MINUTES OF THE

May 28, 2003

BASIC ENERGY SCIENCES ADVISORY COMMITTEE

MEETING

Sheraton National Hotel
Arlington, VA

Geraldine Richmond
Chairperson

http://www.sc.doe.gov/production/bes/BESAC/Meetings.html

BASIC ENERGY SCIENCES ADVISORY COMMITTEE

Meeting Minutes
May 28, 2003
Sheration National Hotel
Arlington, VA

I hereby certify that these minutes constitute a reasonably comprehensive and accurate record of the meeting of the Basic Energy Sciences Advisory Committee held on May 28, 2003.

Geraldine Richmond

Geraldine Richmond, Chairperson

July 21, 03

Date

Minutes are available on the BESAC website at:
http://www.sc.doe.gov/production/bes/BESAC/Meetings.html

Minutes for the
Basic Energy Sciences Advisory Committee Meeting
May 28, 2003
Sheraton National Hotel, Arlington, Virginia

BESAC members present:

Nora Berrah
Mostafa El-Sayed
George Flynn
Laura Greene
John Hemminger
Eric Isaacs
Anthony Johnson
Walter Kohn
Gabrielle Long
Anne Mayes
William McCurdy, Jr.
Bradley Moore, Vice Chair
Daniel Morse
Cherry Murray
Ward Plummer
Geraldine Richmond, Chair
Richard Smalley
Joachim Stohr
Samuel Stupp
Kathleen Taylor
Rudolf Tromp
Mary Wirth

BESAC members absent:

Collin Broholm
Philip Bucksbaum
Patricia Dove
D. Wayne Goodman
Martin Moskovits
John Richards
Stanley Williams

Also participating:

Patricia Dehmer, Associate Director of Science for Basic Energy Sciences, USDOE
Mildred Dresselhaus, Institute Professor, Massachusetts Institute of Technology
Thom Mason, Director, Spallation Neutron Source, Oak Ridge National Laboratory
Raymond Orbach, Director, Office of Science, USDOE
Walter Stevens, Office of Basic Energy Sciences, USDOE

Morning Session

The meeting was called to order at 8:26 a.m. by the **Geraldine Richmond**, Chair of BESAC. She welcomed the attendees and asked each committee member to introduce himself or herself.

Richmond introduced **Raymond Orbach**, Director, Office of Science (SC), U.S. Department of Energy (DOE). He started by noting that there has been some discussion in the government about peer review. There is no difference between mission agencies and a general science-funding agency in use of peer review in reviewing grant applications. A difference lies in selecting excellent science to pursue within the actions of a mission agency.

He acknowledged the effort put into the October 2002 BESAC Workshop on the Basic Research Needs to Assure a Secure Energy Future and showed the different activities that were cited by the Subcommittee as needing research. Each of these research activities was coded to show whether (1) BES basic research could address the needed research activity, (2) other SC and DOE activities could address the needed research activity, or (3) the needed research activity was oriented toward the production of no net carbon emissions. Another version of the same

chart was used to the show how these various activities contribute to important national science issues and areas. The science that SC supports is very high-quality and has important implications. The workshops and advice offered by the advisory committee and its subcommittees are very helpful to, and heavily depended on by, the Department. They not only have an enormous importance but also are influential in the international science communities.

He gave an update on where SC stands on facilities for the future. Each of the Office of Science advisory committees were asked to submit information about projected facility needs. A BESAC subcommittee had considered what facilities might be needed by BES for future research. This information was integrated with parallel advice from the other SC advisory committees. Orbach said that BESAC and its subcommittee did a fabulous job in determining what should be the next steps towards a 20-year plan for such facilities. In all, 53 projects were recommended by the advisory committees. These projects were compared for scientific importance and impact. This process led to an assessment of, and recommended budget for, facilities needed during the next 20 years. These financial requirements were factored into the budget request that was sent to Congress. It is terribly important that the Energy Authorization Bill have an R&D component. There has not been such support in the past energy authorization bills. The facilities plan allows the funding for facilities under the authorization umbrella. This strategy also allows the facilities needs to be considered separately from, and not in competition with, university-based research. He distributed a list of all of the facilities recommended by the advisory committees for funding in the foreseeable future (i.e., 20 years).

He thanked Geri Richmond for her leadership and work during her tenure as Chair. He presented to her a plaque recognizing BESAC's numerous contributions during her five years as Chair.

He then summarized HR 6, the Energy Authorization Bill, a copy of which was distributed to the attendees. This bill is a 4-year authorization plan. When signed by the President, it sets the stage for appropriations and the subsequent annual budgets. This authorization includes the FY04 budget currently under consideration. This plan explicitly specifies several programs of the Office of Science. Significant mention is also made of scholarships and fellowships. Congressional intent to support educational programs is heard loud and clear. This plan was extrapolated out to FY23. If the appropriation level does not meet this authorization level, some of the projects recommended will fall off the table.

Kohn noted that energy conservation has played an important role in research and development in California, but Vice President Cheney only supports it “if it makes you feel good.” He asked what SC’s attitude was toward conservation. Orbach said that conservation is an important component of the energy roadmap and is supported by this Administration. There has to be a drop in energy consumption in the United States brought on by conservation. Industry is very interested in energy conservation. Improving strength, weight, and performance is critical in improving energy efficiency.

El-Sayed asked if the SC budget would be cut to make up for the federal budget deficit. Orbach responded that the support for R&D by the Administration and Congress are both strong. The contribution of R&D to the Nation’s future is clearly understood. Half of the gross domestic product (GDP) increase can be related to R&D.

Moore asked if the internationalization of the secure energy plan will be extended to Asia. Orbach said that there should be an international application of this plan. All countries have the same energy problems. Perhaps this internationalization can be done best by the Department of

State.

Plummer asked what percentage of the budget goes to facilities as one advances through the years. Orbach said that Patricia Dehmer could give a better assessment of that. The basic R&D comes first, and facilities are added to that. Dehmer said that she had done a quick assessment of that issue, and the growth in each sector was about the same as in the other sector.

Richmond introduced **Patricia Dehmer**, Associate Director of Science for Basic Energy Sciences, to present news from BES.

The FY03 budget update is almost finished. No news has been received about the FY04 budget update, and the FY05 budget update is embargoed. She showed a chart indicating the activities and dates of completion associated with the DOE/SC budget cycle; it showed the overlap of the three current fiscal years under development (FY03, FY04, and FY05). Both a recision and a decrease of 1.3% were applied to the FY03 budget appropriation. This resulted in the final budget numbers. Both houses are now marking up the President's Request for FY04. The FY05 budget has been prepared and will be forwarded to the Office of Management and Budget in August 2003. The recommendations in this budget request reflect the recommendations provided by BESAC in its reports.

She reviewed the BES follow-on activities to recent BESAC reports. The Basic Research Needs to Assure a Secure Energy Future workshop has encouraged a number of activities, including a more focused workshop on the Basic Research Needs for Hydrogen Production, Storage, and Use. Most of these follow-on activities are being coordinated through the Office of Basic Energy Sciences, not through the subcommittee structure.

The NSRC Rollout Meeting was held February 2003. About twice as many participants as were expected attended. The workshop was very successful.

The BES Symposium – A Future Retrospective (in the spirit of Iran Thomas) was scheduled to be held May 29, the day following this May 28 BESAC meeting. Dr. Iran L. Thomas was the Director of the Division of Materials Sciences and Engineering in BES from 1987 until his death on February 28, 2003. For the last 7 years of his tenure as Division Director, Iran also served as Deputy Director of BES. Thomas always thought far ahead. Many of the things he worked on did not come to fruition for 20 years, so the planning committee decided to focus the symposium on the impacts of today's science on life 15 years from now, thus BES Science in 2018 – A Future Retrospective. The symposium is intended to be a window to the future, setting the challenge to those who must plan for that future.

An example of Thomas's thinking far ahead is the Spallation Neutron Source (SNS). Thomas worked hard to make an advanced neutron source happen. Dehmer showed pictures of the SNS construction site and of Iran Thomas visiting that site.

Dehmer noted one more transition to be observed, the ascension of a new chair of BESAC. Geraldine Richmond, Richard M. and Patricia H. Noyes Professor of Chemistry at the University of Oregon, has had a long tenure on BESAC, serving as Chair from 1998 to 2003 and as a member from 1995 to 1998. Her tenure as chair has spanned five Office of Science directors. Under her leadership, a large number of reports have been issued, and she presided over 16 full-committee meetings and numerous subcommittee meetings of BESAC. In addition, she has been recognized for her innovation in the Advancement of Women in Science and has been dedicated to her family.

Richmond thanked the Committee and the BES staff for the support provided to her during her years on BESAC. Richmond then introduced **Mildred Dresselhaus** to report on the

Workshop on Basic Research Needs for Hydrogen Production, Storage, and Use.

The thinking for this activity was initiated in March 2003, and the workshop was held in May 2003. The impetus for this effort was President Bush's announcement in his State of the Union Address of a $1.2 billion hydrogen initiative to lessen America's dependence on foreign oil and to reduce greenhouse gas emissions. Congress went along with the initiative, as did the Secretary of Energy.

The workshop charge was to identify fundamental research needs and opportunities in hydrogen production, storage, and use, with a focus on new, emerging, and scientifically challenging areas that have potential significant impact in science and technologies. She identified the workshop organizers and acknowledged the informative presentations by the staff of DOE's Office of Energy Efficiency and Renewable Energy (EERE).

The workshop topics were bundled into (1) Basic Research Challenges in Hydrogen Production, (2) Hydrogen Storage and Distribution, and (3) Fuel Cells and Novel Fuel-Cell Materials. Panels were convened around these topics.

Each panel was asked to address the questions,

- Where are we now?
- What do we already know?
- Where do we want to be?
- What do we need to do to get there?

The workshop made the point that this subject offers an opportunity for SC to work closely and cooperatively with EERE. It also:

- Recognized the great challenge of implementing the hydrogen economy
- Solicited the participation of stakeholders
- Recognized the roles of various DOE programs: their technology goals, objectives, and milestones
- Strove to understand the time scale of each objective
- Planned to coordinate basic research with technology development

The workshop goals were to identify the following.

1. Research needs and opportunities to address long-term grand challenges and to overcome show-stoppers;
2. Prioritized research directions with greatest promise for impact on reaching long-term goals for hydrogen production, storage, and use;
3. Issues cutting across the different research topics/panels that will need multidirectional approaches to ensure that they are properly addressed; and
4. Research needs that bridge basic science and applied technology.

The overall hydrogen question will not be answered during one Administration. A long-term strategy and a sustained effort are needed. Opportunities will be driven by advances in science and technology. The scientific research will be driven by technology needs and will focus on basic research with the highest potential for impact.

The workshop started with five plenary-session presentations and then proceeded to the discussions of the topical panels. Currently, 9 million tons of hydrogen are produced by the

steam reforming of natural gas. Expansion by 40 million tons per year for transportation requires better catalysts and requires CO_2 sequestration to meet the fundamental goals of a hydrogen economy.

Solar electrolysis is only 15% efficient and would require 0.03% of the nation's land area to meet all transportation needs. Thus, it is too expensive to compete at present. Weaning ourselves from fossil fuels will not be easy to do in the next 15 years. To accomplish this would require better catalysts and better materials for fossil- and biomass-conversion processes. The long-term goals of such an effort would be more efficient, cheaper, and more durable solar conversion processes; the development of nuclear resources; and the reduction of the dependence on noble-metal catalysis.

The hydrogen-production panel subdivided its topic into three subtopics and reported the following findings:

1. In fossil-fuel reforming, the major scientific challenges (and opportunities) lie in (a) improved catalysts that are more active, more specific, more stable, and less susceptible to poisoning or fouling and (b) improved gas separations (e.g. membranes – more robust and selective). The priority research areas are (a) combinatorial synthesis and analysis of catalysts and (b) integrated experimental and computational approaches to understand and control catalysts' active sites at the atomic level, catalytic mechanisms, and catalyst design on the nanoscale.
2. In renewable technologies, the major scientific challenges (and opportunities) lie in (a) the integration of light harvesting, charge separation and transport, charge transfer (fuel formation), and stability into working systems and (b) the design and assembly of 2D and 3D systems for very-low-cost solar cells. The priority research areas are the absorption of the full solar spectrum for higher efficiency; controlling the effects of structure, energy-loss mechanisms, and charge separation; and developing composite assemblies.
3. In bio- and bio-inspired hydrogen production, the major scientific challenges (and opportunities) lie in understanding (a) how living organisms efficiently produce hydrogen without noble metals using solar or fixed-carbon energy and (b) how to integrate biomimetic catalysts into complex engineered systems. The priority research areas are identifying microbes and component redox enzymes; developing biological and biomimetic redox catalysts into nanostructured 2D and 3D complexes for catalysis, sensing, and energy transduction; and engineering robust biological hydrogen-production systems
4. In nuclear- and solar-thermal hydrogen production, the major scientific challenges (and opportunities) lie in (a) improving the duty cycle for solar thermochemical production and (b) separations and materials performance. The priority research areas are the development of (a) thermodynamic data and modeling for thermochemistry, (b) high-temperature materials for use in oxidizing environments, high-temperature gas separation, and improved catalysts. These discussions of hydrogen production recognized that hydrogen will have to compete with other energy supplies. With the current technology and knowledge base, the fossil-based economy can be exploited better than can the hydrogen economy. That notwithstanding, the hydrogen economy is going to make it or not on the basis of solving the hydrogen-storage problem. Indeed, hydrogen storage may be a show-stopper for vehicle use. Safety issues must be addressed, and new concepts for hydrogen storage must be developed. The target is to develop a storage system that is 9 wt% fuel by 2015. Currently capabilities (focused mainly on tanks but also looking at solid-state storage) are a factor of 2 or 3 short of that goal. Basic

research is needed to identify new materials and to improve the properties of existing materials for storage systems. And theory and computation are needed to understand the mechanisms, electronic structure, dynamics, and energetics of hydrogen in materials. BES can provide the cohesive force to enable the development of new storage concepts by

- Developing a coordinated plan of research;
- Providing a close coupling between theory and experiment;
- Encouraging and supporting new, untested concepts;
- Implementing "round-robin" exchange of materials and techniques; and
- Enhancing BES/EERE communication by aligning BES strategy better with EERE needs and coordinating and balancing long-range vs. short-range research efforts.

The hydrogen-storage panel identified three priority research areas:

1. Initiating a broadly based research program to explore and further the potential of complex hydrides for hydrogen storage;
2. Exploiting computational methods to predict trends, guide experiments, and identify new promising materials for hydrogen storage and catalysis; and
3. Utilizing fundamentally different physical and chemical properties at the nanoscale in the design of new storage materials.

In fuel-cell technology, engineering investments have been a success, but materials have not changed much in 15 years. Anodes and cathodes need to be improved. If hydrogen storage is not solved, the hydrogen will have to be derived from hydrocarbons by reforming, requiring low-temperature and inexpensive reformer catalysts.

Two scientific challenges and opportunities cited by the fuel cells and novel fuel-cell materials panel are (1) modeling ionic- and electronic-transport processes in bulk, at surfaces, and across interfaces and (2) innovative fuel-cell architectures. The panel identified the following priority research areas:

- Improved cathodes;
- Materials that minimize rare-metal usage in cathodes and anodes;
- Synthesis and processing of designed triple-percolation electrodes;
- "Higher"-temperature proton conductors;
- A fundamental understanding of degradation mechanisms;
- Functionalizing materials with tailored nanostructures;
- Interfaces and adhesion;
- Theory, modeling, and simulation;
- New materials;
- Novel synthesis routes for optimized architectures; and
- Advanced in situ analytical tools.

Several issues cut across these broad topical categories: catalysis; membranes and separations; nanostructured and/or novel materials; sensors, characterization, and measurement techniques (lumped together because advances in nanoscience offer the possibility of putting more sensors in one device); theory, modeling, and simulation (TMS); and safety.

The subcommittee report was currently being written and will contain the reports from the three panels, an integration of major findings, a discussion of cross-cutting issues, and a

reasonable number of research directions.

Stupp asked if the United States has the expertise to make the requisite advancements in hydrogen science and technology. Dresselhaus responded that the answer is mixed. The United States has many people that are knowledgeable in several components. However, it does not have a research tradition in the area of hydrogen as an energy source. Putting a little money into this research field will increase the interest level. Stupp pointed out that she had noted that materials have not changed in years because, in his assessment, U.S. industry is not open to innovation. He asked if it was worthwhile to pursue a hydrogen economy. Dresselhaus said that it is not up to this Subcommittee to decide if the nation goes forward with a hydrogen economy. DOE needs to educate industry and foster education and students in hydrogen energy. She was hopeful that something will happen. She was confident that U.S. scientists are not afraid to think outside the box.

Moore asked why the subcommittee had ruled out liquid hydrogen. Dresselhaus responded that the safety requirements are very far short of the expectations of the American motorist.

El-Sayed asked if BES will get $20 million to do hydrogen research or will hydrogen research have to compete with other programs. Dresselhaus said that it depends what comes out of the program. If some breakthroughs occur, that will foster funding opportunities.

Kohn said that he worries about the Secretary's utopian viewpoint. Dresselhaus said that the statement was written by a nonscientist. Kohn said that the gap between 4 wt% and 9 wt% was portrayed as a huge gap. That is only a factor of 2. The efficiency of vehicles can be improved that much. He did not see that the gap was so great. Dresselhaus responded that the production methods and storage capabilities certainly have to be improved. The fuel cell is one way to use electricity efficiently, but a lot of research is needed to bring down the cost. DOE now rates storage as the top problem, but advances in any area will help achieve the goals for a hydrogen economy. The workshop was free of politics, and that was good.

Taylor noted that there was one large concern with liquid hydrogen: half the energy is used up in the liquefaction process. Plus there is a large wall loss in a small container.

Smalley commented that it does not make any sense to make hydrogen from methane when you can just put the methane into that same vehicle. To that degree, the discussion of hydrogen is not rational. But if you could use coal to make electricity and sequester the carbon, improvements in the distribution grid would be the best way to boost energy production, use, and efficiency. Using wind and solar energy to produce hydrogen that could then be used at any time (unlike wind and solar energy) would be the best use of hydrogen as a fuel. A lot of the gasoline we use is in urban centers. We do not need long-haul capabilities there; that is where electric (or hydrogen) vehicles will dominate. But gasoline would still be needed for long-haul capabilities. One should not look at hydrogen as a replacement for gasoline. Dresselhaus commented that the subcommittee followed its charge, which was quite large with boundaries that were not sharp and clear. Secretary Abraham has pointed to carbon sequestration as an important technology, which will be the subject of many other studies. This workshop identified production, storage, fuel cells, and others as areas that will need research.

Morse said that, to a large extent, biomaterials could be looked on as catalysts at the bionano level. Biomimetics should be one of the focuses of the development of new catalysts. Dresselhaus noted that one of the panels said much the same thing. Methane is not a good hydrogen source (although it is a good energy source itself). But the biomaterials *are* an important research topic. Morse added: especially when you consider that the efficiency of

photosynthesis is almost 100% because of the coupling of the nano and bio states and processes; compare that with the efficiency of solar collectors.

A break was declared at 11:58 a.m. Richmond called the meeting back into session at 11:23 a.m. and introduced **John Hemminger** to report on the Committee of Visitors (COV) review of the Materials Sciences and Engineering programs of BES.

The COV reviewed the files and procedures of several components of the Division of Materials Sciences and Engineering including: Materials Physics; Synthesis, Processing, and Engineering Science; Neutron and X-ray Scattering; Condensed Matter Physics; and Materials Chemistry. The charge called for the COV to assess, for both DOE laboratory and university projects, the efficiency and quality of the processes used to (1) solicit, review, recommend, and document proposal actions and (2) monitor active projects and programs. The COV was asked to comment on how the process has affected the breadth and depth of portfolio elements and the national and international standing of the portfolio elements.

He explained the COV membership, 40% of whom do not receive DOE funding; it was a mixture of academia, DOE, and laboratory personnel. He summarized the process followed by the COV, which included overview presentations, first readings of folders containing grant applications and other program materials, interviews with program managers, breakout sessions among COV members, second readings of folders by reconstituted groups of reviewers (to gain additional perspectives), and summary discussions to initiate the subpanel reports.

The COV found that the quality of science in the program portfolios is outstanding (world class), relevant to the broad DOE mission, very well managed and bringing quality science into the programs [specifically the Experimental Program to Stimulate Competitive Research (EPSCOR)]. It also found that stability of funding of principal investigators (PIs) leads to high-quality science. The personnel are motivated and of high quality despite lean staffing. A special issue associated with the lean staffing is that retirements cause problems.

The COV took issue with several aspects of the Information Management for the Office of Science (IMSC) system through which anyone in SC is supposed to gain access to statistical data. The system is difficult for program managers to use, leading to the development of individualized databases. A reviewer database in the IMSC would be very useful to allow the ready selection of reviewers. DOE does not collect information to characterize the diversity of funding recipients; the database could include anonymous PI data to develop an understanding of diversity issues.

This COV found a tremendous, positive response to the recommendations of the first COV on the Chemical Sciences, Geosciences, and Biosciences Division held one year ago. Building upon those recommendations and responses, this COV had several recommendations concerning the proposal handling and decision process. The documentation could include a time line/document page, which would enhance this tool. Uniform reviewer report forms would be helpful to reviewers but should not reflect a grading system. Verbatim copies of reviews should go to PI's as a matter of course. Conflict-of-interest guidelines should be provided to reviewers; conflict of interest should not be a barrier to comment, but the perspective of the reviewer should be recognized by the program manager. Responses to negative reviews would help both program managers and proposal submitters. Program manager flexibility is a very positive aspect of the DOE/BES proposal review process.

The COV believed that the laboratory programs are over-reviewed. It is quite the opposite for university contracts. So project monitoring should be enhanced for university programs.

Contractor meetings should be held and should include younger investigators not in the program. Travel by program managers to meetings and laboratory visits should be protected to the extent possible.

In terms of the size of grants, consideration should be given to increasing the size of grants, even at the expense of the number of awards made. Evaluations of programs should be undertaken with a clear understanding of the implications (e.g., some older programs will have to be shut down).

In the future, COV reviews should be continued; the COVs have a strong feeling that their findings and recommendations are heard. Improved statistical data (from IMSC) should be made available.

Stohr asked what the average size was of a university grant. Hemminger said that that was the type of information that the COV would like from the IMSC. Carim responded that the value is about $150,000/year if large outliers are not factored in.

Greene noted that the report said that funding has dropped to $50,000. Hemminger replied that that is what the COV was thinking of when it said that smaller projects might not be meaningful. Greene went on to note that one has to be careful what type of message is being sent by saying that big projects might be more likely to be funded. How does one allow PIs to reply to reviewers in a fair manner? Hemminger said that the program manager can tell if a proposal is going to be funded, is outside the scope of the call (or is going to be rejected for some other reason), or is on the margin. In some of those cases, responding to reactions to a negative review is not a good use of a program manager's time. Green responded that it should not seem like there are "favored children."

Plummer asked about the statistics and trends (including subject matter and program alignment) on the number and size of university awards. Those are the questions that need to be answered. The COV says that longevity of funding is favorable. That assertion needs to be proven. Hemminger responded that, to some extent, this information does exist but was collected and provided in a spotty fashion. He agreed with Plummer. The COV could use a lot more data.

Flynn asked what fraction of the funding is in mandated programs (e.g., fellowships). When mandated funds dominate a program, the program manager does not have much flexibility with which to act. Dehmer commented that the programs examined here are almost entirely managed, not mandated, programs.

Kohn observed that one always wants to get new investigators into the pipeline. He asked Hemminger what thoughts the COV had on how this should be done. Hemminger commented that providing a young investigator with insufficient funding does not usually do them any good. Contractor meetings would allow program managers to be exposed to new, young investigators; they then need to look upon themselves as mentors.

Stohr noted that good information is essential to good decisions. The system used at SC needs to be fixed. Dehmer noted that it is a new system and promised that his comments will be passed on. The Office can only provide the information available from the current IMSC.

Greene stated that future COVs should at least be provided with information on (1) the total number of submitted and funded proposals and the percentage of submitted proposals that are funded by BES and (2) the total number of submitted and funded proposals (and percentage of funded proposals) for each BES program or request for proposals. Carim pointed out that some of that information was provided to some degree. In written comments provided to the COV,

Greene also pointed out that a more timely review process was clearly needed and that the program managers at BES should keep track of the coherence and overlap of proposals to help the PIs and program managers to benefit from each other's research and facilities.

Richmond moved that the report be accepted (with editorial changes to be supplied). Moore seconded the motion and the acceptance was unanimously approved by the Committee.

A break for lunch was declared at 12:22 p.m.

Afternoon Session

Richmond called the meeting back to order at 1:59 p.m. and asked **Thom Mason** to present an update on the Spallation Neutron Source (SNS) project.

The SNS will use a 1-GeV proton beam to knock neutrons out of a mercury target. The facility is collocated with the Center for Nanophase Materials Sciences and will begin operation in 2006. Currently, it is well past the midway point of the construction period. At 1.4-MW, it will be about 8 times as powerful as ISIS and have a peak flux an order of magnitude greater than that of ISIS, the world's current leading pulsed spallation source. The peak neutron flux will be 20 to 100 times as powerful as the Institute Laue Langevin (ILL) or the High-Flux Isotope reactor (HFIR). It will be the world's leading facility for neutron scattering, and will be located just a short drive from HFIR.

The SNS will provide high-availability, high-reliability operation of the world's most powerful pulsed neutron source. It will operate as a user facility to support peer-reviewed research on a best-in-class suite of instruments. Research conducted at SNS will be at the forefront of biology, chemistry, physics, materials science, and engineering. SNS will have the capability to advance the state-of-the-art in spallation-neutron-source technology, including R&D in accelerators, target, and instruments to keep SNS at the forefront of research. Enhancement of SNS performance through upgrades of the complex and ongoing instrument development is planned as part of the normal operating life of the facility.

The SNS will evolve along the path envisaged in the Russell Panel (a BESAC panel) specifications. In 20 years, it should be operating about 45 best-in-class instruments with two differently optimized target stations and a beam power in the range of 3 to 4 MW. Depending on the success of the present 1.4-MW one-target station SNS, the power upgrade and introduction of the Long-Wavelength Target Station should mesh with the initial deployment and national needs.

The FY03 request was $225 million, fully funded (a rescission was restored by a supplemental appropriation). The FY04 request is $143 million, as expected. Overall project design is 88% complete. Overall, the project is 61% complete (through March 2003) and within budget and schedule constraints: a cost of $1.4 billion and a June 2006 completion date. Contingency is adequate at about 20%. Moreover, the contingency is staying constant at the rate that the work is being completed. The ES&H performance has been outstanding; more than 3 million hours have been worked without a lost-workday injury [combined hours worked for the construction site and SNS/ORNL (Oak Ridge National Laboratory)].

Major accomplishments since November 2002 include the erection of the steel for the Central Laboratory Office and the Target Building. The beneficial occupancy dates (BOD) of the linac tunnel and klystron have been met. The front-end beam was made ready for the drift-tube linac (DTL) commissioning. The integrated cryomodule was tested with low-level radiofrequency (rf) power. The High Energy Beam Transport (HEBT) Service Building was

completed and its BOD was met. Linac installation was started as was the target installation. Radiofrequency power was injected into DTL Tank 3.

The front-end system (FES) was constructed and commissioned at Lawrence Berkeley Laboratory (LBL), recommissioned in Oak Ridge, and integrated with the Los Alamos National Laboratory (LANL) rf system. Production modules of the integrated cryomodule are now under test. The ring tunnel has now been handed over to ORNL from the contractor, and the DTL has been installed. Target installation has been started. And the integrated system (vacuum, cooling, etc.) has been tested.

The SNS team is continuing to develop plans for operations. An operations budget has been developed and reviewed, and plans for operation have been prepared. An accelerator-readiness review is being held in June 2003. Through an interest-based bargaining process, an agreement has been reached that provides for a dedicated crafts core team that will service SNS facilities from ORNL's Facilities and Operations Directorate (for traditional craft designations). A new multiskilled research mechanic will allow for integration with the Accelerator Systems Division (ASD) workforce and provide flexibility needed to support accelerator (and other technical) operations.

The SNS can support 24 instruments; 16 have been approved through the peer-review process; some are planned for use in 2011. New instruments approved include VISION (for chemical spectroscopy), the neutron spin-echo device for studies of soft materials, and the fundamental physics beamline liquid refractometers for measuring membranes.

In summary, although much work remains, the SNS team is on track to complete the world's most powerful facility for studies of the structure and dynamics of materials safely, on time, and within the approved budget. Because of improvements in technology and ongoing value engineering, the facility will deliver a higher beam power, better performing instruments, and more laboratory and office space for staff and users than initially thought possible at the time the project was approved. The facility's leadership is adapting its plans to deal with issues as they arise, achieving key milestones and recovering from difficulties.

Mayes asked if Europe would get dedicated time because the German government is donating funding for the spin-echo device. Mason replied that the memorandum of understanding (MOU) is not yet written. In similar cases, general users will not see any difference in the peer-review process, no matter who paid for the instrument. There is, however, about 20% of the available time that will be allocated on a discretionary basis to peer-reviewed projects that did not receive beamtime under general-use conditions.

Stohr asked if all 16 instruments were funded outside the SNS construction budget. Mason replied, no; five were funded as part of the construction budget. That allows the project to get started early and gain experience.

El-Sayed asked three questions:

< What is the pulse width of the neutrons?
< What is the uncertainty of the energy?
< Is the coupling magnetic?

Mason replied that the pulse width of the protons is 700 nanoseconds in duration, producing pulse widths up to 200 microseconds for the neutrons. The uncertainty of the energy depends on the width of the neutron pulse and how long the travel path is. The coupling is with the nuclei; one can also see magnetic dipoles.

Berrah asked what fraction of the beamtime was planned to be given to the instruments funded from outside. Mason responded that the amount of dedicated beam time is about 20%, with 80% going to general use.

Isaacs asked what activities were being conducted to attract users. Mason noted that there is a latent user community currently using European facilities. The SNS staff is educating them about the SNS with workshops and seminars. Each workshop attracts about 100 people. Four have been held on different topics and more are planned.

Long asked what operations support would be available. Mason responded that many instrument scientists that build the instruments are subsequently hired by the SNS to operate the instrument. The National Institute of Standards and Technology (NIST), ILL, ISIS, and others have been benchmarked to figure out how many full-time equivalents (FTEs) will be required per instrument (five or six). The instruments will be staffed 7 days a week, 24 hours a day.

Richmond opened the floor to discussion.

Smalley said that Congress seems to be supporting a budget increase for SC and BES during the next 5 years. He asked if BESAC should discuss how that increase should be allocated (i.e., to R&D or to facilities or to instruments). Dehmer said that the Department has yet to see any increases in appropriations. The facilities study has set priorities for that portion of the future budgets. As far as R&D goes, this Committee could always provide suggestions on how to use increased funding. One should always plan for success, and BES will think seriously about charges to the Committee to study how additional R&D funds should be directed.

Richmond noted that this Committee used to kid Iran Thomas that this was a Basic Neutron Science Advisory Committee; it is good to see other disciplines represented in the discussions of this Committee. She called for public comment. There being none, Richmond detailed the schedule of the Iran Thomas Memorial Symposium, which was to begin later in the day and to continue the following day. She then adjourned the meeting at 2: 44 p.m.

Submitted June 25, 2003
Frederick M. O'Hara, Jr.
Recording Secretary