Minutes for the
Basic Energy Sciences Advisory Committee Meeting
July 29-30, 1998, Gaithersburg Hilton Hotel, Gaithersburg, Maryland

BESAC members present:

- Boris Batterman
- Jack Crow
- Marye Anne Fox (Vice Chair)
- Jan Herbst
- Linda Horton
- Franklin Orr
- Geraldine Richmond (Chair)
- Thomas Russell
- Zhi-Xun Shen
- Sunil Sinha
- Richard Smalley
- David Tirrell
- Patricia Thiel

BESAC members absent:

- Barbara Garrison
- Robert Horsch
- Stephen Leone
- Marsha Lester
- Carolyn Meyers
- Edel Wasserman
- Conrad Williams

Also present:

- Jim Decker, Deputy Director, ER (Wednesday only)
- Patricia Dehmer, Associate Director, ER, OBES
- Martha Krebs, Director, ER (Wednesday afternoon only)
- Iran Thomas, Deputy Associate Director, ER, OBES and Director, Division of Materials Sciences, OBES

July 29, 1998

Chair Geraldine Richmond opened the meeting at 8:30 a.m. She had each committee member introduce himself or herself. She then introduced Patricia Dehmer to provide an overview of the Department of Energy (DOE) and of the Office of Basic Energy Sciences (BES).

In her preliminary remarks, Dehmer welcomed the members to the meeting and stressed the importance of this advisory committee, BESAC, pointing out that it produced outcomes as well as outputs. One outcome has been the Birgeneau Report that reviewed the major light-source initiatives; it will be the force in determining funding for those sources, and it has already become part of the vernacular on Capitol Hill. An output has been the analysis of the shutdown of the High-Flux Beam Reactor (HFBR). She pointed out that BESAC already has three charges for this year: to review the High Flux Isotope Reactor (HFIR), to conduct a workshop on fourth-generation light sources, and to conduct a workshop on complex systems. In her introductory remarks, she highlighted BES=s position and role in the structure of DOE and pointed out that it contributes primarily to the science and technology business line of the Department. Basically, most of the basic research that occurs in DOE is funded by BES; and in the physical sciences, BES funds about four times as much basic research as does the National Science Foundation (NSF). From 1996 to 1997, BES=s funding increased $246 million, with most of that going for construction of the Spallation Neutron Source (SNS) and the fourth and final components of the Seitz-Eastman recommendation. She pointed out that BES has four divisions, and that the directors of each of those divisions would address the meeting.

In her prepared presentation, she reviewed the organization of the DOE and the distribution

of FY-1998 appropriations among science and technology, energy resources, national security, and environmental quality. She then summarized these appropriations by Department business line. An organization chart for the Office of Energy Research (ER) highlighted BES, which this committee serves. She noted that the Department ranks within the top five government research organizations for funding the physical sciences, environmental sciences, mathematics and computing, and engineering. She described the structure of the Department=s Energy Research portfolio and noted that it is going to be portfolio roadmapped; the individual activities will then be roadmapped, and the results will be fed back on the portfolio. She stated that research funded by ER undergirds the DOE applied-research portfolio. Positive feedback has already been received about these efforts to analyze and map out present and future activities.

BES conducts 1400 peer-reviewed research projects, funds 200 research institutions, and maintains 18 national user facilities. The FY-1999 congressional budget request for BES is $836.1 million, about half of which is for materials sciences; a quarter for chemical sciences; and the rest for engineering and geosciences, energy biosciences, construction, and small-business programs. The mission of BES is:

- **to foster and support fundamental research in the natural sciences and engineering leading to both new and improved energy technologies and an understanding and mitigation of the environmental impacts of energy technologies and**
- **to plan, construct, and operate major scientific user facilities and to promote user communities for researchers at universities, national laboratories, and industrial laboratories.**

The fundamental tenets to which BES subscribes are:

- **excellence in basic research;**
- **relevance to the nation=s energy future; and**
- **stewardship to ensure stable, essential scientific communities, facilities, and institutions.**

She noted that, as DOE does portfolio mapping, roadmapping, planning, etc., the paper flow will be overwhelming. She commented that it will be important to remember these tenets and to maintain a balance among them. Failure to maintain such a balance could lead to loss of intellectual leadership, portfolio stagnation, an ivory-tower mentality, evaluation in terms of short-term economic impacts, fashion-driven churning of the portfolio, a trend toward megascience, and/or an inability to respond quickly to national needs.

The legislative mandate for BES was shown to be grounded in the Energy Policy Act of 1992.

Dehmer highlighted recent prizes and awards received by researchers funded by BES, including six Nobel prizes since 1986, and underscored the importance of funding work that (1) advances the fields of research and (2) is rapidly recognized as important by scientific peers. All of these Nobel prizes were in fields basic to the mission of DOE, and they show that the Department funds the best researchers in the field(s).

BES has been improving its website, and it now has links to program books, contracts, and the home pages of 18 BES-funded facilities around the nation.

BES is made up of four divisions: The Materials Sciences Division, which is composed of the Condensed Matter Physics and Materials Chemistry Program and the Metal and Ceramic

Sciences Program; the Chemical Sciences Division, which is composed of the Fundamental Interactions Program and the Molecular Processes Program; the Energy Biosciences Division; and the Engineering and Geosciences Division, which is composed of the Geosciences Program and the Engineering Program. It supports four out of the five neutron-source facilities in the United States. (The other is operated by the National Institute for Science and Technology.) The program has a high degree of interaction with applied research and industrial applied technology, even though it funds virtually no industry directly.

The Office has published four booklets that describe its activities: *Scientific Research Facilities*; *Basic Energy Sciences: Serving the Present, Shaping the Future*; *Basic Energy Sciences: Research for the Nation=s Energy Future*; and *Medical Applications of Non-Medical Research*.

A bar chart showed current DOE, ER, and BES funding of the 15 DOE laboratories; one of the most obvious characteristics of this chart was the dominance of the weapons laboratories. The exercises for determining the FY-2000 budget are now complete, and the outlook is not as rosy as had been hoped. After new initiatives (e.g., SNS) are subtracted, it shows a slight decrease; analyzing these figures shows opportunities and shortcomings. A bar chart of the current BES funding for each of the 15 laboratories identified funds for construction, facility operations, research-related capital equipment, Experimental Program to Stimulate Competitive Research (EPSCoR), materials sciences, chemical sciences, engineering and geosciences, and energy biosciences going to each site. A refinement of that chart showing just the research operating budget was displayed; it clearly showed where the BES portfolio is: in user facilities and research. It also showed the varied core strengths of the different laboratories.

Analysis of these numbers and facts indicates that DOE laboratories

! provide most of the nation=s major scientific user facilities
! have specialized facilities not typically found at universities
! support research that may not be Ain vogue@ at universities
! can be cofunded by the technology offices
! can support research of a longer term than that of a doctoral thesis
! can be home to outstanding individual investigators.

It also shows that universities

! provide access to a major scientific talent pool
! train the next generation of scientists
! work in areas important to the mission of DOE
! are not captives of the DOE system
! provide a perspective that often complements that of DOE laboratories.

A segmented graph of budget authority versus fiscal year for (1) base research, (2) facilities operations, and (3) capital equipment and construction showed the variation of these components from 1988 to the 1999 request.

The Department is currently in the process of identifying themes that represent its objectives and that can guide the attainment of those objectives. The four themes that have been suggested are:

- **Fueling the Future: Science for affordable and clean energy**
- **Protecting Our Living Planet: Energy impacts on people and the biosphere**
- **Exploring Matter and Energy: Building blocks of atoms and life**
- **Extraordinary Tools for Extraordinary Science**

From these themes, ER=s research portfolio can be derived and organized, showing the individual offices that contribute to the understanding of each theme. Martha Krebs, the Director of ER, has requested each office to provide roadmaps that show how they will pursue these four themes. Roadmapping pure science like this is difficult but could have a large impact; for one thing, it requires one to explicitly set priorities among the possible actions.

An example of the roadmapping of science was discussed. The subject matter was a new initiative in BES that deals with complex systems, phenomena that are great interest to DOE and that exist only because of the complex or collective behavior of simple entities. Examples of such complex systems are:

- **materials that are beyond binary, that lack stoichiometry, that are far from equilibrium, or that have little or no symmetry or have low dimensionality**
- **functional synthesis for desired properties like superconductivity, magnetism, catalysis, or enzymatic function**
- **phenomena beyond the independent-particle approximation, such as high-temperature conductivity**
- **scaling in space and time**
- **control of entropy by such processes as photosynthesis**

These and other intellectual problems challenge us to come to grips with how we are going to go forward. Part of developing a roadmap is defining the questions that will lead to discovery. A science roadmap should provide leadership, consensus, and alternatives. Such roadmaps are iterative and must be revisited. They should not be rigidly linked to specific scientific disciplines, but in institutions like DOE, they must link science to the Department=s missions.

The roadmap for the complex systems initiative will be developed by using BESAC to

- **provide structure for one or more workshops**
- **produce a clear and simple report**
- **aim the discussions toward producing a roadmap and contributing to the development of the FY-2000 budget request**
- **produce a draft of the report by December 1998**

She closed her prepared presentation with a detailed account of how the ER FY-1999 budget request has fared as it has progressed through DOE, OMB, House, and Senate deliberations.

Jan Herbst asked about unfunded mandates. Dehmer replied that the earmarks are not known until the last minute, but that she had not yet heard of any of any consequence this year.

Russell asked for clarification of two of the BES budget charts. She pointed out that they are the same figures, but that one is in constant dollars.

Richmond commented that, in this exercise of roadmapping, the goals are very

interdisciplinary, but BES has a structure that is highly structured by discipline. Will you go back and restructure your organization as you set the roadmaps? Dehmer replied that education should be disciplinary, but that scientific research should and must be interdisciplinary. This does not mean that university structures need to change, though. Funding mechanisms should be designed to have natural constituencies.

A break was called by Richmond at 9:51 a.m.

The meeting was called back to order by Richmond at 10:14 a.m. She introduced Mike Knotek to speak about DOE=s R&D portfolio. He said that ER is in very good shape in how it is organized, how it gets advice, the quality of the research and researchers, etc. Now the Department is trying to attain coherence in the management of its R&D portfolio. One group, for example, is looking at the organization of the laboratories (the R&D Council); this effort is an outgrowth of the Galvin report. Another concern is that, although ER is proud of its partnerships with industry, ER needs to be more closely tied to DOE=s applied programs. The management organizations of other parts of DOE, however, have not progressed as fast as has that of ER; some do not even have peer-review and project-review capabilities. DOE is trying to duplicate ER=s success in Environmental Management (EM), Defense Programs (DP), and other parts of the Department. Starting with FY 1999, ER is going to describe its budget in terms of the R&D portfolio so the Congress and the White House will know what these fundings translate into. In the future, the mission plan and other documents will also reflect the R&D portfolio.

Knotek then described one component of the future R&D portfolio, the Scientific Simulation Plan. The advance of the frontiers of computer science is being driven by defense concerns, specifically stockpile stewardship requirements. Under the SALT (Strategic Arms Limitation Talks) treaty, the United States is committed to a policy of discontinuing the testing of nuclear weapons. Underlying this commitment is the understanding that everything that could be learned from an actual detonation will, by the year 2005, be able to be determined through computer simulations. These simulations will require enormous computational capabilities that far exceed what is currently commercially available. But, because very few customers exist for such machines, no companies are developing this type of product. As a result, DOE has undertaken an initiative to produce such computers, or ultracomputers, and they have contracted with IBM and Silicon Graphics to design and build them. The ultimate goal is to produce a 100-teraflop machine for nuclear-weapon simulation within the next decade. If such systems were developed, one could attack problems currently not feasible any other way, such as the prediction of global and regional climates, the exploration of biological systems directly from their genetic codes, the design of new materials, and the understanding of combustion processes. What is envisioned is the networking of the computer resources of a large number of institutions across the country with high-speed communications, all anchored by centers of excellence. The infrastructure goals of this initiative are to establish

- **a national network of terascale (10^{14} floating-point operations per second) computing systems by 2003 and**
- **the crosscutting terascale technology base and operating environments (the requisite memory, archival storage, parallel input-output, communications network, and system software).**

Some of the drivers for developing such ultracomputers are

- **increasingly stringent EPA requirements on heavy diesels, boilers, etc. that require a fundamental understanding of how combustion occurs and how it can be altered**
- **the debate about the causes of the observed increase in global atmospheric temperature and its effects on extreme events (such as hurricanes, tornados, floods, and droughts), productivity of the oceans, human health, sea level, and other concerns**
- **the desire of biologists to model what they believe to be a finite number of protein structures to control those that are associated with diseases (such as Alzheimer's) and to produce new ones that have therapeutic value.**

To guide and plan this initiative, many workshops have been and are being held in 1998. Some have dealt with general topics, such as simulation and modeling; data management, analysis, and visualization; and applied mathematics and computer-science techniques. Others have focused on applications of ultracomputers to specific disciplines and research topics, such as biology, materials, chemistry, climate, physics, and combustion.

Thiel asked what types of proof were available to indicate that climate was predictable. Knotek pointed to the Atmospheric Radiation Measurement Program and other courses of investigation that, by dealing with historical data and gathering and analyzing vast amounts of new data, have shown an increased understanding of and ability to predict atmospheric and oceanic processes.

Horton asked if there was a science-hardware duality. Knotek responded that currently there is more money in the science than in the equipment. He pointed out that the European Centre for Medium-Range Weather Forecasts and others have developed their capabilities much more rapidly than have U.S. agencies. Russell asked if this initiative has to be internationalized. Knotek replied that the international effort is well coordinated.

Sunil Sinha noted that, in the applications for weapons, you need a lot of materials data and science and asked whose responsibility that is. Knotek answered that the initiative has a lot of data that have been accumulated over the years but the researchers also have an experimental capability to supplement and extend historical data.

Zhi-Xun Shen asked what else this capability is applicable to. Knotek responded that a lot of work is being done on the simulation and analysis of the national (or, more properly, the international) power grid and of seismic stability.

Richmond then introduced a collaborative presentation (one that called for audience participation) on roadmaps and complex systems led by John Stringer. He said the complexity issue arises because of the chaotic nature of many systems. But, he noted, there is some predictable nature of those systems. You must understand what you are going to do with these systems and what you can model. In the past, we have tried to linearize things and thus to model them.

What can you use roadmaps for, Stringer asked? As Lewis Carroll noted, "If you don't know where you're going, any way will get to there." We may not be able to roadmap science, but we can make *some* predictions. The Electric Power Research Institute (EPRI), for example, has brought up its goals on the World Wide Web. In the next 25 years, it expects to

- **create an electricity supply and delivery system meeting the much greater demands of**

an emerging knowledge-based economy

- **attain at least a 20% higher growth rate for national productivity and economic expansion**
- **bring opportunity for advancement to 2 billion of the world's population currently without access to electricity**
- **fill our environmental-knowledge gaps and facilitate the essential response strategies**
- **establish the confident basis for sustainable global development in the 21st century.**

He said that we do not know who our stakeholders are going to be in the future, but a roadmap allows us to assess *opportunities*. The roadmap itself is not a snapshot fixed in time, but something we are going to constantly reassess. You do the best you can in predicting, and every now and then you look back and reevaluate to see where you might go in light of the changes that have occurred since the last roadmapping. Another use of roadmapping is to formulate a number of objectives and then to look back from these objectives to see where the barriers are and to see what should be done next. Roadmapping is intrinsically different from strategic planning. It is incremental, and it looks *backward* to see where to go.

One of the benefits of having a tool like roadmapping is getting money. One of the participants at a recent Santa Fe Institute meeting said that scientists do not use terms that resonate on Capitol Hill. You have to make what you are doing exciting to those who are deliberating about funding the research, and you must make it relevant to their *personal* interests.

Fox asked him to differentiate between science and technology roadmaps. He said that one (technology) has a shorter time horizon than the other and does not loop back on itself as does the science roadmap.

Pat Dehmer said that BES has to find a way to proceed. The last time BESAC met, gathering a panel to consider complex systems was discussed. Is that a reasonable way to proceed? Sinha said you have to define your possible and probable scenarios. That is very difficult! You *have* to build consensus, though. The community includes those that need it and those that want it. They can identify a goal *for the moment*. This goal definition can be done by such a team if it is chosen properly.

Iran Thomas said that once you have decided what you do not know, you have to decide what is worth learning. *That* is what is so difficult. What is important is to understand whether or not the way we are currently supporting research will get us there. Some endeavors will require broader and stronger efforts than others will. How can a roadmap help us make that judgment? Stringer said that EPRI can now do what, at one time, we did not think could be done. BES does not want to support just work that can be roadmapped; you also want to support basic research that has no apparent application. Thomas said that a roadmap was needed that had Athe road less taken@ as an option. Stringer noted that Rep. Vernon Ehlers had commented that the minority report is never read. Stringer had no answer yet on how to balance the two approaches. The quality of the *people* supported will continue to be the most important aspect.

Linda Horton voiced the concern that, if there are too many workshop attendees, the approach would not work. Dehmer and Thomas noted that there will be many interactions among

diverse disciplines, but that they were striving for a small, manageable workshop that will be productive. Horton asked if they thought a larger group would bring about a broader consensus among the scientific community. Stringer said, it is quite logical; that was his experience at EPRI in putting together EPRI=s *Visions and Destinations Source Book.* The same has been true at the National Aeronautics and Space Administration (NASA) and the Air Force. The further you go into the future, the more difficult it gets. Programming is just a way of indicating that there are objectives; later, you get Triptiks. Dehmer said she did not know the answer to Horton=s question; she felt that the number 25 is reasonable and workable. Larger workshops and their followups are incredibly expensive.

Russell asked about the EPRI objectives, saying that he was curious about the timeframe. Why 25 years? Stringer said 25 years was chosen because that represents the characteristic timeframe of the systems we are looking at (e.g., the construction of a power plant).

Jan Herbst asked what the complex systems are that BES is concerned with. Dehmer responded that the answer to that question is undefined as yet.

Richmond said that she hoped that the new people on the advisory committee appreciate how important this initiative on complex systems is. What BESAC needs to do is to provide Dehmer with names of people who can contribute to a report that is to come out in December. Patricia Thiel said that this new initiative was presented as being very small, but today=s viewgraphs listed it as one of the four major topics, encompassing a very large portion of BES=s portfolio. Dehmer responded that this is correct; the Complex Systems Initiative is an attempt to talk about where science is going in a new way.

Dehmer then spoke about the fourth-generation light sources. She said that Steve Leone has agreed to chair the panel that is to consider them, and she passed out copies of the charge letter addressed to the panel chair. The panel has not yet been chosen; this committee has the opportunity to suggest names for inclusion on the panel. Linda Horton asked if information submitted since the previous meeting should be submitted again. Dehmer answered that that information was on file and need not be resubmitted. Zhi-Xun Shen asked what distinction was implied by the term Afourth generation.@ Dehmer answered, many orders of magnitude over the third-generation light sources. Boris Batterman questioned whether the panel assessing fourth-generation light sources should adopt a DOE or international perspective. Dehmer responded that the panel should adopt a DOE perspective but be cognizant of work done by other nations or international organizations. Sinha noted that the Advanced Photon Source (APS) is having a workshop on fourth-generation light sources in February or March in 1999.

Iran Thomas, speaking as the acting director of Engineering Research and Geosciences Division of BES, then gave an overview of the structure and activities of that division. Its FY-1999 budget is about $44 million, with about $18 million going to engineering and about $26 million to geosciences. The major change in this budget from the previous year is an increase of $3 million for the Climate Change Technology Initiative (which is focused on carbon sequestration).

The Engineering Program is divided into mechanical sciences; system sciences, control, and instrumentation; and data and engineering analysis. The program is aided by the Council for

Energy Engineering Research (CEER), which is not advisory in function but rather assesses research and decides what areas would be interesting to go into. CEER holds a workshop to review each area (e.g., instrumentation and measurement) and to summarize the knowledge in that area. Major topics that the program will explore in the future include micro-electromechanical systems and nanoengineering, bio- and metabolic engineering, picoscale issues, structural integrity and aging, multiphase flow (continuing), computational modeling, the predictive capability of chaos, robotics and intelligent machines, and engineering related to global warming. An example of the program=s efforts is the TRUST (terminal repeller unconstrained subenergy tunneling) project, which developed a process that is 50 times faster than other techniques for identifying minima for functions with as many as 10,000 variables.

The Geosciences Research Program was established in DOE because a significant amount of the energy we use comes out of the Earth and the wastes we produce largely go back into the Earth. It is divided into geochemistry of mineral-fluid interactions; geophysical interrogation of the Earth=s crust; and basic properties of rocks, minerals, and fluids. It is aided by the Earth Sciences Council (ESC). The ESC holds workshops for discussions about relevant topics (such as scaling in geological systems, terrestrial sequestration of carbon dioxide, and geophysical inverse modeling) and prepares summaries of current knowledge and challenges for publication in peer-reviewed journals. The future directions for this program include studies of the complex interactions of geologic processes, predicting the performance of hydrologic and groundwater systems, higher-resolution imaging of the subsurface, and improving mathematical methods to invert geophysical data to recover in situ rock and fluid properties.

Linda Horton asked if the portfolio of Engineering Research and Geosciences is more heavily weighted toward university programs. Thomas responded, yes, decidedly. Horton then asked if the members of the CEER for Geosciences are largely affiliated with universities or if there was an industrial component and contribution. Thomas responded that the members are largely from academia and noted that the councils pick their own memberships.

Richmond called for a lunch break at 12:27 p.m.

Richmond called the committee to order at 1:39 p.m. and introduced Robert Marianelli, Director of the BES Division of Chemical Sciences, to give an overview of that division. The Division is divided into the Fundamental Interactions Team and the Molecular Processes Team and is guided by a research council. The Fundamental Interactions Team is divided into four programs: Chemical Physics; Photochemical and Radiation Sciences; and Atomic, Molecular, and Optical Physics; and Facility Operations. These focus on problems associated with atomic, molecular, chemical, and optical physics; combustion phenomena; catalysis; and solar energy conversion. The Molecular Processes Team is also divided into four programs: Chemical Energy, Separations and Analysis, Chemical Engineering Sciences, and Heavy-Element Chemistry. These focus on understanding chemical processes at a molecular level, new heterogeneous chemistry, and new homogeneous-phase chemistries.

The Division has long tried to involve and aid the chemical community in the solution of environmental problems. Two Nobel prizes have resulted from Division-sponsored work: the 1995 prize in chemistry for work on photocatalytic ozone destruction and the 1996 prize in chemistry for the discovery of Buckminsterfullerene. Another example of research funded by

the division is the development of metallocene catalysts, which demonstrate that, with molecular architecture, you can build a catalyst from the ground up, including the properties you want and excluding those you do not want. Significant developments that have come out of the Division=s programs during the past year include a spectroscopic technique for tumor identification, a landmark experiment that challenges current combustion models, and the first nonflammable lithium-ion battery for consumer products.

The Division=s FY-1997 budget was $201.3 million, which was devoted to laboratory research ($63.3 million), facility operations ($57.4 million), grants ($35.8 million), equipment ($20 million), general plant projects ($9.2 million), and smaller projects and obligations ($15.6 million).

Sinha noted that metallocene catalysts that DOE developed are used by Exxon and others and asked whether these catalysts were proprietary. Marianelli responded that they were, but noted that these companies were consulting with former DOE researchers who have gone on to practice the chemical arts to derive special-purpose versions of the catalysts.

Greg Dilworth then gave an overview of the Energy Biosciences Division, which studies plant science, fermentation microbiology, extremophilic organisms, and biomaterials and biocatalysis. The division supports basic research focused on (1) mechanisms at the molecular and atomic level and (2) processes, systems, and materials related to energy. The research is primarily conducted by the academic community. The division has many interactions with other federal programs to keep track of what activities they are funding, allowing DOE to find out about pertinent areas for research while avoiding duplication of effort; the National Institutes of Health (NIH) is the major player in this arena. The recent accomplishments of research funded by the Division include progress made in unravelling plant cell differentiation, building doors into cells by engineering new pores, creating a new oil-storage organ, reversing photosynthesis, developing new ways of isolating genetic traits, and elucidating the enzymatic mechanism underlying the synthesis of adenosine triphosphate (an effort that won the 1997 Nobel Prize in Chemistry).

The major trends that are being observed in the Division are:

! More research is focusing on the interaction of molecules and bioprocesses rather than on the detailed characterization of individual entities.
! More research is focusing on understanding the biological functions of specific molecules or bioprocesses in determining how specific entities relate to the whole organism.

The reasons behind these trends are (1) the past success of biochemical and biophysical analyses and (2) the new ways that have been derived from genomic analyses to approach biological questions.

The present core research program focuses on the science underlying renewables production and conversion. Other activities that the Division is being asked to address include phytoremediation, agricultural efficiency, carbon management, biopolymer processing, and novel materials. Other paths to which the Division could make a contribution include metabolic pathway topology, artificial chromosomes, organelle genesis, multigenome engineering, and functional genomics.

Carbon management is seen to be a major application of the research that the division has supported in photosynthesis. Future work will study the limitations of carbon flow through photosynthetic systems, photosynthate storage and root exudation, and other autotrophic carbon-fixing mechanisms.

The Division=s FY-1998 budget was about $28 million; its FY-1999 budget is expected to be between $25 million and $33 million.

Orr asked where ocean disposal of carbon dioxide fits in the program. Dilworth said that the Office of Biological and Ecological Research is also strong on biology. They have also addressed this problem and taken the systems approach to it.
Russell commented that the budget is constant but the program is expanded and asked where funding is cut. Dilworth said that the Division tries to allocate resources in such a way that unfavorable impacts are spread over a broad range of projects to minimize impact on any one project. Patricia Thiel asked how complex systems fit in, and he replied that Biosciences= research topics are very complex problems.

Richmond called for a break at 2:30 p.m.

The chair called the session back to order at 3:02 p.m. and introduced Martha Krebs, who gave an update on ER=s activities. She began with the table that Pat Dehmer had ended with, showing ER=s FY-1998 appropriation of $667.3 million, a FY-1999 budget request of $836.1 million (a 10% increase), the House Appropriations Committee markup of $779.1 million (a 6.8% increase from 1998), and the Senate Appropriations Committee markup of $836.1 million (an 8.3% increase).

She then provided a scorecard for major BES requests in the FY-1999 budget. For the SNS, $157 million was requested. The Senate approved all of it; the House $100 million; the shortfall may be made up in the FY-2000 budget. The Senate provided what was asked for science-facilities utilization, and the House added $7.5 million. The House and the Senate have been quietly supportive of the Large Hadron Collider. For the Climate Change Technology Initiative, $27 million was requested; the Senate provided all of it, and the House approved $13.5 million. For the Next-Generation Internet, $22 million was asked. The Senate allowed participation but took off $10 million; the House took it all away. Both the House and the Senate added money for fusion and the International Thermonuclear Experimental Reactor transition, but there is still a big debate about U.S. participation; the big question is how much concern there is about damaging relations with our allies. The $15 million science-education request was zeroed out by both the House and the Senate, but the House added $4 million for required research and the Science Bowl.

From budgetary concerns, she turned to stewardship topics. The Division is rethinking energy research by preparing a strategic plan for ER and developing themes and roadmaps. The ER information system is being improved. We have done a lot of work on safety concerns, but DOE is very complex, and something is always happening. On the evening before this talk, about 15 people were hospitalized and at least one person died during a firefighting test at the Idaho National Engineering and Environmental Laboratory (INEEL). An alarm failed to sound when an enclosed area was flooded with carbon dioxide. She said that we must identify

the best environmental- and safety-management practices and continually compare ourselves to that benchmark of excellence. The Division is participating in the Interagency Working Group on the U.S. Science and Technology Workforce of the Future. She emphasized that we must continually stress the value of the investments we make in science and technology and find new ways to communicate that value.

The Division is identifying the unique role of ER programs within DOE missions and the federal science investment. It is also developing a shared long-term focus for ER programs, their scientific communities, and performers. The Division=s management has been impressed with NASA=s progress and accomplishments made through their identity themes. The reasoning is that, if we have a common sense of where we are going, cooperation will be made easier, especially with Congress and other overseers. Therefore, the Division has identified the four initial themes that Pat Dehmer cited earlier. A working group and ER identified these themes along with several specific questions/challenges for each.
The questions that exemplify Fueling the Future are:

- **What clean, new energy sources can be created and harnessed?**
- **How can energy sources be made more efficient and environmentally sound?**
- **How do we best recover domestic resources (i.e., oil, gas, and coal) to assure national security?**

For Protecting Our Living Planet:

- **What are the sources and fates of energy-related byproducts?**
- **What factors change global climate, and how can they be controlled?**
- **How do complex biological and environmental systems respond to our energy use?**

For Exploring Matter and Energy:

- **What are the fundamental components of matter?**
- **How can the origin and fate of the universe reveal the secrets of energy and matter?**
- **How do atoms and molecules combine to form complex, dynamic systems? This question implies the study of the physics of plasmas and extreme states of matter, the elucidation of the chemical pathways of energy and materials production, the development of molecular assembly and nanofabrication, and the investigation of self-organizing systems and the molecular basis of life.**

For Extraordinary Tools for Extraordinary Science:

- **How can we explore the frontiers of the natural sciences? (The answers to this question that are currently known are with new particle accelerators and detectors, with brilliant x-rays and high-flux neutrons, with innovative plasma-confinement devices, with facilities for high-speed genome sequencing, and with sources for heavy elements.)**
- **How can we predict the behavior of complex systems? (The known answers here are with advanced mathematical tools; with petaflop computing and modeling; and with petabyte data acquisition, simulation, and imaging.)**
- **How can we strengthen the nation=s capacity for multidisciplinary science? (The known answers here are with the national laboratory system and university centers, with government-university-industry partnerships, with virtual laboratories and information networks, with the next generation of scientists and engineers, and with energy-science literacy and education.)**

The next step is to develop each of these themes into goals and an overall strategy, with each of the offices of ER contributing responses to these questions. We need BESAC to help us through this process.

Herbst asked her to share with the committee her concept of complex systems. She used as examples physical and biological systems. This concern about complex systems is also showing up in other agencies. At the National Institutes of Health (NIH), they need new investments for science and engineering to investigate processes at the interface of, say, the life and engineering sciences. She noted that this was akin to DOE=s thinking about how to harness plant processes for energy production.

Orr asked if the President=s Committee of Advisors on Science and Technology report on energy R&D has had an impact on the budget this year. Krebs said that they made an effort to use the report because it justifies a substantial increase on the technology side. But Congress and the White House have been at odds about how or whether to implement the Kyoto accord. The rhetoric is more heated on the House side than the Senate side, but she is hopeful that the disagreement will be worked out and that the country will meet its responsibilities.

Russell asked her to expand on the INEEL event and its significance. She responded that managing safety in a complex environment is with us constantly, and we will have to keep addressing it.

Richmond asked if she sensed more support from Congress for long-term research. Krebs replied that she thought the FY-2000 budget will see some restoration of funds, but cautioned that you always have to argue for your position. The idea of doubling the budget for science and technology is actively under consideration, not only by the Executive Branch but also in Congress, with the Speaker of the House leading the charge. Energy research is a critical player in ensuring the nation=s security. Senator Domenici and others are convinced of that fact and are championing it. In the face of having balanced the budget, it is easier to justify more support for research and development. Richmond asked how BESAC could help, and Krebs responded that BESAC could put together something that could be delivered to Congress so they are aware of what we do and can do. In the case of the Birgeneau report, she wanted some affirmation.

An unidentified representative of DOE noted that much research on brain function is referred to as complex systems and stated that he hoped that people are not confused by this new use of the terminology. Krebs said that she would take advice on this issue, but Acomplex systems@ is the best term that has come up so far. ER wants to convey interest in frontiers to people beyond ourselves. This is not about being precise; you can be precise in the request for proposals.

Jack Crow then reviewed the BESAC assessment of the HFIR. He went over the charge to the committee and identified each committee member, telling each one=s strengths. He said the meeting, site visit, and report writing will happen in the next few weeks or months with a draft report given to BESAC at the next meeting and a final version prepared by November.

Horton asked who will look at radiation damage. Crow answered that he would consider this apparent need.

A short break was declared by Vice Chair Fox at 4:08 p.m. because the committee was running

ahead of schedule and the next speaker needed time to set up.

Richmond called the group back into session at 4:21 p.m. and had Iran Thomas introduce Barry Bozeman and Juan Rogers to speak on research value mapping (RVM). They described a study funded by BES to identify economic, scientific, social, and other impacts and effects of the research sponsored over the years by BES. The Abenefits@ of such efforts had often been interpreted much more broadly than they were here. The approach that Bozeman and Rogers took was to

- select cases for site visits;
- make site visits at national laboratories and universities with semistructured interviews;
- ask principal investigators and managers to identify projects that, they thought, produced significant impacts;
- develop case study narratives;
- select cases for a Web questionnaire;
- develop a technique for identifying discreet variables to be measured; and
- analyze the RVM and case data.

They wanted to find patterns among the cases so they could infer how management affected the research, its outcome, and its impacts.

They found five patterns of how the organizational structure interacted with the knowledge generated. The first was a single-sector sporadic-exchange system in which most work was done in contact with only similar (e.g., university) types of the research community but with occasional contacts outside that regime. The second was a multiple-sector, mutually adapting system in which researchers had many contacts with individuals and institutions outside their own social sphere with significant feedback loops occurring; the two sectors (e.g., university and industry) tend to adapt their operations to the models and needs of the other sector. The third was an enabling-star system in which the research team worked on applications that could be used only by *other* research teams and thus have a broader effect. These enabling-star systems would work and find their solutions in the context of the applications= needs rather than being driven by funding or industrial needs. The fourth was an organized, expanding-knowledge system in which the research organization would grow as the project progressed, bringing them into contact with more and more institutions throughout a field of science with a close association with support functions. The fifth was an organized, converging-knowledge system in which the research organization got bigger and bigger to bring multiple talents together to study a specific knowledge goal intensively; close connection was maintained with program managers of the supporting agencies.

A major finding was that projects with patents and licenses are even more likely than others to be examples of basic research and less likely than others to be examples of commercially oriented applied research or technology development.

The other lessons they learned were:

1. Producing commercial results is not dependent on doing basic research.
2. BES funding is prized because it is stable, is predictable, can be used as a core, and can be leveraged.
3. People develop innovative organization designs without even thinking about it, driven by multidisciplinarism and contact between sectors.

4. **Interdisciplinary work requires an entrepreneurial management concept trying to make connections with overlapping sets of communities (e.g., using students or tapping multiple funding sources).**
5. **No big differences between universities and national laboratories were found in the impacts produced.**

Batterman responded that this seems to be counter to the roadmap people. Bozeman responded that the type of research reported here seems to go against the common perception. Batterman said he thought that we would do better by picking out bright people and letting them do their work. Bozeman responded that we need to observe those bright people and learn from them. His copresenter, Juan Rogers, said that the bright researchers often took the roadmaps and used them very creatively to attain their knowledge goals.

Fox asked how much more likely basic research projects were to lead to patents, and Bozeman responded at least two to one. Horton observed that patenting is very rapid at the beginning of a basic research project but slows down significantly as the project moves into applied research, so a time factor may enter in here.

Fox asked about the meaning of their first RVM analysis. Bozeman responded that core metrics are generally not metrics; they do not count the right things or many of the important variables. Counting things is not enough to determine how fields flourish. We need to understand not the metrics but the change dynamics. Management by objective and zero-based budgeting suffered from just this problem. Having a strategic plan is a good idea. Having a roadmap to guide us is a good idea. Having metrics is not such a good idea. If you knew what the limitations were, it would not be so bad; but you generally do not know those limitations.

Thiel noted that Bozeman and Rogers had given a lot of models and asked if one is better than the others. Bozeman responded that it depends on what you are trying to achieve; each one will produce a different mix of outcomes.

Richmond then opened the floor to the public.

Judy Harrison of the APS (American Physical Society) asked if Bozeman found that the amount of money invested is reflected in results. Bozeman said that the number of dollars spent is not correlated with output variables.

Iran Thomas commented that the management of science has evolved haphazardly to a decentralized model (as opposed to a centralized-economy approach) and asked if he was correct in assuming that their research is finding such a decentralized model to be effective. Bozeman responded that Thomas was correct and, moreover, that the model at DOE is different from that at NIH, which is advantageous.

Richmond asked Bozeman and Rogers what the most interesting or surprising upshot was from the project. Bozeman said the most unexpected finding to them was the extent to which basic research projects are having a commercial application. The fecundity of the fundamental research process surprised them.

Richmond adjourned the session at 5:25 p.m.

July 30, 1998

Richmond called the meeting to order at 8:33 a.m. and introduced Iran Thomas to review the organization and activities of the Division of Materials Sciences, speaking as the director of that division. He started on a philosophical note, commenting that we, as scientists, try to understand fundamental principles not only so we can predict when something will break but also so we can invent something that will not break. Air-quality figures from the *Washington Post* showed that the air is much better in Los Angeles, Washington, and New York than in some cities of lesser-developed countries. The point he was trying to make was that, ultimately, the major objectives of scientific inquiry include increased wealth and a higher quality of life.

Thomas began his prepared presentation by noting that the Division of Materials Sciences is divided into two programs. The Metal and Ceramic Sciences Program investigates synthesis and processing science; predictive theory, simulation, and modeling; structural characterization at the Angstrom scale; and mechanical and physical behavior. The Condensed Matter Physics and Materials Chemistry Program studies the structure and dynamics of solids, liquids, and surfaces; electronic structure; new materials synthesis; surfaces and interfaces; and the development of experimental techniques. The total budget of the division is more than $417 million for FY 1999, of which $189 million supports research and $218 million supports facilities operation. The division is also responsible for EPSCoR, which allocates funds in a manner that geographically balances funding. A major component of the budget is the SNS, which has been under development since the 1980s. Three other additions to this year=s budget are notable: the Climate Change Technology Initiative, the Complex and Collective Phenomena Initiative, and the Partnership for Academic and Industrial Research.

He reviewed the upgrades of the various facilities in progress. The upgrade of the Los Alamos Neutron Science Center (LANSCE), which will cost $20.5 million over the next five years, will increase the facility=s power and add at least four new instruments. The upgrade of the HFIR was not fully funded, but a more modest upgrade is being carried out (primarily the replacement of the beryllium reflector) at a total project cost of $38.3 million. The cost was increased by a change in scope and by unforeseen safety requirements. The schedule of the upgrade of the HFBR has slipped somewhat. The environmental impact statement (EIS) is under way but is progressing slower than hoped for, in part because of a large number of community comments (about 600), some of which required substantial analysis. It is now hoped that a record of decision will be dated May 1999.

He noted that the Division is aided by the Council on Materials Sciences, which studies and reports on potential courses of research. The future directions and opportunities of the Metal and Ceramic Sciences Program include bulk metallic glasses, electron-beam microcharacterization, mechanical behavior of condensed matter, monolithic and composite structural ceramics for ultrahigh- temperature load-bearing applications, predictive theory and modeling, nondestructive evaluation, and reliable predictive modeling of and improved resistance to radiation-induced damage and embrittlement. The future directions and

opportunities of the Condensed Matter Physics and Materials Chemistry Program include advanced-level neutron scattering, properties and behavior of complex materials at high magnetic fields, Sp^2-bonded materials, granular materials, complex materials, high-temperature superconductivity, molecular self-assembly, complex fluids, theory and simulation, and combinatorial chemistry.

Russell asked the tenor of the comments about the HFBR. Thomas replied some were favorable, some reasonable, and some unreasonable; most were not positive; and many voiced concern about restarting the reactor. Sinha asked if the new management at Brookhaven National Laboratory (BNL) was committed to restart. Thomas said they are awaiting guidance from Duke Power, the Nuclear Regulatory Commission, Congress, and the community. When they receive that guidance, they will make a decision. From a technical sense, what is coming in does not preclude restart. Herbst asked what Duke Power had had to say about BNL=s restart of the HFBR. Thomas said that nothing additional had been found that would make the reactor unsafe to operate.

Sinha commented that no mention had been made about the upgrades of synchrotrons. Thomas replied that what he talked about was upgrades that have been funded. Congress has not provided funds for the recommended upgrades of the synchrotrons, although some funds have been shifted to start those upgrades.

Daniel Chemla reviewed his career and qualifications and described the background of the Advanced Light Source (ALS). The birth of the ALS was difficult; only enough money for one beamline and a very modest experimental program was allocated. At the time of the Birgeneau Report, it had 13 beamlines. Today it has 27 (out of a possible 38) beamlines operating. Each beamline is designed for a specific class of experiments, and the scientists coordinate their experiments and access to the beamlines.

Many managerial changes have been made in light of the criticisms leveled by the Birgeneau report:

- ! **ALS was established as an independent division of the Lawrence Berkeley National Laboratory (LBNL).**
- ! **The ALS Scientific Policy Board was convened to reevaluate the scientific program. The strategic priorities that it set forth were to develop (1) the best possible scientific program, (2) a partnership between ALS and its users, and (3) *all* the capabilities of the ALS.**
- ! **The ALS International Workshop was held to define the scientific program that would be pursued; it attracted 330 attendees from 10 countries, representing industry, the national laboratories, and academia. Working groups considered the scientific issues that should be addressed, the role of the ALS, and the specific tools that would be needed. The working groups recommended an openness to proposals in three main areas:**
  (1) complex materials (including unconventional superconductivity; magnetism in multielectron extended systems; reduced or confined dimensionality in mesoscopic systems, nanostructures, quantum wells, etc.; multiparticle and correlated systems; and novel phase transitions),
  (2) environmental and earth sciences (including in situ speciation studies of soils, clays,

minerals, and bioorganisms; speciation spectroscopy of second-row-element K-edges; and buildout of the entire sector), and
(3) protein crystallography [including superbend microcrystallography MAD (multiwavelength anomalous dispersion) beamlines, side stations on the ALS wiggler for non-MAD work, existing ALS bend magnets, and structural genomics]; there is a huge need in the western United States for these capabilities

- **The ALS Users Task Force made a series of recommendations to establish a world-class user program:**
  (1) establish productive and respectful two-way communications,
  (2) articulate and pursue a clear scientific vision for the facility,
  (3) establish a well understood process for resource allocation,
  (4) strengthen general support to users and streamline administration, and
  (5) maintain and enhance resources for technical support to users.
- **A new ALS director was appointed.**
- **The average number of hours per day that the ALS operates has been increased.**

In addition to all these changes, a joint western U.S. center is being negotiated with the Stanford Synchrotron Radiation Laboratory (SSRL).

A series of examples of research being pursued at the ALS was presented; it included probing coupled quantum wells with microfocused x-rays, multiatom resonant photoemission, high-resolution zone plate microscopy, macromolecular structures of humic substances, chemical heterogeneity in soil organic molecules, x-ray microscopy of the tubulin network in epithelial cells, soft x-ray and confocal microscopy of the splicing factor in HMEC (S1-50), and the development of a figure of merit for protein crystallography. The point being made was that a lot of science can be performed in this range of energy.

From FY 1997 to FY 1998, the annual number of users increased from 291 to 600. Since November 1997, the Macromolecular Crystallography Facility alone attracted more than 100 users from 26 research groups. Still, the beamlines are oversubscribed, the most heavily used ones turning down as much as 75% of the beamline requests. At the same time that the number of users has dramatically increased, the facility=s inflation-adjusted operating budget has declined slightly but steadily for four years.

Nevertheless, measures have been taken to respond to the ALS Users Task Force=s recommendations:

- **Users' Executive Committee (UEC) and Center for X-Ray Optics (CXRO) representatives attend the weekly Strategic Management Team meetings.**
- **The UEC chair and representatives and the CXRO representatives attend the semiannual ALS Strategic Planning Meeting.**
- **The representation of users in the ALS Science Advisory Committee is larger.**
- **The representation of users in the Program Study Panel that evaluates proposals for beamline allocation is larger.**

Involvement of faculty members of the University of California at Berkeley has also been increased.

The performance of the ALS will be enhanced by improving the third-harmonic RF system to increase beam lifetime from 4 to 12 hours, developing new instrumentation, coordinating

activities with the LBNL Materials Sciences Division and CXRO, and helping users develop *their* programs. And the capabilities of the ALS will be extended to include infrared beamlines, a 1- to 4-keV undulator, femtosecond x-ray sources, and superbends with superconducting magnets.

Chemla ended by stating that users are influenced by hardware capabilities, beamlines, resolution, and energy range. The ALS will continue to conduct workshops to identify both people working on similar scientific problems and how the ALS can support them.

Thiel commented that examples of participation had been given in terms of people, but support in the form of administrative actions is more important. Chemla responded that 30% of the assistance is in the form of administrative support.

Sinha asked about pharmaceutical research, and Chemla responded that he thought that it is going to grow as, say, the drug companies see the results. Batterman said that he would agree but that it would be the type of research that could be done rather than the uniqueness that would be attractive. Chemla responded that they were doing the best they could to help the users by giving them some money and beam time. There is a need to understand the stress field at a submicron level; once we have met demonstration, we will have a large impact in this area; a proposal is in the works. Batterman countered that his concern was that there were so few Berkeley people involved. Chemla said that the mechanism is to use the discretionary funds of the director for their first experiments and to have them find the funds thereafter.

Russell asked what arrangements were in place between ALS and SSRL. Chemla said there is a large amount of science going on. If the facilities are doing complementary work, duplication can be avoided if overlapping work is coordinated carefully.
Russell asked why the ALS capabilities are being extended with superbends and undulators. Chemla said it was to meet the demand of users. Dehmer commented that the committee looking into this issue reported out about two months ago and suggested that committee members might want to consider making a formal response to its report. Boris Batterman said that what we heard here today was a lot of planning, which is extremely positive. He said that he was happy with what he had heard.

Richmond said that the ALS aspires to be a world-class facility and asked how it is going to assure that it gets the best users addressing the most important issues. Chemla cited two mechanisms: (1) Procedures and administrative concerns have been simplified by conducting all experiments in the extreme ultraviolet. It is difficult for someone to just arrive and insert a sample. The process needs to be made user friendly by lowering the barriers to using the facility. (2) The LBNL Director is committed to use discretionary funds to support the research of non-LBNL workers within the legal restrictions on the use of such funds.

A break was declared at 10:30 a.m.

Richmond called the attendees back into session at 11:02 a.m. She commented on the ALS presentation and said that BESAC is impressed with their efforts to address user concerns, the need for management reorganization, and a focus on world-class science. She said that the committee was pleased with the planning and progress to date and that she would be writing a letter to BES expressing this approval. She introduced Iran Thomas to talk about BES=s

provision of user facilities.

He pointed out that the Department is the major supporter of research in the physical sciences among all government agencies. Moreover, for historical reasons, DOE is the largest supporter of R&D proposals in the United States. Early on, the Department started building a wide range of facilities to host research efforts.

Thomas presented a series of bar charts that were constructed by ER personnel from the advice and suggestions of the scientific community and of the division=s advisory committees. The subjects of the charts were facilities that could be built to advance one or more frontiers of science. The charts (one for high-energy-physics facilities, one for nuclear-physics facilities, one for major fusion facilities, and one for major biological and environmental facilities) postulated when the research, construction, and operation for each recommended facility might occur. To give decision makers a full view of the opportunities available for scientific advance, all needs of the scientific community were considered and mapped out as timelines without regard to budgetary constraints.

He then exhibited a roadmap for BES facilities covering the period from 1999 to 2020, indicating when R&D, construction, and operations would be expected to occur. This chart included existing facilities (the SNS, HFIR upgrade, HFBR upgrade, Second Generation Synchrotron Radiation Light Source upgrade, Third Generation Synchrotron Radiation Light Source upgrades and beamlines, and the APS) as well as new ones (the Fourth Generation Light Source, additional Electron Beam Microcharacterization equipment, and Steady State Neutron Source). A question was raised as to why the computational facilities were not included in the roadmap, and Dehmer replied that they are now.

Sinha asked if there were any planning for a prioritization of these items if an infinite amount of money were not available. Thomas replied that for the SNS, the money was added on *top* of the BES budget. That might also happen for other projects. Usually, though, the Department gets a target from the Office of Management and Budget (OMB). If the Department exceeds that target, they can go back to OMB and request an adjustment of the target. Or OMB may instruct the Department to take something else out of the proposed budget. Or, a new project may be undertaken in phases, and the full amount for the complete project will not adversely affect the budget for any given fiscal year. He hastened to point out that, every time BES builds up a facility, the operating costs go up, too.

Pat Dehmer commented on a small interagency activity with the Office of Science and Technology Policy that was based on anecdotal reports that microbiologist user groups did not have adequate access to synchrotrons. Reports are being issued by a working group and by another group. These reports show that, indeed, access was slow and the beamlines needed improvement. The reports have not yet been officially released. Nevertheless, actions are going forward even though the beamlines are being upgraded across the country. Small blocks of time are going to be made available for immediate use. Also, the facilities will be operated for the maximum number of hours per year. These actions all have costs and put budgeting pressures on DOE. These actions come directly from the Birgeneau Report and the Committee=s recommendations, and they underscore the specific recommendation that funds for operating these facilities should come from a single source.

A National Academy of Sciences study has been initiated by the observation that many facilities evolve to new uses that are very different from their original purposes and roles. For example, some facilities have started out with a materials-science focus and ended up being used for biological-science studies. The NSF prompted this study and wants to have planning for change built into future facilities like the SNS. This study has not yet begun. A workshop will be held Nov. 10-11 to gather data.

Richmond summarized committee actions since the February meeting:

! The report on *Neutron Source Facility Upgrades and the Technical Specifications for the Spallation Neutron Source* was published by BESAC.
! The Birgeneau Report was given broader publication by DOE at BESAC=s request.
! Writing of the BESAC annual report was begun by John Stringer.

She then initiated a discussion of new business by putting forward tentative dates for the next two meetings: Nov. 2-3 and Feb. 24-25. Russell noted that it had been suggested that some of these meetings be held elsewhere than Washington, perhaps at a user facility. Richmond said that the suggestion will be taken under advisement in setting the schedules. Pat Dehmer noted that BESAC members are always welcome at the various workshops organized by the committee. She also stated that names for the two upcoming workshops are due by Aug. 7.

The meeting was opened to public comment.

Denis McWhan of BNL made the comment that, at the EIS scoping meetings, the comments were roughly 50-50, a very balanced discussion. He also said that Chemla=s comments on the ALS as being the only such source in the country were incorrect in that the Brookhaven light source also has a ring optimized for such capabilities. He also commented on the infinite-dollar roadmap with upgrades for the ALS by pointing out that parallel committees like NSAC (Nuclear Science Advisory Committee) play an important role in determining the priorities among such lists of possible activities.

Roger Pynn of Los Alamos National Laboratory said that he was surprised that BES did not take credit for the LANSCE upgrade. He noted that the neutron reactors will need to be shut down for upgrades and maintenance. This will not only shut off the nation=s supply of specialty isotopes but also cripple neutron-scattering research, so DOE should have another neutron source besides the SNS, preferably a complementary type of facility. [In fact, Thomas did include the LANSCE upgrade in his presentation on the Division of Materials Science, and a multipage description of the LANSCE upgrade was included in the handouts that accompanied that presentation.]

John Stringer of EPRI stated that what Iran Thomas presented was not a roadmap in any way. It was a wish list of what might be considered in deriving a roadmap.

There being no other comments, Richmond adjourned the meeting at 12:00 noon sharp.

F. M. O=Hara, Jr 8/22/98, 10/5/98
L. L. Horton, rev. 8/23/98, 9/8/98
G. L. Richmond, rev. 10/2/98