactor program, the AFCI, with most of its work being done in Europe; the United States was an observer. In 2003, AFCI established a new management structure and was integrated with the Gen-IV fuel-cycle development, which was to recover the energy value of spent nuclear fuel, reduce the inventory of civilian plutonium, reduce the heat and toxicity of high-level nuclear waste bound for geologic disposal, and be proliferation resistant. AFCI did not have as strong an industry participation as did Gen-IV.

The AFCI program

- Demonstrated laboratory-scale, high-purity separation of uranium, cesium, strontium, plutonium-neptunium, americium/curium, and group transuranics from spent LWR fuel with UREX+.

- Fabricated and irradiated in the ATR nonfertile and low-fertile metallic, nitride, and oxide fuel samples containing multiple transuranics. Post-irradiation examinations indicated the fuels (except the nitrides) retained integrity.
- Built a lead-bismuth test loop at LANL and completed a 1000-h corrosion test on several steels and alloys.
- Improved the nuclear cross-section data bank with new data on plutonium, neptunium, and americium isotopes.
- Conducted analyses to provide options to optimize thermal- and fast-spectrum transmutation.
- Prepared for fast-spectrum irradiations of transmutation fuels in Phenix.
- Started preconceptual design studies for an AFCF that would test and improve advanced separations, fuels, and safeguard technologies.
- Established and maintained robust university and international collaboration programs.

Secretary Bodman announced plans for GNEP in the FY07 budget rollout. The FY06 budget language was supportive of accelerating technology decisions and engineering-scale demonstrations. AFCI started to be reworked with a focus on GNEP projects, especially the engineering-scale demonstration of UREX+. R&D not directly supportive of GNEP was reduced in scope or stopped.

A breeder economy is a Gen-IV objective. GNEP wants to jump directly into burner reactors. The AFCI budget was increased each year; $243 million was requested for FY07; however, the congressional resolution limited it to the $79 million budgeted in FY06. The FY08 budget request is $405 million, including $10 million for NNSA support of GNEP for safeguards development. Technology development and R&D will support the entire GNEP program and will be integrated into the campaigns. A handheld will provide program and technical integration; other national laboratories will provide support.

Separations technology development is designed to reduce risk and major uncertainties in separating spent fuel into products and waste forms. It will develop methods to improve the system's operational effectiveness using advanced modeling and simulation techniques. Major activities include aqueous technologies (focused on UREX+) and pyroprocessing technologies (the preferred technology, but one that will not be used for LWR spent fuel because of the volume of waste) with simulation and modeling.

Spent nuclear fuel is 94% uranium, 0.9% plutonium, 0.1% neptunium, 0.1% americium, 0.015% curium, and 4.9% fission products.

Advanced fuels development will provide solutions for important parts of the fuel-development process, where there is high or moderate risk, so that a qualified transmutation fuel is available for use in the Advanced Recycle Reactor. Metal and oxide transmutation fuels are being looked at. Reactor-fuel test samples are being fabricated and irradiated in the ATR and in far and fast reactors to consume transuranics. Long-term R&D will be continued for next-generation facilities, including the production of data for modeling and simulation. R&D will be pursued for alternative fuels.

Transmutation science supports advanced recycling reactors, including reactor and transmutation physics and the development of advanced structural materials. Fast-burner-reactor design and development will be supported by reducing and refining the

uncertainties in the behavior of major isotopes of importance to the ABR. Mechanical testing and analysis of irradiated structural materials will be performed. Materials for use in fast-reactor transmutation systems will be recommended and selected. International activities [e.g., the Megawatt Pilot Experiment (MEGAPIE) in Switzerland and the MATRIX-SIM at Phenix] will be supported.

Technology readiness level (TRL) assessment was developed by the National Aeronautics and Space Administration (NASA) and adapted by DOE. Advanced-fuel R&D was evaluated according to this system. The TRL metric assesses the maturity of a technology and compares the maturities of different technologies. GNEP will use the TRL assessment to determine R&D and technology-development needs and priorities, although the TRL level is not the only indicator of technical maturity. An example of the TRL process has been prepared for the uranium–plutonium fuels with high maturity.

AFCI/GNEP has committed $26 million to university programs in FY07. The University of Nevada at Las Vegas as a transmutation research program funded at $5 million; it will be continued. The University of Nevada at Reno has a congressional earmark of $1.75 million in FY06 for research in transmutation. The Idaho Accelerator Center at Idaho State University is funded at $2 million in FY06; that will be continued. NERI has 19 continuing projects selected in FY05 and 13 continuing projects selected in FY06 to which GNEP is a major contributor ($4.4 million in FY06 and $8 million in FY07; this funding will be expanded in FY08). A large university component is expected to be retained in GNEP; it will be peer-reviewed, competitively selected R&D and technology-development activities. It is desirable to expand the Fellowship program to include PhDs.

In summary, the GNEP R&D program evolved from the AFCI program that developed programmatic approaches to spent-fuel waste management. The AFCI emphasis was on R&D at national laboratories with support from universities, and a strong international collaboration. These aspects remain in GNEP, but with a shift in emphasis to industry-led facility design supported by AFCI resources and with a larger role for advanced simulation and modeling. R&D in the near term will support technology-development needs of GNEP facilities and in the long term advance the development and approval of fuel-cycle technology. Technology readiness will be evaluated using the TRL approach.

Rebecca Smith-Kevern was introduced to describe the status of Nuclear Power 2010.

NP 2010 began as a demonstration project in 2002. It is a government–industry cooperative effort that has 50-50 cost-shared industry projects and is market-driven.

Its major projects include

- Three early site permit (ESP) demonstration projects designed to address site suitability, environmental protection, and emergency planning for a given site for 10 to 20 years, renewable. The NRC is about to issue Clinton and Grand Gulf ESPs; a North Anna permit is in the final hearing phase. Approval decisions on all three are expected in 2007.
- Two new nuclear plant licensing demonstration projects
- COL Guidance and Generic Issues Project
- The Standby Support Insurance Incentive, providing support to the Loan Guarantee and Production Tax Credit Incentive Support

The first new-plant licensing demonstration project is for Dominion Energy's COL for its economical, simplified boiling-water reactor (ESBWR) at North Anna. DOE is providing funding for the COL application preparation and NRC review, the ESBWR design certification and first of a kind engineering, and some site deployment planning and assessment. The General Electric ESBWR design certification was docketed in December 2005, and the license application is expected to be submitted in the fall of 2007.

The second COL is for one of NuStart Energy's installations. Funding is being provided for the NRC review of one COL and completion of engineering for the selected reactor technology. The Westinghouse AP 1000 reactor design was certified in December 2005. NuStart expects to submit two license applications in the fall of 2007.

Since 2002, NP 2010 has evolved from demonstration to deployment. The timeline started in November 2003 with the issuance of DOE's solicitation. NuStart submitted its proposal in April 2004, a cooperative agreement in April 2005, and a project baseline in December 2005. Dominion is to submit the ESBWR license application in November 2007, and DOE is expected to sign the standby support conditional agreements with industry in early 2009. The NRC is expected to issue the ESBWR design certification and the NuStart AP 1000 license in fall 2010. The COL projects would be complete at the end of 2011, and commercial operation might begin in 2014 or 2015.

The Energy Policy Act of 2005, Section 638, provides indemnification for six new advanced nuclear reactors for delays related to the failure of the NRC to comply with scheduled reviews and approvals and for certain litigation that delays commencement of full-power operation. For the initial two reactors, 100% of the cost of delay is covered, up to $500 million per contract; for the subsequent four reactors, 50% of the cost, up to $250 million per contract, is covered after an initial 180-day delay. DOE issued the final rulemaking on August 4, 2006. The standby support contract is a two-step process that involves an initial conditional agreement. The Department will complete a conditional agreement in the spring of 2007 before the utilities submit their COL applications to the NRC; standby support conditional agreements with industry will be implemented by December 2008.

The production credit is the province of the Internal Revenue Service, but NP 2010 staff members are supporting Treasury in developing a process for allocation and approval of production credits. There is a national megawatt limitation of 6000 MW, and the credit is limited to a maximum of $125 million per 1000 MW per year for eight years.

Loan guarantees help reduce loan interest rates and allow greater debt-to-equity ratios, thereby reducing total project cost for selected technologies. DOE provides up to 80% guarantees with a term not to exceed 30 years or 90% of project useful life. DOE published guidelines and issued a small-scale solicitation in 2006. The solicitation did not invite new nuclear projects. The Department is currently developing a notice of public rulemaking. It is unable to issue a loan guarantee until it has authorization to do so in an appropriations bill.

Three ESPs are under review, and industry has indicated that up to three more applications may be submitted to the NRC for as many as 30 units. Nine of these power companies participate in NP 2010 COL projects. Two designs have been certified, one design is under NRC review, and one design certification application is to be submitted to NRC in 2007. Long-lead equipment orders have been initiated.

Long said that it looks like Duke Power is on track for submitting their COL by October 2007. Also, it would be good for DOE to push standardization of first of a kind engineering (FOKE) and balance of plant. Spurgeon replied that there is a great focus on that issue in the COL process. A pathway to standardization is being created.

Grossenbacher introduced the Mayor of Idaho Falls, **Jared Fuhriman**, who thanked NERAC for coming to Idaho Falls. The city has always supported the national laboratory. For the first time, the national laboratory has a 10-year contract, which has stabilized the city. The Battelle Energy Alliance has been impressive with their leadership and their integration with the community. The cleanup is going well. A few months ago, the region went out for bond for a coal-fired generator in Utah. The region needs to build more generating capacity because of growth. Nuclear power is seen as the long-term solution. Local mayors are gathering next week, and the main topics are water and GNEP. The city provides the tools and support for DOE's facilities and employees. The city will continue to build up that infrastructure.

Phil Hildebrandt was introduced to review the status of the NGNP.

The concept for the NGNP is a high-temperature gas-cooled reactor (HTGR) demonstration, a process-heat machine operating at 900 °C for direct use in industry. Gas-cooled reactors have important safety features and are modular. This is a step between R&D and commercialization.

There is a partial project organization for the NGNP. A commercial alliance is essential to obtain adequate funding for development; this will be a government partnership. A preliminary project risk assessment/management plan has been written. Engineering studies and preconceptual design are in process. A preliminary R&D plan is in place as are rough order-of-magnitude cost and schedule estimates from 23 companies. The technical and functional requirements are to be developed from the preconceptual design work and will define what R&D needs to be done.

The defining documents include the Business Strategy, which is being used to approach potential end users, who need a 95% availability; the Technology Review, which has been specified and uses a 2018 operating goal; and the Technology Risk Assessment, which was performed in March 2006.

The near-term priorities include engineering studies and a preconceptual design, selected R&D, a licensing strategy, quality-assurance excellence, and planning for project success. The project is divided into four phases: program development and project definition, plant design and licensing, plant construction and operation, and commercial deployment.

Key issues are the NRC license application and licensing process, technology development and qualification, the acquisition strategy and long-lead procurement, and startup testing and initial operations.

The steps that must be taken to assure a viable commercial HTGR are

- Establish an industry alliance [a 501(c)(3) organization] to enter into a public/private partnership;
- Complete the conceptual, preliminary, and final design of a prototype HTGR that produces process heat, hydrogen, and electricity;
- License it with the NRC;
- Build and operate a demonstration plant in sufficient time to confirm performance; and

- Certify standardized HTGR designs for commercial deployment in a broad range of applications.

The NGNP must balance economics, performance, reliability, design risk, technology-development risk, and timing. The design and technology development risks are the TRISO [tri-isotropic] fuel's performance and availability, graphite structural materials (design requirements must be established), intermediate heat exchangers' design and materials, the heat-transport medium and its operating conditions and degree of isolation, and the process-heat applications' identification and scalability.

Long pointed out that another characteristic of a world-class site is the presence of a special facility and asked if the NGNP could be such a facility. Hildebrandt answered that conversations have been started with international collaborators. All the industrial participants are international teams. The opportunity of this being a user facility is recognized, but as yet unplanned.

Todreas asked if they were going to pick a particular design path or have the end-users do that. Hildebrandt responded that the program will recommend a path next fall, some decisions will be proposed, and they will be reviewed by the emergent commercial alliance. That alliance will not exist for 12 to 18 months. Decisions will not exclude any potential vendors from the table.

Ray applauded the progress and focus of the program. Carbon emissions may affect the production and pricing of process heat. It would be good to know the enabling (economic) conditions. Hildebrandt noted that one industry member said that economics would not drive them to this, but carbon restrictions would make it very desirable.

Long asked about the reliability of recirculating pumps. Hildebrandt replied that it is not the highest risk, but such pumps are a challenge at these temperatures, although they are believed to be able to do the task with existing technology.

Martin opened the floor to general questions from the Committee.

Ray noted that many things have to happen in NP-2010, but the milestone for deciding on the agreement to finance a project is critical. One has to line up customers and get them on the hook.

Long stated that NERAC should recommend that DOE engage faculty members and students in the NGNP program.

Martin opened the floor to public comment.

Bob Leyse suggested the adoption of ultrasonic fuel cleaning to remove scale and to decrease thermal resistance. A small amount of scale can reduce heat transfer significantly.

Ann Rydalch, Chair of the Energy, Natural Resource, and Agriculture Policy Committee for the National Foundation for Women Legislators, said that the Committee addresses policy issues and has heard about nuclear energy's resurgence and GNEP. That Committee recognized the role of nuclear power in the future energy mix. The peace of mind that constituents are looking for is the safe disposal of spent nuclear fuel waste. GNEP will reduce that concern. The rest of the world has pursued recycling spent nuclear fuel. It is time for the United States to join them. She urged the Committee to demand that the United States once again become the world leader in nuclear energy.

Lane Allgood, Executive Director of the Partnership for Science and Technology, said that the organization was an advocate for nuclear issues that would benefit society. Idaho Falls business leaders in the late 1940s demonstrated to the Atomic Energy

Commission that nuclear energy was welcome in Eastern Idaho. Idaho Falls and the government facilities here have grown up together. Idaho is adopting a state energy plan in which nuclear power and the Idaho National Laboratory play a major role; 77% of Eastern Idaho citizens support nuclear-energy research.

Martin called for closing remarks.

Long commented that the large amount of information presented was reassuring about the progress of the program.

Ray regretted that more members could not attend and echoed Long's comments.

Todreas added his appreciation of the focus on GNEP. He pointed to progress on identifying a path forward for nuclear energy research and the focus provided by the Secretary's decision in 2008. Quite a bit has been accomplished.

Spurgeon thanked the Committee for coming to Idaho. Meeting here in Idaho is important for a number of reasons. He thanked the meeting hosts and his staff. Some possible tasks for the Committee to look at have been drafted and include GNEP review, systems analysis work, and a vision for what comes after NP-2010. Siting plants on greenfield sites will raise several challenges. The members of the Committee should get involved in advising on the Department's international activities. The Department needs to re-engage with NERAC. Everyone needs to work together for the common good.

Martin said that there are very few directorates that have as many international responsibilities as this one does. GNEP returns DOE to a position of prestige and should pull together a supportive constituency. He thanked the hosts of the meeting and John Boger, Designated Federal Officer, for their services.

There being no further business, he adjourned the meeting at 1:50 p.m.

Respectfully submitted,
Frederick M. O'Hara, Jr.
Recording Secretary
March 16, 2007