DOE Office of Science

FY 2006

Performance Evaluation of The Regents of the University of California for the Management and Operations of the Ernest Orlando Lawrence Berkeley National Laboratory

February 2007

CONTRACTING OFFICER'S EVALUATION

The Department of Energy, Berkeley Site Office Senior Management reviewed and discussed the recommendations of functional managers and staff concerning the appropriate numeric scores and grades with which to rate the University of California's performance in the management and operation of the Lawrence Berkeley National Laboratory. Based upon this process, an overall score of 3.9 with a grade of "A" is recommended for the Science and Technology component of the evaluation. An overall score of 3.8 with a grade of "A" is recommended for the Management and Operation component of the evaluation. These recommendations have been forwarded to and considered by the Office of Science and approved. This report, entitled *FY 2006 Performance Evaluation of The Regents of the University of California for the Management and Operations of the Ernest Orlando Lawrence Berkeley National Laboratory* provides the basis for my determination, and is hereby endorsed and approved.

Recommendation:

_____ Date: 2/15/07

Charles W. Marshall, Contracting Officer
Department of Energy
Berkeley Site Office

Approval:

_____ Date: _____

Aundra M. Richards, Site Manager
Department of Energy
Berkeley Site Office

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I. OVERALL SUMMARY RATING/FEE

Performance-Based Score and Adjectival Rating:
The basis for the evaluation of The Regents of the University of California (the Contractor) for the management and operations of the Ernest Orlando Lawrence Berkeley National Laboratory (the Laboratory) during FY 2006 centered on the Objectives found within the following Performance Goals:

1.0 Provide for Efficient and Effective Mission Accomplishment (Quality, Productivity, Leadership, & Timeliness of Research and Development)

2.0 Provide for Efficient and Effective Design, Fabrication, Construction and Operations of Facilities

3.0 Provide Effective and Efficient Science and Technology Research Project/Program Management

4.0 Provide Sound and Competent Leadership and Stewardship of the Laboratory

5.0 Sustain Excellence and Enhance Effectiveness of Integrated Safety, Health, and Environmental Protection

6.0 Deliver Efficient, Effective, and Responsive Business Systems and Resources that Enable the Successful Achievement of the Laboratory Mission(s)

7.0 Sustain Excellence in Operating, Maintaining, and Renewing the Facility and Infrastructure Portfolio to Meet Laboratory Needs

8.0 Sustain and Enhance the Effectiveness of Integrated Safeguards and Security Management (ISSM) and Emergency Management Systems

Each Performance Goal was composed of two or more weighted Objectives and most Objectives had a set of performance measures, which assisted in determining the Contractor's overall performance in meeting that Objective. Each of the performance measures identified significant activities, requirements, and/or milestones important to the success of the corresponding Objective. The following describes the methodology utilized in determining the Contractor performance rating.

Each Objective within a Goal was assigned a numerical score by the evaluating office. Each evaluation measured the degree of effectiveness and performance of the Contractor in meeting the Objective and was based on the Contractor's success in meeting the set of Performance Measures/Targets identified for each Objective as well as other performance information available to the evaluating office from other sources to include, but not limited to, the Contractor's self-evaluation report, operational awareness (daily oversight) activities; "For Cause" reviews (if any); other outside agency reviews (OIG, GAO, DCAA, etc.), and the annual 2-week review (if needed). If no performance measures/targets were utilized the description of the general expectations for the success of the objective was utilized as the baseline of the effectiveness and performance of the Contractor in meeting the corresponding Objective and in determining the score assigned. The Goal score was then computed by multiplying the numerical score by the weight of each Objective within a Goal. These values were then added together to develop an overall score for each Goal. This score was then compared to Table A to determine the overall grade for each Goal. A set of tables is provided at the end of each Performance Goal section of this document to assist in the calculation of Objective scores to the Goal score. The raw score (rounded to the nearest hundredth) from each calculation was carried through to the next stage of the calculation process. The raw score for Science and Technology and Management and Operations was rounded to the nearest tenth of a point for utilization in determining fee as discussed below. A standard rounding convention of x.44 and less rounds down to the nearest tenth (here, x.4), while x.45 and greater rounds up to the nearest tenth (here, x.50).

Final Grade	A+	A	A-	B+	B	B-	C+	C	C-	D	F
Total Score	**4.3-4.1**	**4.0-3.8**	**3.7-3.5**	**3.4-3.1**	**3.0-2.8**	**2.7-2.5**	**2.4-2.1**	**2.0-1.8**	**1.7-1.1**	**1.0-0.8**	**0.7-0**

Table A. FY 2006 Contractor Letter Grade Scale

Based on the evaluation of *Insert Contractors Name* performance against the Goals and Objectives contained within the FY 2006 Performance Evaluation and Measurement Plan (PEMP) the scores and corresponding grades awarded for each are provided within Table B below. Specific information regarding the Contractor's performance in meeting each of the Goals and their corresponding Objectives is provided within Section II of this report.

S&T Performance Goal	Numerical Score	Letter Grade	Weight	Weighted Score	Total Score
1.0 Mission Accomplishment	4.1	A+	37%	1.52	
2.0 Design, Fabrication, Construction and Operations of Facilities	3.9	A	39%	1.51	
3.0 Science and Technology Research Project/Program Management	3.8	A	24%	.90	
				Total Score	3.9
M&O Performance Goal	**Numerical Score**	**Letter Grade**	**Weight**	**Weighted Score**	**Total Score**
4.0 Leadership and Stewardship of the Laboratory	3.9	A	25%	.98	
5.0 Integrated Safety, Health, and Environmental Protection	3.4	B+	22%	.75	
6.0 Business Systems	3.9	A	25%	.98	
7.0 Operating, Maintaining, and Renewing Facility and Infrastructure Portfolio	3.7	A-	20%	.74	
8.0 Integrated Safeguards and Security Management and Emergency Management Systems	4.1	A+	8%	.33	
				Total Score	3.8

Table B. FY 2006 Contractor Evaluation Score Calculation

Performance-Based Fee Earned:
Utilizing Table B, above, the scores for each of the Science and Technology (S&T) Goals and Management and Operations (M&O) Goals were multiplied by the weight assigned and these were summed to provide an overall score for each. The percentage of the available performance-based fee that was earned by the Contractor was determined based on the overall weighted score for the S&T Goals (see Table B.) and then compared to Table C. below. The overall numerical score of the M&O Goals from Table B. was then utilized to determine the final fee multiplier (see Table C.), which was utilized to determine the overall amount of performance-based fee earned for FY 2006 as calculated within Table D. Based on the overall performance within the S&T and M&O Goals the Contractor is awarded $4,365,000 in performance based fee for FY 2006.

Overall Weighted Score from Table A.	Percent S&T Fee Earned	M&O Fee Multiplier
4.3	100%	100%
4.2		
4.1		
4.0	97%	100%
3.9		
3.8		
3.7	94%	100%
3.6		
3.5		
3.4	91%	100%
3.3		
3.2		
3.1		
3.0	88%	95%
2.9		
2.8		
2.7	85%	90%
2.6		
2.5		
2.4	75%	85%
2.3		
2.2		
2.1		
2.0	50%	75%
1.9		
1.8		
1.7	0%	60%
1.6		
1.5		
1.4		
1.3		
1.2		
1.1		
1.0 to 0.8	0%	0%
0.7 to 0.0	0%	0%

Table C. – Performance-Based Fee Earned Scale

Overall Fee Determination	
Percent S&T Fee Earned from Table C.	97%
M&O Fee Multiplier from Table C.	X 100%
Overall Earned Performance-Based Fee	97%

Table D. – Final Percentage of Performance-Based Fee Earned Determination

Performance Fee and Rating Adjustment Factor:
Insert information regarding any Performance Fee and/or Rating Adjustment Factor utilized if necessary.

Performance Adjustment Determination	
Percent Fee Earned from Table D.	**97%**
Percentage of Performance Adjustment	**- 0%**
Final Percentage of Fee Earned	**97%**
Final Performance Grade Awarded	**No Change**

Table E. Performance Adjustment Factor Calculation

Based on the performance adjustment determination the Contractor is awarded $4,365,000 in performance based fee for FY 2006 subject to the limitation set out in clause H.45 that the total fee payable for the period of June 1, 2005 through September 30, 2006 shall not exceed $4 million.

II. PERFORMANCE GOALS, OBJECTIVES, AND MEASURES/TARGETS

For Science and Technology the format used by the program offices did not compute overall scores for all programs at the objective level, only at the goal level. Therefore no overall score and rating is identified at the objective level.

1.0 Provide for Efficient and Effective Mission Accomplishment (Quality, Productivity, Leadership, & Timeliness of Research and Development)

The Contractor produces high-quality, original, and creative results that advance science and technology; demonstrates sustained scientific progress and impact; receives appropriate external recognition of accomplishments; and contributes to overall research and development goals of the Department and its customers.

The weight of this Goal is **37%**

The Provide for Efficient and Effective Mission Accomplishment Goal measured the overall effectiveness and performance of the Contractor in delivering science and technology results which contributed to and enhanced the DOE's mission of protecting our national and economic security by providing world-class scientific research capacity and advancing scientific knowledge by supporting world-class, peer-reviewed scientific results, which were recognized by others.

LBNL achieved a score of 4.1 and a grade of A+.
Many of the research activities have made significant contributions, were deemed excellent, and in some cases, world class for which some received prestigious awards. Some of LBNL 's programs are extremely productive, innovative, and demonstrated excellent scientific progress.

1.1 Science and Technology Results Provide Meaningful Impact on the Field

ASCR- LBNL plays a key role in simulation efforts with many significant contributions to computational science, applied mathematics, networking and high performance computing (HPC). LBNL researchers are leading five SciDAC projects, including the SciDAC Outreach Center, and participating in many more – these large collaborations with significant cross-fertilization to other disciplines were extremely competitive (<10% success rate). LBNL is the world leader in key areas of applied mathematics for High Performance Computing (CFD, Reacting flows, optimization, Adaptive Mesh refinement (AMR)) and advanced network research with many notable contributions in FY06

BES-The Condensed Matter Physics program was reviewed in January 2006. Many of the research activities, including Superconductivity, Ultrafast Materials Science, Quantum Materials, and Magnetism, were deemed excellent and in some cases, world class.

The Electronic Materials Program continues to be world-class, extremely productive, and imaginative. Several new activities, including those in magnetic thin films and hydrogen fuel cells, were initiated in FY 2006. While the reviewers were highly complimentary on some components of these new activities, they also cautioned the need for improved coherence within the two new programs. An important recent research highlight includes the development of the first nanofluidic "transistor" in which the flow of ions in solution can be controlled with external voltages.

Peer review of the Chemical Physics Program and Chemical Dynamics Beamline (CDB) was conducted jointly in FY 2006. The three elements of the Chemical Physics Program reviewed as follow: the effort in experimental reaction dynamics was evaluated as extraordinarily productive, innovative, and exhibiting excellent synergy among the principal investigators; the dynamical and structural theory program reviewed very well; the coalescence of three small projects focused broadly on condensed-phase chemical physics reviewed well, with varying emphases by the reviewers on results produced to date, the adventurous nature of the proposed research, and confidence in the talent of the investigators. The CDB at the Advanced Light Source (ALS) was viewed as a facility dedicated

to state-of-the-art investigations in combustion dynamics, aerosol chemistry, optical properties of nanoparticles, biomolecular energetics, spectroscopy, kinetics, and state-resolved chemical dynamics processes using tunable vacuum ultraviolet light for excitation or detection. The beamline director and his staff received rave reviews for the improvements made at the CDB during the past three years. The CDB is more productive, innovative, flexible, and user-oriented than at any time since its inception. Two other projects were reviewed in FY 2006: the LBNL-led collaborative project on scalable methods for electronic excitation and optical responses in nanostructures reviewed strongly and was renewed; the combustion chemistry project also got very solid reviews and was renewed. Ten new or renewal, individual principal investigator projects in geosciences and one renewal in physical biosciences were mail reviewed during the evaluation period. The former reviewed well; the overall program in geophysics and geochemistry will grow in the future. The biosciences project was praised for its accomplishments, but criticized for aspects of the proposed future directions.

Research conducted in the catalysis; heavy element chemistry; analysis; atomic, molecular, and optical (AMO) sciences; and photochemistry programs continue to be extremely productive and demonstrate excellent scientific progress.

BER- LBNL is the most successful and productive laboratory in conducting BER life sciences programs in GTL, Low Dose and in DNA sequencing. BER Life Sciences funds approximately $66M of fundamental research in these program areas.

Researchers are developing innovative and ground-breaking projects on developing high throughput approaches to characterize and image with high resolution multi-molecular complexes. These projects substantially contribute to the fundamental science underpinning the GTL program, as well as produce technology strategies and data that is disseminated to the wider scientific community. Several of these projects were reviewed in FY 2006 by their respective project Advisory Committees, comprised of independent scientific experts, and were given high marks for very good progress. LBNL GTL-supported research on microbial systems biology has been prominently featured in high-impact factor journals.

Noteworthy publication from LBNL scientists documented important advances in community analysis of microbial populations from the Oak Ridge Field Research Center. Similarly, several publications documented the role of LBNL geophysics in monitoring subsurface activities associated with environmental remediation. LBNL is commended for a Best Student Paper award in EOS for research supported by ERSD. The environmental synchrotron science program at the ALS is helping many ERSD investigators to take advantage of the facility/capability.

FES- LBNL is the lead institution for the Virtual National Laboratory (VNL) for Heavy Ion Beam Science. The other member institutions of the VNL include LLNL and PPPL. Under LBNL leadership, the VNL has produced 110 peer reviewed publications in the past one and a half years, of which 22 publications were from LBNL. The accomplishments of the Heavy Ion Fusion Science (HIFS)-VNL, communicated by these publications, have changed the way the High Energy Density Physics (HEDP) research community thinks about using beam pulse compression and unique control of ion beam deposition properties to improve measurements of warm dense matter properties, an important, discovery-rich branch of high energy density physics. This research field has been featured as one of the 15 thrust areas identified by the US National Task Force on High Energy Density Physics. Thirty-eight of the 110 peer-reviewed publications in the VNL involve advances outside the field in atomic physics (heavy ion stripping and ionization cross sections), warm dense matter physics (part of HEDP), and general accelerator science (e-cloud effects). Thirty one invited talks given by the VNL at major meetings, of which 12 were delivered by LBNL, in fusion, high energy physics, and warm dense matter, demonstrate the wide impact of the HIFS-VNL research over the past year and a half.

HEP- LBNL physicists received several prestigious prizes for their work in cosmology. George Smoot will share the 2006 Nobel Prize in Physics for his work on the anisotropy of the cosmic microwave

background. Saul Perlmutter shares the 2006 Shaw Prize in Astronomy for his work on the acceleration of universe measured with supernovae.

LBNL also received an R&D 100 award for their work on restoring antique audio recordings. This work was a spin-off from the detector development work done by the Physics Division.

NP- Within the low energy program, the Sudbury Neutrino Observatory (SNO) experiment (solar neutrinos) and the KamLAND experiment (reactor and geo-neutrinos), where LBNL staff play prominent roles, have had a very high impact in the area of neutrino physics. LBNL researchers have a strong weak interactions program studying 14-O superallowed beta decay and beta-neutrino correlations in 21-Na decay. The heavy elements programs are once again becoming world-leading in the physics and chemistry of heavy elements and searches for superheavy elements, especially by making a systematic study of hot fusion for heavy element production. In the area of nuclear structure, staff is pursuing studies of the proton-neutron interaction in N = Z nuclei. Researchers are leading the effort in developing and fabricating the next generation gamma ray tracking array which will be the next-generation research tool (GRETINA) for studying nuclear structure and astrophysics at the National low energy user facilities. To date, project performance for the GRETINA Major Item of Equipment has been within cost and schedule plans.

The LBNL research staff have an excellent collaboration with National Reconnaissance Office (NRO) and USAF for the development of the capabilities of the 88-Inch Cyclotron and its infrastructure for the testing the radiation hardness of microelectronics that are deployed in space applications.
Within the relativistic heavy ion program, the scientific and technical contributions of the Relativistic Nuclear Collisions (RNC) group at LBNL continue to be significant. Its staff has provided outstanding scientific, technical and management leadership in the RHIC STAR program. RNC scientists have appeared as lead authors on a large fraction of STAR publications, demonstrating a high level of productivity especially in its areas of expertise on bulk properties of matter, short-lived probes and jet suppression in heavy ion collisions.

The group has continued to maintain a very active and semi-permanent presence at BNL in support of the STAR experiment and its detector upgrade R&D program – particularly, the Heavy Flavor Tracker (HFT) detector upgrade which should enable the measurement of open charm (D_0, D_s, D^+, Λ_c and their anti-particles). The RNC group leads this ambitious and challenging R&D project to build a high resolution pixel vertex detector based on CMOS technology. A technical effort is directed in the design of new STAR TPC front-end electronics that will speed up the read-out by a factor of 10. RNC scientists are also leading the development of an experimental program that will extend the present hard probes program in ALICE at the LHC. Specifically, the design and construction of an electromagnetic calorimeter has made significant progress. The Parallel Distributed Systems Facility (PDSF) is the STAR data analysis center operated jointly by NERSC and the RNC group at LBNL. This resource is used by the entire STAR collaboration and it continues to have a significant impact on the collaboration's scientific productivity. Overall, the RNC group is considered to be among the two strongest in the national laboratory heavy ion research program.

Within the Theory Program, LBNL scientists have had significant impact in relativistic heavy ion physics, providing support for interpretations of STAR data at the Relativistic Heavy Ion Collider (RHIC). No other theory group at any of the national laboratories has had as much impact on the RHIC program as the LBNL group has had. The continuing positive interaction between the theory group and the experimental RNC group greatly enhances the effectiveness of LBNL scientists in the area of RHIC physics. The past work on interpretations of RHIC data constitutes a significant achievement of the nuclear theory program, and the planned work is an essential component of the NP research portfolio.

Within the Nuclear Data program, a small group of LBNL scientists plays a significant role in the national nuclear data effort that provides evaluated nuclear structure and decay data to the basic research and applied physics communities. The importance of this effort has been recently reaffirmed,

as the nuclear data activities are important for counter-terrorism efforts. Additions to staff this year are expected to maintain the historical effort of The Isotopes Project, but it also suggest a likely new thrust in the direction of nuclear data needs for the advanced fuel cycle initiative.

WDTS- LBNL's Center for Science and Engineering (CSE) does a superior job in managing the Workforce Development programs. Their strength lies in the fact that over the recent few years and especially in 06 they achieved all program deliverables and creatively leveraged the WD programs to extend science ed to students and teachers well beyond those for which they are provided funding. CSE has developed a cooperative learning environment at the lab by designing programs that collaborative learning and facilitate interaction among participants from different programs. They also use the programs and the internship/fellowship at the lab to encourage culture improvement such as safety and the importance of ongoing scientific exchange between Pis and the scientific community outside the lab.

EERE:
Buildings- LBNL has with the help of SAGE Electrochromics Inc., developed the first integrated highly insulating dynamic full-scale window prototype. While there is considerable work ahead to commercialize this product, the FY 2006 achievements regarding windows are significant. LBNL exhibits cutting edge R&D capability with its commercial building control and monitoring work and is able to foresee the potential impacts caused by changing the ways buildings will be built and operated

LBNL's performance on appliance standards is average. First drafts of work are getting better, but LBNL still needs to improve the draft standards to get a quality product on time and on budget to DOE.

The lighting research and development (LR&D) element of the BTP is focused on solid state lighting, with activities largely in physics, chemistry, and electrical engineering of semiconductors (applied research for breakthroughs). LBNL's work on the Integrated Building Energy Controls and High Dynamic Range Image-Based Controls tasks do fall within the broad range of EERE's mission, but are not a good fit with LR&D. Neither task is related to semiconductor science/engineering or advancing pre-commercial technology in a "push the envelope" sense for their respective areas. Most activities are late-stage product development or demonstration (more suited for private companies).

FreedomCAR- LBNL is the lead laboratory for a multi-million dollar, multi-university exploratory battery research program — the Batteries for Advanced Transportation Technology program — and contributes diagnostic expertise to the DOE's Advanced Technology Development program. The investigators at LBNL are highly regarded, world-class scientists who perform leading edge research toward understanding the fundamental issues impeding the development of electric, hybrid, and fuel cell vehicle batteries. LBNL's contributions are critical to the FreedomCar Vehicle Technologies (FCVT) program realizing its mission goals.

Geothermal- LBNL delineated a systematic regional trend in helium isotope geochemistry across the Basin and Range in western United States. The Basin and Range is a promising area for geothermal power plant development and LBNL's research provides a map for delineating fault systems characterized by high, deep permeability. This research will help focus geothermal exploration for commercial-size geothermal resources on high probability areas throughout the Basin and Range. This original research has generated much interest in the geothermal community and was very highly rated in the last Exploration subprogram peer review. LBNL refined state-of-the-art magnetotelluric geophysical methods and produced a 3-D resistivity model of the Coso geothermal system in California that clearly shows the controlling geological structures influencing well production. Furthermore, it was demonstrated that by extending data set and modeling capability to lower frequency (0.3 Hertz), it enhances the ability to locate subsurface fluids, as defined by electrical conductivity contacts, which is critical for well placement in exploration and development of commercial geothermal systems.

Industrial- DOE's goal in the Industrial Technologies Program (ITP) Best Practices subprogram is to reach and influence 50,000 plants to save more than 2.5 percent energy for each. LBNL's effort has helped DOE reach its goals. LBNL has continued its successful development and implementation of public/private partnerships that form the core of the ITP Technology Delivery subprogram. ITP's private sector partners laud the laboratory for timeliness and accuracy in its delivery of energy management best practices. The laboratory has managed the creation of a database of the largest energy using industrial companies in the United States, an activity that has proven essential to the ITP Technology Delivery strategy.

RW- For the last 20 years, LBNL's Earth Sciences Division (ESD) has significantly contributed to many aspects of the site characterization and performance assessment efforts of Yucca Mountain for the Office of Civilian Radioactive Waste Management (OCRWM). LBNL's research has been focused on the 600-m-thick unsaturated zone.

Prior to the Yucca Mountain studies, most published research in unsaturated zone was confined to near-surface flow and transport processes in relation to the soil vadose zone. LBNL's studies at Yucca Mountain-published widely in peer-reviewed journals, including two special issues of Journal of Contaminant Hydrology-have greatly advanced the knowledge of flow and transport in thick, fractured, unsaturated rocks, and brought LBNL the recognition in the scientific research community as the leader in fundamental understanding, testing, analysis, and modeling of unsaturated flow and transport in fractured porous media. Within OCRWM, LBNL's scientific contribution to the waste disposal program is highly valued, and LBNL's scientific judgment is trusted. LBNL has frequently been selected to represent the Yucca Mountain project to external oversight panels and review boards.

During the 2006 performance period, LBNL staff have participated in development of the technical bases for projecting long term (>10,00 years) performance of a geologic repository for spent nuclear fuel and high-level radioactive waste. LBNL staff is primary authors of reports on Unsaturated Zone Flow and Transport reports that will be referenced in the repository License Application. The work has been timely, accurate, and of high quality.

At the establishment of the Science and Technology Program (S&T) in OCRWM, the director of ESD was appointed to be the Head of the Natural Barriers Thrust, one of three science thrusts in the S&T program. The Thrust Lead has assembled a balanced portfolio of projects to develop outstanding core competencies and scientific excellence in exploratory, high-risk research that is expected to result in greatly improved repository performance at reduced cost.

In addition to leading the Natural Barrier Thrust, LBNL's ESD staff is investigators for 10 research projects within the S&T program. The results of the LBNL S&T projects have the potential to change the current view of the capability of the natural system at Yucca Mountain to isolate the radioactive waste in a geological repository. Examples of significant ongoing studies include: (1) developing new understanding of field-scale matrix diffusion coefficients over those derived from laboratory studies; (2) analog studies are developing a greater understanding of the drift-shadow concept, which may result in significantly delayed release of radionuclides from the emplacement drifts to the rocks; (3) preliminary results from a study of coupled thermal-hydrological processes within the drift indicates that natural convection removes moisture from the waste packages, thus reducing the potential for corrosion of waste packages and engineered components; (4) the development of a fully coupled, state-of-the-art thermal, hydrological, chemical (THC) model will enhance our ability to realistically delineate THC processes in the rock and the emplacement drifts; and (5) field observation indicated localized fast transport in the fractured volcanic tuff at Yucca Mountain.

1.2 Provide Quality Leadership in Science and Technology

ASCR- LBNL researchers are invited to give many talks at the SciDAC annual meeting and other significant conferences related to computational science and high performance computing.

BES- In general, all research projects supported by the Materials Sciences and Engineering Division are deemed to be world-leading as determined by the most recent program reviews.
Many of the principal investigators within the Chemical Sciences Division under review in FY 2006 were recognized by the reviewers as being world leaders in their fields. The reviews revealed multiple demonstrations of a willingness to undertake bold and innovative long-term research. Of particular note are the new and exciting research areas enabled by changes in the Chemical Dynamics Beamline, including a new project in nano-imaging of organics initiated in FY 2006, based on successful peer review under Notice 05-30. The collective set of BES supported geosciences principal investigators are well respected nationally. Many of the principal investigators in the areas of catalysis, actinide chemistry, laser spectroscopy, AMO sciences, and photochemistry are extremely highly regarded nationally and internationally.

BER- Researchers display tremendous leadership for several programs within the Life and Medical Sciences Division. Dr. Mina Bissell, the Distinguished Scientist for the Life and Medical Sciences Division, was awarded the Ted Couch Lectureship in Cancer Research for her significant contributions to cancer research. Dr. Mary Helen Barcellos-Hoff serves as the Chief Scientist for the Low Dose Radiation program, and has assisted with program planning and recruitment of personnel to the LBNL low dose radiation program. Dr. Jay Keasling organized the highly successful Synthetic Biology Workshop 2.0, bringing together an international group of scientists to discuss recent findings and future directions for this nascent area of interest for the GTL program. Many researchers serve as organizers or co-chairs of scientific meetings and conferences, both setting the agenda, selecting session speakers and topics, and also serving as keynote speakers.

LBNL provides important leadership to the program in the areas of environmental microbiology and geosciences with emphasis on field applications. LBNL hosts the ERSD Distinguished Scientist – Terry Hazen. Dr. Hazen has published regularly on diverse topics with application to the program; continues to conduct important research for the program and integrates well with other DOE program offices. PI's are providing scientific leadership in the application of synchrotron capabilities to environmental remediation science.

LBNL remains a relatively minor player in BER's climate change research. LBNL lacks sufficient core capabilities to be considered a leader in any area of BER's climate change research program

FES- Under the scientific leadership of LBNL, the HIFS-VNL has been willing to pursue novel approaches and innovative solutions to problems. The invention of neutralized drift compression has led to an unprecedented 60 X longitudinal compression of a high intensity ion beam. A novel type of pulse line ion accelerator has also been invented.

HEP- LBNL has world leading programs in cosmology, collider physics, detector development, superconducting magnets, and laser driven electron accelerators. All programs have performed up to their high standards this year, but the laser acceleration program stands out by achieving another breakthrough. Last year they demonstrated the acceleration of "beam quality" electron pulse to 70 MeV. The energy spread was a smaller than their ability to measure it, so that these pulses are candidates for use in a real accelerator. This year they followed that success with the acceleration of a similarly high quality electron pulse to 1 GeV in a plasma channel of only 3.3 cm.

NP- LBNL researchers have significant scientific leadership in the national neutrino physics program including the ongoing SNO and KamLAND experiments, future neutrino-less double beta decay experiments, and in the development of the NSF funded Deep Underground Science and Engineering Laboratory. They are among the world leaders in heavy element chemistry and physics, and are one of two groups in the world that are at the forefront of the development of large segmented germanium array spectrometers. Several LBNL scientists are in leadership roles in the national nuclear physics community and in overall Nuclear Physics program planning.

RNC Group has provided scientific and technological leadership on the STAR and ALICE experiments at RHIC and LHC, respectively. LBNL scientists have published many papers in the top

scientific journals. RNC staff includes: the deputy spokesperson of the STAR experiment; the lead scientist on the R&D of the silicon pixel Heavy Flavor tracker upgrade identified in the BNL Mid-Term Strategic plan; the deputy project manager of the ALICE electromagnetic calorimeter project, and other Physics Working Group leadership positions.

Important scientific and technical achievements during the last year, in which the RNC staff played a major role, include: investigation of Mach Cones using di-hadron correlation shapes in Au+Au collisions; □-meson production in Au+Au collisions; the study color charge dependence of the energy loss and the fragmentation functions at high transverse momentum; yields and/or elliptic flow of single electrons, K^0_s, Λ, d and ^{3}He in Au+Au collisions; the study of nucleon spin with jets and hyperons; the continued R&D and simulations of the Heavy Flavor pixel tracker and its readout and data sparsification system; development and study of mechanical concepts for support, cooling, thin beam pipe technology and installation; the DOE ALICE EMCAL Review; and the project engineering for the construction of the ALICE EMCAL Support Structure.

The RNC group has demonstrated a willingness to pursue novel, high-risk technology approaches which, if successful, would significantly advance the development of super-thin pixel detectors.

RW- As the S&T program Natural Barriers Thrust Lead, LBNL has assembled a balanced portfolio of projects to develop (1) outstanding core competencies in understanding the natural system, and (2) scientific excellence in exploratory, high-risk research that are expected to result in greatly improved repository performance. The corresponding scientific challenges-reflected in an S&T call for proposals-has attracted participation from universities and other research institutions.

Projects led by LBNL staff are pursuing innovative solutions to high-level waste isolation, taking on high-risk/high-payoff research problems. The LBNL research related to the concept of a drift shadow, description of the thermally driven coupled processes within emplacement drifts, and field and laboratory studies on transport parameters and retardation processes, are providing a strong scientific basis for the capability of Yucca Mountain to effectively isolate radionuclides from the accessible environment. In 2006, LBNL scientists made several presentations to the Nuclear Waste Technical Review Board, and received complimentary responses for addressing the Board's concerns. Similarly, the S&T program was favorably received by the U.S. Nuclear Regulatory Commission Advisory Board. Both advisory boards recognize that the natural barriers program led by LBNL plays an important role in resolving outstanding waste isolation issues.

1.3 Provide and sustain Science and Technology Outputs that Advance Program Objectives and Goals

ASCR- LBNL researchers have made many important contributions to related publications and are considered leaders in many aspects of HPC, networking, and computational science.

BES- The activities supported by the Materials Sciences and Engineering Division continue to produce a large number of excellent quality, peer reviewed journal articles.

BER- Researchers demonstrate significant productivity, in the form of peer-reviewed publications in well-respected, high-profile scientific journals; many of these publications have been featured on the journal covers, affording an additional element of visibility to the corresponding DOE-supported research. The GTL data generated by LBNL researchers is made widely available to the entire GTL research community, to assist with modeling refinement and validation.

FES- Under the leadership of LBNL, the HIFS-VNL has published 110 total peer-reviewed publications in 2005 and to date in 2006 with the following breakdown with 22 contributed by scientists at LBNL. Of those 110, about 30 % are in fields outside of heavy ion fusion. Also, 30% of those publications are associated with invited papers at major scientific conferences.

NP- The low energy researchers have a commendable record of publication in refereed journals with 54 in nuclear structure/astrophysics, 17 in neutrino science, and 12 in accelerator physics. Research at the 88-Inch Cyclotron facility has resulted in 4 PhD theses.

The high rate of scientific publications is testimony for a very productive heavy ion group. RNC scientists continue to play a leading role in high-impact RHIC publications. Invited talks at international conferences demonstrate a high level of recognition of the group's research and technical advancements by the scientific community.

RW- The OCRWM program is focused on successful submittal of a license application in 2008, defense of the application and receipt of a construction authorization to allow a repository for spent nuclear fuel and high-level radioactive waste to open by 2018. The work performed by LBNL is a key part of that work. The LBNL investigators working on the OCRWM program have done an outstanding job in completing the work necessary to achieve the program goals.

Each of the Targeted Thrusts in the S&T program assembled external experts to conduct an independent review of the S&T projects to evaluate program accomplishments and to provide advice on program direction and emphasis. Every LBNL S&T project has received high marks on the independent peer reviews. The LBNL project results obtained during the two years since the inception of the S&T program have been published in multiple conference proceedings and have been submitted to peer-reviewed journals. All LBNL S&T projects were showcased in two special sessions at the International High-Level Nuclear Waste Management Meeting in April 2006.

1.4 Provide for Effective Delivery of Science and Technology

BES- The activities supported by the Division of Materials Sciences and Engineering have been effective in transmitting the results to the community

BER- PI's are well integrated throughout the program providing support to the program in general as well as to specific funded projects. The geophysics group has been effective at integrating with the ERSD field activities. PI's have been effective in their interactions with and support of other funded investigators wishing to utilize the ALS

FES- LBNL has met all of its quarterly milestones and yearly targets. It has communicated its progress to DOE with weekly progress reports and has been responsive to all requests for information from DOE. It has documented this progress through a large number of peer-reviewed publications.

HEP- LBNL has world leading programs in cosmology, collider physics, detector development, superconducting magnets, and laser driven electron accelerators. All programs have performed up to their high standards this year, but the laser acceleration program stands out by achieving another breakthrough. Last year they demonstrated the acceleration of "beam quality" electron pulse to 70 MeV. The energy spread was a smaller than their ability to measure it, so that these pulses are candidates for use in a real accelerator. This year they followed that success with the acceleration of a similarly high quality electron pulse to 1 GeV in a plasma channel of only 3.3 cm.

NP- LBNL researchers address a number of Nuclear Physics program performance milestones in nuclear structure and astrophysics, as well as in fundamental interactions and neutrinos. The NRO and USAF view the 88-Inch Cyclotron as their "facility of first choice" for their applied research programs. The high rate of scientific publications by the RNC group is a testimony its efficiency and effectiveness in delivering the science. The Parallel Distributed Systems Facility (PDSF) operated by the RNC group is an essential resource utilized the entire STAR data analysis efforts. This resource has continued to sustain the STAR collaboration's ability to effectively and efficiently deliver the science.

RW- All projects within the LBNL-led Natural Barriers Thrust met expected goals and milestones. Despite reduced FY 2006 funding, LBNL and the Natural Barrier Thrust delivered quarterly reports of excellent quality on time and met established milestones. LBNL also coordinated and published the S&T annual report, a volume of over 200 pages. The annual report was widely distributed to the Nuclear Waste Program and the scientific community. Research results were effectively disseminated through peer- reviewed journal articles, conference proceedings, meetings, and presentations to review boards

		ASCR	
		Weights	
	Objective	Goal	
	Score	Objective	Funding
Goal #1 Mission Accomplishment		40%	20.9%
Objectives			
1.1 Impact	4.2	40%	
1.2 Leadership	4.2	30%	
1.3 Output (productivity)	4.3	15%	
1.4 Delivery	4.3	15%	
Goal #1 Score (calculated)	**4.23**		

		BES	
		Weights	
	Objective	Goal	
	Score	Objective	Funding
Goal #1 Mission Accomplishment		30%	31.5%
Objectives			
1.1 Impact	4	50%	
1.2 Leadership	4	20%	
1.3 Output (productivity)	4.3	15%	
1.4 Delivery	4.3	15%	
Goal #1 Score (calculated)	**4.09**		

		BER	
		Weights	
	Objective	Goal	
	Score	Objective	Funding
Goal #1 Mission Accomplishment		25%	20.7%
Objectives			
1.1 Impact	4	30%	
1.2 Leadership	4	20%	
1.3 Output (productivity)	4.3	20%	
1.4 Delivery	4.3	30%	
Goal #1 Score (calculated)	**4.15**		

		FES	
		Weights	
	Objective	Goal	
	Score	Objective	Funding
Goal #1 Mission Accomplishment		70%	1.5%
Objectives			
1.1 Impact	3.5	30%	
1.2 Leadership	3.7	30%	
1.3 Output (productivity)	4.3	20%	
1.4 Delivery	4.3	20%	
Goal #1 Score (calculated)	**3.88**		
		HEP	
		Weights	
	Objective	Goal	
	Score	Objective	Funding
Goal #1 Mission Accomplishment		45%	13.0%
Objectives			
1.1 Impact	4.1	30%	
1.2 Leadership	3.7	30%	
1.3 Output (productivity)	4.3	30%	
1.4 Delivery	4.3	10%	
Goal #1 Score (calculated)	**4.06**		
		NP	
		Weights	
	Objective	Goal	
	Score	Objective	Funding
Goal #1 Mission Accomplishment		45%	5.5%
Objectives			
1.1 Impact	3.9	40%	
1.2 Leadership	3.8	30%	
1.3 Output (productivity)	4.3	15%	
1.4 Delivery	4.3	15%	
Goal #1 Score (calculated)	**3.99**		
		WDTS	
		Weights	
	Objective	Goal	
	Score	Objective	Funding
Goal #1 Mission Accomplishment		65%	0.2%
Objectives			
1.1 Impact	3.7	25%	
1.2 Leadership	3.7	30%	
1.3 Output (productivity)	4.3	30%	
1.4 Delivery	4.3	15%	
Goal #1 Score (calculated)	**3.97**		

Table 1.1 – 1.0 SC Program Office Performance Goal Score Development

Science Program Office	Letter Grade	Numerical Score	Funding Weight (BA)	Goal Weight	Overall Goal Weighted Score
Office of Advanced Scientific Research	A+	4.23	20.9%	40%	
Office of Basic Energy Sciences	A+	4.09	31.5%	30%	
Office of Biological and Environmental Research	A+	4.15	20.7%	25%	
Office of Fusion Energy Sciences	A+	3.88	1.5%	70%	
Office of High Energy Physics	A+	4.06	13.0%	45%	
Office of Nuclear Physics	A	3.99	5.5%	45%	
Office of Workforce Development for Teachers and Scientists	A	3.97	0.2%	65%	
				Performance Goal 1.0 Total	4.12

Table 1.2 – SC Program Office Overall Performance Goal Score Development

HQ Program Office	Letter Grade	Numerical Score	Weight	Weighted Score	Overall Goal Score
Assistant Secretary for Energy Efficiency and Renewable Energy					
				Overall EERE Goal 1Total	3.6
Office of Civilian Radioactive Waste Management (RW)					
				Overall RW Goal 1 Total	4.12

Table 1.3 – 1.0 Other Program Office & Customer Performance Goal Score Development

HQ Program Office	Letter Grade	Numerical Score	Weight	Weighted Score	Overall Goal Weighted Score
Office of Science	A+	4.12	93.33%	3.85	
Office of Energy Efficiency and Renewable Energy (EERE)	A-	3.6	4.71%	0.17	
Office of Civilian Radioactive Waste Management (RW)	A+	4.12	1.96%	0.08	
				Performance Goal 1.0 Total	4.1

Table 1.4 – Overall Performance Goal Score Development

Total Score	4.3-4.1	4.0-3.8	3.7-3.5	3.4-3.1	3.0-2.8	2.7-2.5	2.4-2.1	2.0-1.8	1.7-1.1	1.0-0.8	0.7-0
Final Grade	A+	A	A-	B+	B	B-	C+	C	C-	D	F

Table 1.5 – 1.0 Goal Final Letter Grade

2.0 Provide for Efficient and Effective Design, Fabrication, Construction and Operations of Facilities

The Contractor provides effective and efficient strategic planning; fabrication, construction and/or operations of Laboratory facilities; and is responsive to the user community.

The weight of this Goal is **39**%.

The Provide for Efficient and Effective Design, Fabrication, Construction and Operations of Research Facilities Goal measures the overall effectiveness and performance of the Contractor in planning for and delivering leading-edge specialty research and/or user facilities to ensure the required capabilities are present to meet today's and tomorrow's complex challenges. It also measured the Contractor's innovative operational and programmatic means for implementation of systems that ensures the availability, reliability, and efficiency of these facilities; and the appropriate balance between R&D and user support.

LBNL achieved a score of 3.9 and a grade of A.
LBNL operation of the user facilities has been highly reliable and in some cases more user hours were made available then planned.

Management has been responsive to program and user needs

LBNL has met all of their milestones on time and on budget for various projects underway at LBNL

Objectives:

2.1 Provide Effective Facility Design(s) as Required to Support Laboratory Programs
BES- LBNL's National Center for Electron Microscopy leads the DOE Transmission Electron Aberration-corrected Microscopy (TEAM) project. LBNL has primary responsibility for project management, controls, and direction, as well as technical leadership on stage design and column integration. Management of this complex Major Item of Equipment project, which involves four other research groups and two commercial vendors, has been exceptional throughout the design phase.
The User Support Building project is progressing fast with good planning and good management response

HEP- LBNL is involved in two major design efforts. The first is the Supernova Acceleration Probe which is a candidate for the Joint Dark Energy Mission of NASA and DOE. The other is the Daya Bay reactor neutrino experiment to measure $\sin(\theta_{13})$. Both efforts are making satisfactory progress. SNAP has been conducting a through research and development program to develop new light sensors for the experiment. Both the rad-hard CCDs and the new infrared detectors have reached a state of maturity that they can be used to satisfy the design requirements. SNAP has put together a management team to carry out the design of the experiment. They have effectively supported DOE's efforts to plan the project.

Daya Bay reactor neutrino experiment is a joint US-China proposal that would address the mission need for a measurement of the neutrino mixing angle, $\sin(\theta_{13})$. The LBNL group in the Daya Bay collaboration includes both Kam-Bui Luk, the cospokesman of the collaboration and William Edwards, the acting project manager. The Daya Bay group has just passed a review of the scientific reach of the experiment, and will now proceed to CD-1.

EERE:

Buildings- Beyond the control of the windows research group, the laboratory decided to move the sputtering chamber that is used to deposit a variety of experimental hydride layers on glass substrates. This work is critical for the Reflective Hydride Electrochromic project which LBNL won an R&D 100

Award in FY 2004. However, the move was poorly coordinated and the result was that the facility was shut down for an exceptionally long time. This resulted in significant delays for planned milestones in mid-FY 2006. LBNL has been working to make up the schedule, but the milestones will still be late

FreedomCAR-Energy storage technologies, especially batteries, are critical enabling technologies for the development of advanced, fuel-efficient, light- and heavy-duty vehicles and are, thus, key components of the DOE's Energy Strategic Goal. LBNL has recently upgraded their cell making laboratory, enhancing both the quality and consistency of the lab-built cells, enabling more rigorous evaluation of novel materials, and enhancing their ability to support the university researchers' efforts.

2.2 Provide for the Effective and Efficient Construction of Facilities and/or Fabrication of Components

BES- Construction of the Molecular Foundry, a nanoscience user facility, will be completed in December 2006 and is on schedule and being executed well. Conventional construction for the facility was completed and the building was formally accepted on schedule in the spring of 2006. Progress towards project completion through installation and commissioning of technical equipment proceeded during the remainder of FY 2006. Formal CD-4a approval for the Start of Initial Operations was signed in April 2006.

BER- The soft x-ray microscopy station for biological research at the ALS was completed according to cost/schedule performance milestones.

HEP- The major fabrication effort (post CD-2) at LBNL is the ATLAS project being built at CERN. LBNL has met all of their milestones on time and on budget.

2.3 Provide Efficient and Effective Operation of Facilities

ASCR- LBNL manages two major facilities Esnet and NERSC. NERSC is a world class capacity facility with exceptional user ratings and reputation. Management is responsive to both users and ASCR balancing a wide array of requirements from a large user community within budget constraints. NERSC management has been equally adept at negotiating with vendors and ASCR is pleased with the resulting contract for the NERSC upgrade. The management of Esnet has been equally successful this year. ASCR is particularly pleased with the partnership with Internet 2.

BES- The ALS continues to excel in it high-profile scientific output and operational reliability. Under Dr. Janos Kirz's the ALS completed former Director Chemla's original strategic plan and developed a new plan working closely with the ALS user community and the ALS Scientific Advisory Committee. The plan consists of three main components: source upgrade, replacement of older insertion devices, and new beamlines. The ALS will begin to incorporate top-off operational periods in 2007 which will double the time averaged current and reduce beam emittance by a factor of 5. Rodger Falcone, succeeded Dr. Kirz as ALS Director in September 2006.

The National Center for Electron Microscopy (NCEM) is transitioning from a BES-supported laboratory research program at LBNL to a stand-alone user facility that is expected to exemplify both scientific excellence and first-rate service to the broad community of users. The NCEM underwent its first operational review as a stand-alone user facility in April 2006, and management is addressing the needed changes. The Molecular Foundry, a Nanoscale Science Research Center, began initial operations in FY 2006 with partial-year funds and has successfully initiated user research programs and high-quality scientific work within the new facility, leading to well-regarded scientific accomplishments.

BER- The JGI is a multi-lab operation, LBNL has taken the major role in management. Notable JGI achievements include: JGI sequencing output has steadily increased to approximately 3 Gb per month, or one human genome equivalent per month. The cost of sequencing has steadily decreased, to the point where today it is essentially 1/10 cent per base pair or $1 per kilobase (roughly equivalent to

$5,000 for low throughput coverage of a microbial genome). In November, 2005, a subcommittee of BERAC reviewed the operations and science of the JGI and returned a very strongly positive assessment.

In February 2006, the JGI held its first User Meeting and over 200 scientists attended to present work derived from JGI sequencing efforts. The 2007 User Meeting is expecting over 400 attendees, so many that a new location had to be identified and reserved for the event.

NP- The operations of the 88-Inch Cyclotron are supported for an in-house Nuclear Physics program, and partially supported by the NRO and USAF. The Cyclotron provided more hours than they had planned, with high reliability for their local basic research program and for applied users. The NRO and USAF utilized approximately 40% of the beamtime; approximately three quarters of that time was for the so-called cocktail beams that enable efficient changes of beam species for their applications.

2.4 Utilization of Facility to Grow and Support Lab's Research Base and External User Community

BES- The ALS is effectively used by the research programs at LBNL. User mechanisms and appropriate efforts to take advantage of the Molecular Foundry appear to be well underway as the facility entered initial operations in FY 2006; initial operations review will not take place until FY 2007. Access balancing and outreach for NCEM are being attended to but need substantial work as documented by the FY 2006 operations review. The strong resident research community has been an asset, but also sometimes a constraint on broad access and optimal use.

BER- The number of JGI collaborations has steadily increased as they take on more sequencing projects for university and outside collaborators. Further, JGI has reached out to initiate the Laboratory Sequencing Program which, in one year, now has more than a dozen active projects underway.

The new ALS soft x-ray microscopy station has attracted widespread interest and there are several research projects already being carried out using it by investigators from outside the Laboratory.

NP- The 88-Inch Cyclotron is utilized for nuclear physics and chemistry research, to test and develop segmented germanium array technology and methods, and for the NRO and USAF applied programs where LBNL has provided special capabilities attuned to their needs. The facility is developing capabilities relevant to science for Stockpile Stewardship such as neutron beams, and instrumentation for particle-gamma-ray coincidence studies that are relevant to science for Stockpile Stewardship and possibly advance fuel cycles.

		ASCR	
		Weights	
	Objective	Goal	
	Score	Objective	Funding
Goal #2 Design, Fabrication, Construction and Operation of Facilities		40%	22.8%
Objectives			
2.1 Design of Facility	0	0%	
2.2 Construction of Facility/Fabrication of Components	0	0%	
2.3 Operation of Facility	4.2	90%	
2.4 Utilization of Facility to Grow and Support Lab's Research Base	4.2	10%	
Goal #2 Score (calculated)	**4.2**		

		BES	
		Weights	
	Objective	Goal	
	Score	Objective	Funding
Goal #2 Design, Fabrication, Construction and Operation of Facilities		50%	34.4%
Objectives			
2.1 Design of Facility	3.9	10%	
2.2 Construction of Facility/Fabrication of Components	3.6	30%	
2.3 Operation of Facility	3.9	45%	
2.4 Utilization of Facility to Grow and Support Lab's Research Base	3.3	15%	
Goal #2 Score (calculated)	**3.72**		

		BER	
		Weights	
	Objective	Goal	
	Score	Objective	Funding
Goal #2 Design, Fabrication, Construction and Operation of Facilities		50%	22.7%
Objectives			
2.1 Design of Facility	0	0%	
2.2 Construction of Facility/Fabrication of Components	0	0%	
2.3 Operation of Facility	4	90%	
2.4 Utilization of Facility to Grow and Support Lab's Research Base	4	10%	
Goal #2 Score (calculated)	**4**		

		HEP	
		Weights	
	Objective	Goal	
	Score	Objective	Funding
Goal #2 Design, Fabrication, Construction and Operation of Facilities		20%	14.1%
Objectives			
2.1 Design of Facility	3.4	80%	
2.2 Construction of Facility/Fabrication of Components	3.4	20%	
2.3 Operation of Facility	0	0%	
2.4 Utilization of Facility to Grow and Support Lab's Research Base	0	0%	
Goal #2 Score (calculated)	**3.4**		

		NP	
		Weights	
	Objective	Goal	
	Score	Objective	Funding
Goal #2 Design, Fabrication, Construction and Operation of Facilities		25%	6.0%
Objectives			
2.1 Design of Facility	0	0%	
2.2 Construction of Facility/Fabrication of Components	0	0%	
2.3 Operation of Facility	3.4	85%	
2.4 Utilization of Facility to Grow and Support Lab's Research Base	3.5	15%	
Goal #2 Score (calculated)	**3.42**		

Table 2.1 – 2.0 Program Office Performance Goal Score Development

Science Program Office	Letter Grade	Numerical Score	Funding Weight (BA)	Goal Weight	Overall Goal Weighted Score
Office of Advanced Scientific Research	A+	4.2	22.8%	40%	
Office of Basic Energy Sciences	A-	3.72	34.4%	50%	
Office of Biological and Environmental Research	A	4	22.7%	50%	
Office of High Energy Physics	B+	3.4	14.1%	20%	
Office of Nuclear Physics	B+	3.42	6.0%	25%	
				Overall Program Office Total	3.9

Table 2.2 – Overall Performance Goal Score Development

Total Score	**4.3-4.1**	**4.0-3.8**	**3.7-3.5**	**3.4-3.1**	**3.0-2.8**	**2.7-2.5**	**2.4-2.1**	**2.0-1.8**	**1.7-1.1**	**1.0-0.8**	**0.7-0**
Final Grade	A+	A	A-	B+	B	B-	C+	C	C-	D	F

Table 2.3 – 2.0 Goal Final Letter Grade

3.0 Provide Effective and Efficient Science and Technology Research Project/Program Management

The Contractor provides effective program vision and leadership; strategic planning and development of initiatives; recruits and retains a quality scientific workforce; and provides outstanding research processes, which improve research productivity.

The weight of this Goal is **24%**.

The Provide Effective and Efficient Science and Technology Research Project/Program Management Goal measured the Contractor's overall leadership in executing S&T programs. Dimensions of program management covered included: 1) providing key competencies to support research programs to include key staffing requirements; 2) providing quality research plans that take into account technical risks and identify actions to mitigate risks; and 3) maintaining effective communications with customers to include providing quality responses to customer needs.

LBNL achieved a score of 3.8 and a grade of A.
The research facilities at this laboratory are performing as worldwide leaders in their respective fields. LBNL has been a leader in formulating new directions. LBNL has been extremely responsive and proactive in terms of alignment to program goals and priorities. Scientific staff have made important contributions to the programs visions and pin terms of representation at national meetings. Communications and coordination have been excellent and the lab is responsive to program management and needs but there is always room for improvement

Objectives:

3.1 Provide Effective and Efficient Stewardship of Scientific Capabilities and Program Vision

ASCR- LBNL is a leader in HPC and computational science, making significant contributions to the vision, planning and coordination of these efforts and changing the thinking or direction of the community in areas such as visualization, advanced networking and simulations in materials, combustion and physics.

BES- The Materials Sciences and Engineering program is very responsive to the Department's mission in basic science and provides a strong underpinning to mission needs and applications in ceramics, electronic materials, and nanotechnology. LBNL has been a leader in formulating new applications and research in nanoscale materials with programs in areas such as buckeyballs, nanotubes, and photoconversion.

Research within the Chemical Sciences Division reviewed in FY2006 is effective in its use of the scientific capabilities of LBNL. Each project has a well defined scientific objective, most have world-class principal investigators, and synergism among principal investigators has improved in some areas. Successful recruiting of junior staff, particularly to the Ultrafast X-ray Science Laboratory, is a positive sign. Management supports a vision of excellence in science that is borne out through nationally and internationally known scientists.

The research facilities at this laboratory are performing as worldwide leaders in their respective fields.

BER- Important support for synchrotron capabilities and science, both of which are important to the program. The recent JGI review lauded LBNL's management of the inter-laboratory operation of JGI

FES- The Program Advisory Committees for the heavy ion beam program, consisting of 12 highly regarding accelerator and fusion experts, have conducted seven reviews on the quality of research in the program, on an average of twice a year. The PAC reports indicate that LBNL has quickly, appropriately, and effectively made a major re-direction of its research to meet new DOE objectives to

support high energy density physics and cross-cutting accelerator beam science, while preserving core-competencies necessary for future facilities such as the IB-HEDPX, which is on the DOE list for a start in 2015. The LBNL has made great improvements in the capabilities of its existing facilities and equipment exploiting innovative new experimental techniques such as neutralized drift compression. This high risk approach has paid off in spectacular advances in heavy ion beam science and application to high energy density physics.

HEP- The development of new detector technologies and advancing the state of the art in superconducting magnets has been a core competency of LBNL for years. In recent years this has resulted in major contributions to the Babar, CDF, and ATLAS silicon vertex detectors. The Microsystems Laboratory has been critical to these efforts and is now contributing to the development of CCD detectors for SNAP and the Dark Energy Survey. LBNL has also developed technology for cosmic microwave background (CMB) measurements and is developing highly integrated detectors to search for the polarization of the CMB.

NP- Scientific and technical staff continue excellent operation of 88-Inch Cyclotron and its infrastructure and are building on their strength in ion sources for accelerators. The staff continues a strong stewardship of heavy element chemistry, essentially the only such program in the U.S. The scientific staff is identifying and developing of capabilities that may be used for science related to Stockpile Stewardship and advanced fuel cycles. They continue to plan for new instrumentation capabilities such as GRETA. The 88-Inch Cyclotron research staff has developed a ten-year facility and science plan.

WDTS- CSE is a highly motivated well managed team that works continually to integrate science education and workforce development into the research mission of the lab. CSE has successfully advanced the education culture at the lab and has successfully collaborated with local and state school systems and builds on those links to extend the venture of science education.

EERE:
Geothermal- LBNL showed leadership and professionalism in the ongoing close-out activities by promptly providing to Headquarters (HQ) GTP cost data and other pertinent information required for an efficient close-out that preserves the fruits of past research. LBNL also participated frankly and succinctly in HQ close-out meetings dealing with changes to personnel and research activities. LBNL has shown visionary thinking in its proposal to extract heat from geothermal reservoirs by using carbon dioxide instead of water. This proposed use of carbon dioxide may also have the added benefit of sequestering carbon dioxide away from the atmosphere.

Industrial- LBNL has provided important assistance to the ITP Best Practice activity. They have been a major contributor to the delivery of near-term energy efficiency practices to the industrial sector, and have provided critical support to the Secretary's initiative on the *Save Energy Now* campaign. This campaign is helping industry to identify achievable energy savings in their plants. LBNL has demonstrated highly effective planning and management of projects. This includes excellent transfer of results to private companies. Budget management has been exceptional. Below is a list of LBNL achievements in supporting the DOE ITP Best Practices program goal to reach and influence 50,000 plants to save more than 2.5 percent energy for each:

- $ Developed Energy Savings Assessment Management System that allows tracking of results of *Save Energy Now* energy savings assessments.
- $ Refined the Best Practices Tracking System database to more accurately measure impact of the manufacturing plant's use of DOE Best Practices tools and resources.
- $ Updated the Large Energy Users database that is a database of the largest 4,000 manufacturing plants in the United States.
- $ Prepared quarterly reports tracking the new manufacturing plants impacted by ITP/EERE resources. This information is integral to the ITP and the Best Practices program to report on one of its JOULE targets.

RW- LBNL contributes and participates in the OCRWM S&T program in two ways. First, LBNL scientists are Pis for multiple S&T projects. Second, the director of LBNL's Earth Sciences Division serves as the Head of the Natural Barriers Thrust Area in the S&T Program. For its role as the Natural Barriers Thrust Lead, LBNL collaborated with the other Thrust Area (Source Term and Material Management) Leads to develop outstanding core competencies as well as scientific excellence in exploratory, high-risk research that is expected to result in greatly improved repository performance, which is vital to the S&T program mission. Similarly, the emphasis of the Thrust Area portfolio on advanced understanding of the natural system (with the view to reduce uncertainty in the prediction of the repository performance), and the success in attracting excellent scientists from universities, indicates effective and efficient stewardship of scientific capabilities as well as program vision.

3.2 Provide Effective and Efficient Science and Technology Project/Program Planning and Management

ASCR- Planning for the upgrades to NERSC and Esnet have been excellent and LBNL has demonstrated significant strength in this area.

BES- In FY 2006, in order to address the need for greater program coherence, LBNL was directed to develop a management plan for all activities supported by the Materials Sciences and Engineering Division. The laboratory will need to show how the various subtasks of the project interact, and how the overall program is managed. The LBNL program has been successful in attracting funds from other sources; however, there is a noted tendency to steer BES-funded research in directions that are more appropriate to other agencies, e.g., NIH. The laboratory should be more cognizant of clearly delineating research that has no bearing on the basic research or mission needs of the DOE.
The laboratory is encouraged to become more fully engaged in BES scientific workshops, especially those that address the fundamental energy challenges of the future.

Despite improvements in synergism in some areas, projects within the Chemical Sciences Division still tend to be stand-alone and principal investigator-driven. The Division lacks an overarching strategic plan that delineates its role within a broader vision for LBNL.

The program management and planning at the scientific users facilities is a model to follow by other laboratories.

BER- Science conducted is consistent with both the LBNL overall mission and the specific workplans for each project. Programs are effective and well managed, reflecting an effective laboratory management program. However, there is no evidence of program planning at LBNL to establish a core capability in any area of BER's climate change research program.

FES- LBNL has advanced the state of the art in beam driven high energy density physics by making hard decisions in a timely manner to focus the VNL resources onto the new DOE goals for high energy density physics. LBNL management voluntarily closed down a test stand at one of its labs when necessary to optimize remaining resources.

HEP- The superconducting magnet group has managed to preserve a lean but well integrated group that has expertise on all aspects of superconducting magnet development from conductor development to magnet fabrication and through testing.

NP- The LBNL low energy group is planning to maintain and build on present successes in neutrino physics, heavy element physics and chemistry, and for nuclear structure and astrophysics. They have plans that enable them to continue to be responsive to the NRO and USAF with the new capabilities they need throughout the period covered by the MOA. The low energy group is proactive in pursuing science relevant to applied areas.

EERE:

Buildings- Coordination of commercial buildings controls work with other efforts funded separately makes management far more difficult. LBNL's success in managing the work and the vision necessary to undertake this work is of the highest standard.

Building Technologies Program management changed the reporting requirements for the National Laboratories to a quarterly basis, and the windows Technology Development Manager (TDM) still requested a brief monthly report. While these reports are being prepared in accordance with the TDM guidelines, they could be improving timeliness.

Project management of appliance standards is improving after several discussions with DOE management. Overall, LBNL is starting to move in the right direction but it will take time to quantify the magnitude of this change in direction and to confirm these improvements as being permanent.

Four out of five deliverable reports on the Integrated Building Energy Control System and the High Dynamic Range Image-Based Controls tasks are late in FY 2006, as of August. The quarterly reporting of progress and spending is simply not working. Events occur and are reported well after the fact. This leaves the TDM with little control and limited current knowledge to take action.

FreedomCAR- Investigators at LBNL manage a major FCVT program that concentrates on exploratory research into advanced materials for electrochemical energy storage. As part of this program, LBNL oversees and/or directs the research of 23 principal investigators at LBNL, two other national labs, plus eight academic and one commercial institution. Each year DOE holds a full merit review meeting, at which outside experts from the auto industry, universities, and commercial enterprises review and score the projects that LBNL manages. Each year, the LBNL management has been exemplary in implementing the changes identified by DOE management through this process. Finally, the managers at LBNL have consistently sought out the most qualified principal investigators for specific research tasks regardless of where they are employed.

RW- LBNL, as the Natural Barriers Thrust Lead, developed a Thrust portfolio that is (1) aligned with the S&T vision of advanced science, and (2) targets research in those areas that have the highest potential pay-off in repository performance. LBNL worked closely with the DOE management of both the S&T and the mainline repository development programs. In spite of budget reduction in FY 2006, the productivity of the projects in the Natural Barriers Thrust was excellent through realignment of project priorities by the Thrust Lead, and the morale of the Pis remained high. The thrust received an excellent review from the peer review panel in February 2006.

3.3 Provide Efficient and Effective Communications and Responsiveness to Customer Needs

ASCR- Communications and coordination have been excellent and the lab is responsive to program concerns and needs but there is always room for improvement in communications especially given the given the significant investments and challenges in upgrading the facilities at LBNL.

BES- Communications with BES materials program management has improved; however, the laboratory often does not respond to requests for information in a timely manner. The laboratory also should continue to improve on conveying pertinent research results, and be fully communicative on changes in research directions and personnel by consulting with and obtaining prior approval from. Communications with BES management in the Chemical Sciences and Geosciences Divisions is appropriate. The responsiveness of the laboratory to BES scientific users facilities management is prompt and effective.

BER- Overall, BER finds management to be extremely responsive and proactive in terms of alignment to program goals and priorities. Environmental science staff have made important contributions to the program in terms of representation at national meetings and the organization of communications within the program. Susan Hubbard is effective and proactive in representing the environmental science program to BER and vice versa.

FES- LBNL has provided requested information from the DOE program office when asked, usually within a few days turnaround time, sometimes within less than 24 hours when required. LBNL management initiates phone calls to the DOE program manager whenever there is a pending or emerging issue to seek guidance, or to avoid surprises. These communications between LBNL and the DOE have been very effective.

HEP- Management of the research program has been effective in a difficult budget environment. Priority has been given to those efforts that match national priorities and utilize LBNL's strengths. Communications with headquarters have been useful and productive.

NP- LBNL management provides a strong laboratory manager's briefing. The group has provided the most recent Laboratory internal review report of their program and documentation of their self evaluation in lieu of a regular Office of Nuclear Physics program review. LBNL expresses strong interest in an S&T-like review of their program on a yearly basis.

EERE:
Geothermal- LBNL has worked closely and productively with the Lawrence Livermore National Laboratory on the Remote Sensing of Localized Strain project and cooperates effectively with members of geothermal industry to acquire field data for research activities.

RW- LBNL as the Natural Barriers Thrust Lead was always responsive to customer requests for information. The responses were thorough and correct and provided in a timely manner. The communication channels between the Natural Barriers Thrust Lead and S&T DOE management was excellent. The LBNL thrust lead initiated a communication with the S&T DOE management on emerging issues. For example, when preliminary results from field measurement indicated the possibility of localized fast paths in the saturated zone, the customer was promptly informed, and plans for a path forward were developed based on thorough discussions between the LBNL Pis, the LBNL Natural Barriers Thrust Lead, and the customers, and resources were made available to address this important issue.

		ASCR	
		Weights	
	Objective	Goal	
	Score	Objective	Funding
Goal #3 Program Management		20%	20.9%
Objectives			
3.1 Stewardship of Scientific Capabilities and Programmatic Vision	4.2	35%	
3.2 Program Planning and Management	4.2	35%	
3.3 Program Management- Communication & Responsiveness (to HQ)	4	30%	
Goal #3 Score (calculated)	**4.14**		

		BES	
		Weights	
	Objective	Goal	
	Score	Objective	Funding
Goal #3 Program Management		20%	31.5%
Objectives			
3.1 Stewardship of Scientific Capabilities and Programmatic Vision	3.8	40%	
3.2 Program Planning and Management	3.6	30%	
3.3 Program Management-Communication & Responsiveness (to HQ)	3.5	30%	
Goal #3 Score (calculated)	**3.65**		

		BER	
		Weights	
	Objective	Goal	
	Score	Objective	Funding
Goal #3 Program Management		25%	20.7%
Objectives			
3.1 Stewardship of Scientific Capabilities and Programmatic Vision	4	20%	
3.2 Program Planning and Management	4	30%	
3.3 Program Management-Communication & Responsiveness (to HQ)	4	50%	
Goal #3 Score (calculated)	**4**		

		FES	
		Weights	
	Objective	Goal	
	Score	Objective	Funding
Goal #3 Program Management		30.0%	1.5%
Objectives			
3.1 Stewardship of Scientific Capabilities and Programmatic Vision	3.7	35%	
3.2 Program Planning and Management	3.5	35%	
3.3 Program Management-Communication & Responsiveness (to HQ)	3.6	30%	
Goal #3 Score (calculated)	**3.6**		

		HEP	
		Weights	
	Objective	Goal	
	Score	Objective	Funding
Goal #3 Program Management		35%	13.0%
Objectives			
3.1 Stewardship of Scientific Capabilities and Programmatic Vision	3.6	40%	
3.2 Program Planning and Management	3.3	40%	
3.3 Program Management-Communication & Responsiveness (to HQ)	3.4	20%	
Goal #3 Score (calculated)	**3.44**		
		NP	
		Weights	
	Objective	Goal	
	Score	Objective	Funding
Goal #3 Program Management		30%	5.5%
Objectives			
3.1 Stewardship of Scientific Capabilities and Programmatic Vision	3.6	40%	
3.2 Program Planning and Management	3.5	40%	
3.3 Program Management-Communication & Responsiveness (to HQ)	3.3	20%	
Goal #3 Score (calculated)	**3.5**		
		WDTS	
		Weights	
	Objective	Goal	
	Score	Objective	Funding
Goal #3 Program Management		35%	0.2%
Objectives			
3.1 Stewardship of Scientific Capabilities and Programmatic Vision	3.8	20%	
3.2 Program Planning and Management	4.1	40%	
3.3 Program Management-Communication & Responsiveness (to HQ)	4	40%	
Goal #3 Score (calculated)	**4**		

Table 3.1 – 3.0 SC Program Office Performance Goal Score Development

Science Program Office	Letter Grade	Numerical Score	Funding Weight (BA)	Goal Weight	Overall Goal Weighted Score
Office of Advanced Scientific Research	A+	4.14	20.9%	20%	
Office of Basic Energy Sciences	A-	3.65	31.5%	20%	
Office of Biological and Environmental Research	A	4	20.7%	25%	
Office of Fusion Energy Sciences	A	3.6	1.5%	30%	
Office of High Energy Physics	B+	3.44	13.0%	35%	
Office of Nuclear Physics	A-	3.5	5.5%	30%	
Office of Workforce Development for Teachers and Scientists	A	4	0.2%	35%	
				Performance Goal 3.0 Total	3.77

Table 3.2 – SC Program Office Overall Performance Goal Score Development

HQ Program Office	Letter Grade	Numerical Score	Weight	Weighted Score	Overall Score
Assistant Secretary for Energy Efficiency and Renewable Energy (EERE)					
				Overall EERE Goal 3Total	3.6
Office of Civilian Radioactive Waste Management (RW)					
				Overall RW Total	3.89

Table 3.3 – 3.0 Other Program Office & Customer Performance Goal Score Development

HQ Program Office	Letter Grade	Numerical Score	Funding Weight (BA)	Weighted Score	Overall Weighted Score
Office of Science	A	3.77	93.33%	3.52	
Office of Energy Efficiency and Renewable Energy	A-	3.6	4.71%	0.17	
Office of Civilian Radioactive Waste Management (RW)	A	3.89	1.96%	0.08	
				Performance Goal 3.0 Total	3.8

Table 3.4 – Overall Performance Goal Score Development

Total Score	4.3-4.1	4.0-3.8	3.7-3.5	3.4-3.1	3.0-2.8	2.7-2.5	2.4-2.1	2.0-1.8	1.7-1.1	1.0-0.8	0.7-0
Final Grade	A+	A	A-	B+	B	B-	C+	C	C-	D	F

Table 3.5 – 3.0 Goal Final Letter Grade

EERE- Guidance for the Next Performance Period

Performance Expectations for the National Laboratory for the Next Performance Period (for example, anticipated accomplishments and level of work, areas of concentration, and remedial actions).

Building Technologies Program- LBNL needs to complete the stage gating activities for the reflective hydride windows research project and then DOE will determine if this project has the true potential to achieve the second-generation electrochromic performance that is needed to offer dramatic cost reductions.

LBNL should continue to pursue possible partnerships with private industry for the commercialization of highly insulated windows.

LBNL should continue to find ways to further leverage the technology support work through private industry investments in windows research.

With the air duct ventilation Delta-Q work and the air cleaning work winding down, there will be a need to articulate a good plan for future residential and commercial ventilation R&D to compete successfully for limited research dollars.

LBNL should continue to develop projects and statements of work in the context of Stage Gate requirements and evaluations.

FreedomCAR- It is anticipated that investigators will follow recommended DOE guidance and continue to make excellent progress.

Geothermal- At the time of this evaluation, the President's FY 2007 request for the GTP was zero dollars. The House mark is $5 million, and the Senate mark is $22.5 million. Due to the large uncertainty in future funding for the GTP, HQ GTP expects that LBNL will close out geothermal activities in a timely manner and provide final reports to HQ and to Oak Ridge's Office of Science and Technical Information for addition to the geothermal database. If the GTP receives significant funding in FY 2007, selected geothermal research activities may continue at LBNL.

Industrial- Continued contributions to the public/private partnerships are the central feature of the ITP Technology Delivery subprogram. Continue contribution to the documentation of actions relevant to the DOE and EERE missions and to improving industry energy efficiency and productivity.

Input on Concerns for Laboratory Management (discussion of potential problem areas):

Building- LBNL needs to do a better job preparing items for reporting to DOE's management. While the TDM notes that it is difficult to find items from a very technical based research program that are of interest to a general DOE audience, throughout the course of these projects there should be ample opportunity for such reporting.

4.0 Provide Sound and Competent Leadership and Stewardship of the Laboratory

The Contractor's Leadership provides effective and efficient direction in strategic planning to meet the mission and vision of the overall Laboratory; is accountable and responsive to specific issues and needs when required; and corporate office leadership provides appropriate levels of resources and support for the overall success of the Laboratory.

The weight of this Goal is 25%.

The Provide Sound and Competent Leadership and Stewardship of the Laboratory Goal measured the Contractor's Leadership capabilities in leading the direction of the overall Laboratory. It also measured the responsiveness of the Contractor to issues and opportunities for continuous improvement and corporate office involvement/commitment to the overall success of the Laboratory.

For Goal 4.0, Lawrence Berkeley National Laboratory (LBNL) achieved a numerical score of 3.9, the equivalent of an A. Goal 4.0 has 3 objectives with a total of 13 measures.

LBNL, managed and operated by the University of California (UC), is a unique, well-managed, and world-leading multi-program research institution, with extensive external partnerships and a compelling vision and strategic plan for transformational science to advance the Department of Energy's (DOE's) missions. UC and LBNL leadership efforts in FY 2006 are helping to make a great institution even greater. The interdisciplinary *HELIOS* initiative (solar to chemical energy) is broadly leveraging the Laboratory's expertise and facilities, and promises to provide vital solutions to the critical national and international problem of a clean and abundant energy supply. LBNL Director Steven Chu played a leading role in the National Academy of Sciences Committee that prepared the report "Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future," which became the basis for the American Competitiveness Initiative (ACI) announced by the President in the 2006 State of the Union address. He also co-chairs a study by the InterAcademy Council (the world's science academies) on how to achieve a global transition to a sustainable, affordable, and clean energy supply. As a true *national* laboratory, LBNL has been successful in performing a wide variety of mission-related Work for Others, which comprises about a quarter of it's ~$525M in annual funding.

LBNL has been managed effectively internally and externally, and in an accountable and responsive manner. Of the 26 management initiatives in the UC proposal for LBNL, the set of FY 2006 Laboratory Leadership measures and targets captures all those that are relevant to this Goal (about half of the total). In 2006 LBNL implemented a first-ever comprehensive workplace climate survey aimed at identifying improvement opportunities for the institution and its workforce. It maintains a positive, proactive relationship with its local community, and conducts a science education outreach program that is a model among DOE laboratories. LBNL celebrated its 75th Anniversary in 2006 with a series of events and communications that brought much recognition to its path-breaking history, its current work, and its future direction.

To help ensure institutional stewardship and operational assurance under the new LBNL Contract 31, several new groups were formed within UC and LBNL. These include: 1) the UC Laboratory Advisory Board, a high-level mostly external group advising on LBNL's science and operations; 2) a UC Contract Assurance Council (CAC), a high-level mostly internal group providing contract and operational oversight and assistance to the Laboratory; and 3) the LBNL Office of Institutional Assurance, comprised of the Office of Contract Assurance and the Project Management Office. Together, these entities provide mechanisms for formal contractor involvement with and commitment to the overall success of the Laboratory, and also for the central identification, pursuit and tracking of opportunities for continuous improvement.

Safety was a top Laboratory leadership priority in FY 2006. Priority management attention, increased ES&H resources, and many new internal safety initiatives helped LBNL to exceed its DOE targets for

worker injuries rates for the year. Two external reviews, including a bottoms-up Integrated Safety Management (ISM) review at year-end, noted a strong safety culture and program at LBNL, but recommended a number of areas for strengthening and improvement which the Laboratory is implementing. Another focus of strategic operational improvement is realizing efficiency gains (cost savings) through initiatives in many areas of Laboratory operations, including: Information Technology (IT) management (workstation standardization and centralization, employee remote-access, email, expanded scientific clusters), facilities management, supply-chain re-engineering, web-based Budget and Forecasting System, and others.

LBNL connections and partnerships with the UC Berkeley campus are perhaps the strongest ever, with both institutions realizing the unique synergies to benefit from each other. The number of UC-LBNL joint faculty-research staff appointments increased from ~260 to 274 during FY 2006, with gains in about half of LBNL's scientific divisions. UC is also helping LBNL to build its physical plant. UC and LBNL leadership progressed in planning for the construction of three alternative finance buildings using UC's debt capacity and ability to secure low-interest rate bonds. The first of these, a ~$10M User Guest House, is scheduled to begin construction in the summer of 2007. The other two facilities, for Computational Research and the *HELIOS* initiative, are still having their business plans and financing mechanisms developed, and are expected to be submitted to the UC Regents for approval in mid-FY2007.

4.1 Provide a Distinctive Vision for the Laboratory and an Effective Plan for Accomplishment of the Vision to Include Strong Partnerships Required to Carry Out those Plans

For Objective 4.1, UC-LBNL achieved a numerical score of 3.9, the equivalent of an A. Objective 4.1 has 5 measures, each with associated target(s).

LBNL is a world-leading scientific institution performing a distinctive and diverse mission of research and development within the DOE laboratory system. The DOE Office of Science (SC) developed a final 2006 Business Plan for LBNL based on timely, quality inputs from the Laboratory, including a draft Business Plan and associated presentation by Director Chu to the SC Director and Program Associate Directors. LBNL's unique mission is: "to deliver science-based solutions to the Nation's energy, environmental, and science needs. LBNL is noted as a world center for particle accelerator and detector innovation and design, provider of high-performance computing tools for scientific applications, and a national leader in microscopy and the characterization and fabrication of nanostructured materials, and for its ability to exploit computation, bioinformatics, cutting-edge imaging technologies and structural cell biology to understand the complexity of biological systems." LBNL's mission statement has the most multi-disciplinary breadth and uniqueness among the SC laboratories.

The Laboratory's Business Plan was built on seven core competencies applied toward seven business lines in DOE-SC's Business Plan for the Laboratory: 1) Science for a Secure and Globally Sustainable Energy Future, 2) Leading Facilities in VUV, Soft-X-ray and Ultrafast Science, 3) Novel Materials and Nanodevices, 4) Engineering Living Systems for Energy and Environmental Solutions, 5) Understanding, Detecting and Preventing Energy and Environmental Causes of Disease, 6) Matter and Energy in the Universe, and 7) Advanced Scientific Computing for DOE Research Programs. Of particular note is that five of the six major activity initiatives in the Business Plan are considered to offer *transformational* potential benefits: 1) Advanced Light Source Upgrades, 2) Solar to Chemical Energy (*HELIOS)*, 3) Joint Dark Energy Mission, 4) Optical Accelerators for the Energy Frontier, and 5) Molecular Foundry User Facility Operations. The sixth major activity initiative, upgrade of the National Energy Research Computing Center (NERSC), is expected to offer *substantial* benefits to its over 2000 users across all of SC's programs and many other DOE programs.

Interdisciplinary Institutional Initiative

LBNL's *HELIOS* initiative to examine different physical and biological pathways to convert *solar energy into chemical fuels* pursues *transformational* basic research to provide solutions for a critical national and international problem – developing a clean, abundant, and affordable supply of carbon-neutral energy, particularly for transportation. By applying state-of-the-art knowledge and tools now becoming available at the junction of materials science, biology and chemistry, the *HELIOS* initiative leverages LBNL's unique capabilities and facilities in a very interdisciplinary way, further building on a hallmark characteristic of the institution, and exceeding expectations.

National & International Leadership

LBNL Director Steven Chu provided national and international leadership through his participation in two groups reviewing and providing recommendations on science and technology planning. He was the sole DOE national laboratory director on the National Academy of Sciences' Committee on Prospering in the Global Economy of the 21st Century. The Committee's report, "Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future" became the basis for the American Competitiveness Initiative (ACI) announced by the President in the 2006 State of the Union address. This significantly exceeds expectations, because among other things, the ACI would double federal investment in basic research in the physical sciences, including the DOE Office of Science (SC), over the decade of FY2007-2016. Dr. Chu also co-leads a study by the InterAcademy Council (the world's science academies) on how to achieve a global transition to a sustainable, affordable, and clean energy supply. He has promoted this internationally as the top science and technology challenge of the 21st century. Director Chu appointed two prominent researchers to lead LBNL user facilities: Carolyn Bertozzi is the founding Director of the Molecular Foundry, and Roger Falcone is the new director of the Advanced Light Source (ALS).

Partnership & Collaborations

LBNL expanded its already extensive partnerships and collaborations during the year in many areas. The Molecular Foundry commenced operation in 2006 as the Laboratory's newest national user facility, and it is already supporting a wide variety of collaborative and user projects. The Foundry is also establishing strategic partnerships with other laboratories and companies, e.g., with Intel on next generation lithography materials, and with Lawrence Livermore National Laboratory (LLNL) on hollow nanocrystals for inertial fusion targets to be used at the National Ignition Facility. The collaboration on the Supernova Acceleration Probe (SNAP) project continues to grow and progress, with Research and Development (R&D) contributions from the Stanford Linear Accelerator Center (SLAC) and Fermilab now added to the partnerships with several dozen institutions (laboratories, industry, universities) in the United States and abroad. The DOE Joint Genome Institute (JGI) expanded connections with the bioscience programs at other DOE laboratories by introducing the new Laboratory Sequencing Program (LSP), in which 15-20% of its DNA sequencing capacity (~35 billion base-pair per month) is available for DOE mission-related, merit-reviewed proposals from the laboratories. In the areas of high energy density physics and ultrafast science, LBNL has expanded in collaboration with SLAC on the Linac Coherent Light Source (LCLS) project, and developed a proposal of an Institute for Material Dynamics at Extreme Conditions, as a mechanism for building collaboration and harness capabilities within the UC system. LBNL remains deeply involved in the California Institute for Quantitative Biomedical Research (QB3), set to open in the new Stanley Hall on the UC Berkeley campus in 2007. LBNL is leading an international, multi-disciplinary scientific consortium for a Deep Underground Science and Engineering Laboratory (DUSEL) at the Homestake Mine in South Dakota, one of the final two competing U.S. sites that are expected to be decided by the National Science Foundation (NSF) in 2007. LBNL is also the primary DOE national laboratory collaborating and providing instrumentation for the NSF's ICE^3 astrophysical neutrino telescope project being constructed at the south pole. Two of the four R&D 100 Awards that LBNL won in 2006 involved external collaborations: the *Ocean Carbon Explorer* was developed with the Scripps Institution of Oceanography, and the *Laser Ultrasonic Sensor* was jointly developed with the Georgia Tech Institute of Paper Science and Technology. These wide-ranging activities demonstrate growth and progress in the development of quality partnerships and collaborations that exceed expectations.

Work For Others (WFO)

In FY2006, LBNL demonstrated progress in its institutional WFO planning and information reporting. The LBNL Office of Planning and Development and the Office Chief Financial Officer (Sponsored Projects Office and Budget Office) together produced a FY 2007- 2008 WFO Report and Plan that described the scope and role of the program at the Laboratory, identified major sponsors and projects, and projected program funding and costs. Information in the document assisted the BSO in securing HQ-SC approval for a prospective WFO funding level of $138.3M in FY 2007. The Laboratory also provided the BSO with the ability to review and approve WFO proposals electronically in its proposal database system. LBNL is preparing to implement new mandates requiring the on-line submission of federal grant applications through "Grants.gov" beginning in early 2007, and has begun internal training and changes to business processes. Overall, LBNL met expectations in this area, with the above notable improvements.

Workforce Diversity and Working Environment Quality

All LBNL Divisions have Diversity Plans that are posted on the Laboratory's homepage. The Laboratory's Best Practices Diversity Council reviewed Division Diversity Programs over the past four years, and developed a set of best practice recommendations for lab-wide initiatives in the areas of Strategic Recruitment, Mentoring/Pipeline development, and employee Training/Awareness. LBNL implemented a comprehensive workplace climate survey for the first time in June 2006. It generated over 1700 responses, a remarkable 45 percent return rate. The results have been analyzed, recommendations for improvement are being prepared, and Laboratory management decisions and follow-up actions are expected in FY 2007. Laboratory leadership has also undertaken initiatives aimed at improving the quality of the working environment for employees, including pursuing new facilities/increased onsite space, planning for modernizing and seismically upgrading facilities, re-focusing operations units on client and mission support, enhanced site safety signage and walkway designations, and boosting institutional pride through internal communications on the Laboratory's rich history, the contributions of its current work, and highlighting a cross-section of employees who help the Laboratory to operate effectively. Overall, LBNL met expectations in this area, with the above notable improvements.

Community Relations and Science Education Outreach

A broad, year-long set of outreach efforts were made in 2006 to commemorate LBNL's 75th Anniversary, and target audiences included laboratory employees, the local community and Bay Area region, and national stakeholders in DOE and Congress. The Laboratory's "Friends of Science" program sponsored a series of nine community lectures. Laboratory scientists and managers spoke at over sixty events throughout the community. The Summer Lecture series, held during lunchtimes when many students are working at the Laboratory, featured LBNL veterans in a series of talks that linked the historical roots of LBNL research to ongoing, current programs. The Community Relations Department provided three-dozen tours during the year, including to the 50-member Board of Directors of the East Bay Economic Development Alliance. LBNL's bi-weekly newspaper, "The VIEW," featured a series of historical issues highlighting different periods in the Laboratory's history. Over a thousand people attended LBNL's "Founders Day" in August 2006, which included speeches by local officials and tributes from members of Congress. An all-day Science Symposium was planned for the fall, culminating in a gala dinner with community and government leaders invited and Secretary Bodman as the keynote speaker. LBNL worked closely and effectively with City of Berkeley officials in landmarking the Bevatron site (where four Nobel prizes were achieved), but not the building itself; thereby enabling the planned demolition project to proceed. LBNL enjoys good media relations. It follows SC's policy on submitting draft press releases to DOE for pre-approval and including attribution to work sponsors, but erred in not doing one time (for the Shaw award). LBNL's Center for Science and Engineering Education (CSEE) is a model among science education outreach programs at the national laboratories. It leverages modest DOE funding with grants from NSF, National Institute of Health (NIH), and private donations to provide a broad-range of programs for students from the elementary school level up through university undergraduates. It also provides

training and mentored research experiences for middle and high school science teachers. In 2006, CSEE initiated a comprehensive tracking and assessment program for students in its programs going back to 2000, with the objectives of assessing impacts on their majors, career choices, graduate school attendance rates, and connecting them to applicant pools for future employment at the Laboratory. Overall, LBNL's proactive and constructive community relations and exemplary science education outreach programs notably exceed expectations.

4.2 Provide for Responsive and Accountable Leadership throughout the Organization

For Objective 4.1, UC-LBNL achieved a numerical score of 3.8, the equivalent of an A. Objective 4.2 has 5 measures, each with associated target(s).

UC LBNL Contract Assurance Council

The UC Contract Assurance Council (CAC) was established and staffed in June 2005 at the start of the new LBNL Contract 31. It includes senior officials both within and outside of the University of California Office of the President. The CAC meets monthly, with agenda items covering the full-range of assurance and laboratory operations support topics including: safety performance, project management performance, infrastructure, cyber-security, IT reporting, procurement and property management, the Federal Managers Financial Integrity Act (FMFIA) assurance report, emergency planning and management, corrective actions and Contract 31 risk registry tracking, and preparation for external reviews.

Other UC Support to LBNL

The UC Office of the President (UCOP) continues to provide the Laboratory with advice and support on financial management controls, human resources management and labor relations, facilities and environmental planning, and project management. During 2006, UC provided personnel support to LBNL, including the new EH&S Division Director, and a senior project manager from LLNL to support the B.51/Bevatron Demolition and Disposal project. The Bevatron project team developed an alternative demolition plan that resulted in a $15M reduction in the estimated total project cost. A senior UC procurement specialist was also detailed to LBNL to deliver on a commitment to DOE to update the department's internal operating procedures. UC officials and functional managers were involved in the quarterly PEMP meetings with BSO and LBNL in which the status of contract performance measures was reviewed and tracked in the risk registry. Overall, UC and LBNL notably exceeded expectations in this area.

LBNL Institutional Assurance Office

LBNL's Office of Institutional Assurance (OIA) was established and staffed in June 2005 at the start of the new LBNL Contract 31. It includes the Office of Contract Assurance (OCA) and the Project Management Office (PMO). During FY 2006, OIA was involved in a broad range of assurance functions, including implementation of a consolidated, laboratory-wide Corrective Action Tracking System (CATS), instituting a Contract 31 deliverables tracking system and Risk Registry, and assistance in preparing for external technical and operational reviews, e.g., DOE-SC (Lehman) reviews of construction projects, major acquisitions, and program plans, and the McCallum-Turner bottoms-up Integrated Safety Management (ISM) review in September 2006. OCA coordinated quarterly reviews of the Contract 31 Performance Evaluation Management Plan (PEMP) Management & Operations (M&O) measures by LBNL, UC, and BSO functional leads and senior managers. OIA achieved external certification of LBNL's Earned Value Management System (EVMS) in 2006 based on its highly successful use for the Molecular Foundry construction project. Building on the Environment, Safety and Health (ES&H) lessons-learned program, OIA initiated the process of instituting a laboratory-wide lessons-learned program across all areas of operations. OIA initiated a Property Management Improvement Project to strategically improve this entire function, including its integration with the Laboratory's financial systems. On a quarterly basis, the OIA and OCA directors

briefed the BSO Site Manager on assurance activities, progress, and plans. Overall, LBNL notably exceeded expectations in this area.

Standards Tailoring/Replacement Process

LBNL, UC, and BSO developed a Standards/Tailoring Replacement Process to replace DOE contract directives with applicable national, international, or industry consensus standards, with the intent of improving the Laboratory's operational efficiency and effectiveness. A procedure for modifying the DOE directives in Contract 31, Appendix I was also developed. To date, two orders have been identified for possible tailoring and replacement, with draft plans of action submitted to BSO: DOE O142.3 (Unclassified Foreign Visits and Assignments) and DOE O243.1 (Records Management). Overall, the Laboratory met expectations for the FY2006 measure and target in this area, but with no significant change in performance.

Safety Leadership

LBNL leadership, from the Laboratory Director on down, placed a major emphasis on safety and instituted a proactive safety awareness program with many new initiatives that helped the Laboratory to exceed its FY 2006 Total Recordable Cases (TRC)/Days Away, Restricted, or Transferred (DART) targets. Safety is a standing topic in senior management meetings, including those with the BSO Site Manager. The Director, Chief Operating Officer, and new EH&S Division Director have been conducting laboratory walk-throughs across the entire institution. In early 2006, Director Chu directed all Division Directors to conduct safety walk-throughs of their facilities, and to make worker safety a top priority within their organizations. All safety incidents receive senior management attention and follow-up. Essentially all employees with supervisory responsibility (520) received ES&H Training for Supervisors. A new training course was developed on "Conducting Effective Safety Walk-Arounds." Safety events and brown-bag lunches, banners, handouts, Director's memos to all-hands, and 45 bulletins/articles in the "Today at Berkeley Lab" web-newsletter have been used to raise awareness and share lessons-learned. Increased incentive awards have been given for safety-related accomplishments and improvement suggestions. In FY 2006, LBNL's leadership augmented the EH&S operating budget by ~$1.2M which enabled the retention and hiring of new personnel, including a Laser Safety Officer, Electrical Safety Officer, a Construction Safety Manager, and backfilling an industrial hygiene position, and the retention of other ES&H services. Additionally, a variety of new ES&H related projects were implemented around the site using General Plant Project/Equipment (GPP, GPE) and indirect funding. Finally, LBNL had two external institutional safety reviews in FY2006: a Safety Peer Review was conducted in January, 2006 and a McCallum-Turner led Integrated Safety Management System (ISMS) review was conducted in August and September 2006. Both noted LBNL's strong commitment to safety and provided recommendations for improvements. The Corrective Action Plan (CAP) from the first review, with actions already underway, is being integrated into the ISM CAP for the second review and will be implemented in FY 2007. Overall, LBNL's strong leadership notably exceeded expectations in this area.

Management Efficiency Initiatives

UC and LBNL have followed-up on the three efficiency initiatives in the Contract 31 proposal and are pursuing several additional ones. The proposed Supply-chain Re-engineering, Workstation Standardization and Centralization (WS&C) initiative, and the Integrated Facilities Condition Management System (IFCMS) were all being implemented in FY 2006, and the progress was briefed quarterly to the BSO. A new desktop electronic supply ordering system, eBuy, was developed, tested, and deployed laboratory-wide. The WS&C initiative completed its major milestones for 2006: Total Cost of Ownership was baselined, a method of automating property tracking was developed with a self-audit function demonstrated, and the standard desktop software including remote assistance was selected. These initiatives are both expected to yield cost savings that should be quantified in 2007. The new IFCMS is enabling LBNL to better manage the maintenance of its aging plant by integrating information on facility conditions, including deferred maintenance and future maintenance requirements, with the Laboratory's work-ordering and financial systems, and including local site

factor costs. Additional operational efficiency initiatives completed or in the process of being implemented include: a dramatic reduction in the cost of remote high-speed access services for employees; a new Email strategy expected to reduces costs by as much as half; a new Facilities Strategic Plan with a changed business model is expected to save ~$3M/year in FY2007 and beyond; a web-based Budget and Forecasting System; and further leveraging economies of scale in a growing Laboratory's computational Scientific Cluster Support Program. LBNL has successfully integrated its business and financial systems with evolving DOE systems, including ePMA (Field Work Proposal submission and review), STARS (financial accounting and reporting), and I-MANAGE (integrated business enterprise applications). The Laboratory is to be commended for an exceptional outcome from a July 2006 DOE Cybersecurity review, which described LBNL as having "set the bar" for the Office of Science. Overall, LBNL significantly exceeded expectations in this area because of the additional efficiency/cost savings initiatives it is pursuing throughout its operations units beyond the three in the FY2006 measure and target.

4.3 Provide Efficient and Effective Corporate Office Support as Appropriate

For Objective 4.3, UC-LBNL achieved a numerical score of 3.9, the equivalent of an A. Objective 4.3 has 3 measures, each with associated target(s).

UC LBNL Advisory Board

UC appointed a distinguished LBNL Advisory Board, co-chaired by Norm Augustine (Lockheed-Martin, retired) and Bruce Darling (University of California Office of the President (UCOP), acting), and comprised of a group of 11 accomplished members from universities, industry, and government and representing diverse disciplinary backgrounds. The caliber of this group is a credit to the institution, and significantly exceeds expectations. The Board held its first meeting at LBNL in April 2006, received scientific and operational briefings and laboratory tours, and discussed institutional issues and challenges. The Board approved the current scientific direction of the laboratory, and applauded the Director's vision to sustain a thriving scientific environment with capabilities broadly applied to urgent national needs; particularly carbon-neutral energy supply (Helios initiative). It acknowledged the critical role that efficient infrastructure has on the success of the scientific enterprise, and provided several valuable recommendations. The Board requested more information on infrastructure needs and costs, and encouraged UC to leverage its resources to support cost-effective means to finance needed new facilities at LBNL.

UC Leadership Involvement, Protocol, and Communications

The contractor's involvement with and support of LBNL is not very visible to DOE-HQ, and greater engagement is encouraged. UC representatives do not always participate in high-level visits to LBNL, e.g., during the Deputy Secretary's visit in 2006. Laboratory leadership generally communicates effectively with HQ-SC, but improved communications are desired when the Director visits senior officials in Washington so that SC has the opportunity to assist with initiatives and concerns.

New UC Joint Appointments

From mid-FY 2005 through FY 2006, over twenty new faculty members, half in the nanoscience area, joined LBNL, notably exceeding expectations. Many of the top researchers at LBNL hold joint appointments on faculties at the adjacent University of California Berkeley (UCB) campus. This arrangement leverages funding resources (UCB pays part of research professors' salaries), engages undergraduate, graduate-student and post-doctoral fellows in Laboratory research programs, and concurrently furthers DOE's science-education/workforce development mission. The number of UC-LBNL joint appointments increased from ~260 to 274. In addition to recruitments in the area of nanoscience, new appointments were made in the Advanced Light Source, Chemical Sciences, Computational Research, Environmental Energy Technologies, Earth Sciences, Genomics, Materials Science, and the Physical Biosciences Divisions. This came about because LBNL Director Chu and

Deputy Director Fleming actively engaged with UCB Deans (Physical Sciences, Engineering) and several department chairs. A formal Memorandum of Understanding has been drafted regarding joint appointments among the Human Resources departments at LBNL and UCB, and UC Academic Affairs.

Alternative Finance Facilities

LBNL leadership communicated proactively with key UC Regents members and UC President Dynes to enlist their support for scientific initiatives and facility investments. In follow-up to a UC proposal initiative, UCOP and LBNL leaders engaged extensively during FY 2006 to discuss and develop plans for the construction of new facilities at LBNL through alternative financing. This financing will come primarily through UC's debt capacity and at interest rates considerably lower than the commercial market because of UC's non-profit, tax-free status. In December 2005, a UC Bond Funded Capital Plan was completed and it included three new buildings at LBNL: a User Guest House (UGH), a Computational Research and Theory (CRT) building, and a Nanoscience Research Laboratory/HELIOS Facility. A policy committee comprised of LBNL leadership and UC Deans has been formed to move these three projects forward. UCB-LBNL committees have been formed for each building, and a fourth one for financing. Business Plans were drafted for the UGH and CRT buildings, and the conceptual designs for both were initiated. The HELIOS facility was also authorized to proceed with scoping and conceptual design. Construction of the ~$10M, 60-room UGH is planned to begin in the summer of 2007. When it becomes operational in the fall of 2008, its revenue is expected to fully repay the financing as well as operating costs. For the CRT facility, UC Berkeley is planning to contribute $10M of the ~$100M required for this ~115k sq ft. building. Planning for the HELIOS facility is pursuing three funding sources: State of California, UC-backed low-interest bond, and private donations. The specific mechanisms of funding for the CRT and HELIOS facilities have not yet been finalized. More specific project and finance plans are currently being developed, and are expected to be presented for UC Regents approval in mid-FY 2007. Progress toward the CRT facility has been somewhat slower than expected, which is likely to necessitate an extension of the Oakland Scientific Facility lease beyond its current June 2010 expiration. Progress toward the HELIOS facility is beyond the FY2006 target and is noted. Overall, the Contractor slightly exceeds expectations in this area.

ELEMENT	Letter Grade	Numerical Score	Objective Weight	Total Points	Total Points
4.0 Effectiveness and Efficiency of Contractor Leadership and Stewardship					
4.1 Provide a Distinctive Vision for the Laboratory and an Effective Plan for Accomplishment of the Vision to Include Strong Partnerships Required to Carry Out those Plans	A	3.9	40%	1.56	
4.2 Provide for Responsive and Accountable Leadership throughout the Organization	A	3.8	30%	1.14	
4.3 Provide Efficient and Effective Corporate Office Support as Appropriate	A	3.9	30%	1.17	
				Performance Goal 4.0 Total	3.9

Table 4.1 – 4.0 Goal Performance Rating Development

Total Score	4.3-4.1	4.0-3.8	3.7-3.5	3.4-3.1	3.0-2.8	2.7-2.5	2.4-2.1	2.0-1.8	1.7-1.1	1.0-0.8	0.7-0
Final Grade	A+	A	A-	B+	B	B-	C+	C	C-	D	F

Table 4.2 – 4.0 Goal Final Letter Grade

5.0 Sustain Excellence and Enhance Effectiveness of Integrated Safety, Health, and Environmental Protection

The Contractor sustains and enhances the effectiveness of integrated safety, health and environmental protection through a strong and well deployed system.

The weight of this Goal is 22 percent.

The Sustain Excellence and Enhance Effectiveness of Integrated Safety, Health, and Environmental Protection Goal measured the Contractor's overall success in preventing worker injury and illness; implementation of ISM down through and across the organization; and providing effective and efficient waste management, minimization, and pollution prevention.

For Goal 5.0, Lawrence Berkeley National Laboratory (LBNL) earned a numerical score of 3.6, the equivalent of an A- based on the targets and measures of the PEMP. Goal 5.0 has three objectives with a total of 10 measures. However, as stated in the PEMP the measures and targets are to be the primary though not exclusive source for performance information. During this rating period the Laboratory undertook a self-assessment and had undergone a "McCallum-Turner Review" of its Integrated Safety Management System (ISMS). The self-assessment found and the McCallum-Turner Review confirmed numerous needed improvements in the implementation of ISMS at the Laboratory. Due to the breadth and depth of needed improvements the Contracting Officer has determined that the proper evaluation for the goal is a 3.4, the equivalent of a B+ or "meets expectations" rating. This rating did not impact the amount of fee earned by the Laboratory.

LBNL did quite well in two of the three objectives, exceeding targets in protection of workers and the environment, and in waste management and minimization. There are notable weaknesses in the other objective, related to effectiveness of ISMS implementation; this is reflected in lower scores in that area. Injury rates in and of themselves do not necessarily indicate the strength of safety management systems. For example, over the past few years, LBNL has gone from the top of the SC labs to the bottom and back to the top of the pack in injury rates, without significant changes in its safety management systems. When LBNL has developed and maintained a robust and comprehensive ISMS, management will be in a more proactive mode, and there should be greater predictability.

In FY 2006, Laboratory leadership established safety as a top priority. Due to high level attention and increased Environment, Safety and Health (ES&H) resources, noticeable improvements in safety communications and awareness were made across the institution, which contributed to the excellent safety record for the year. LBNL exceeded the goal for days away, restricted or transferred (DART) with a rate of 0.24 (versus the goal of 0.5, and an FY 2005 rate of 0.64), and met the goal for total recordable cases (TRC) with a rate of 1.09 (versus the goal of 1.17, and an FY 2005 rate of 1.70). This has placed the Laboratory among the top safety performers of the Office of Science (SC) laboratories in FY 2006.

In response to DOE concerns regarding safety performance at LBNL, the University of California committed to and conducted an independent Peer Review of safety management at LBNL in January. A more in-depth review of the Laboratory's Integrated Safety Management System was held in September. Both reviews noted a strong commitment to safety, an open culture, and that there is an overall framework for safety. They also identified weaknesses that need attention, and made

recommendations to strengthen the Laboratory's safety management systems. This is discussed in greater detail below.

In general, the Laboratory has been compliant with regulations, receiving two minor regulatory violations, and two reportable radiological incidents. One of the incidents was actually the result of an effort to improve the quality of an inventory process, by taking pictures of items in inventory. There were no unintended releases or exposures resulting from the incidents.

Various efforts in ES&H training have undergirded improvements in safety, including increased training staff, development of new courses tailored to the intended audiences, and attention to completion of required training. It's clear that effort is being made to ensure the training is effective.

In general, higher hazards (e.g., radiation, lasers), are adequately managed, however, improvements are needed in the identification and control of lower hazards which don't currently require a formal hazard authorization. Communications within divisions, between management and staff, are satisfactory in many areas, but full ownership of responsibility for safety hasn't fully permeated the entire Laboratory. Efforts are underway to improve this, and should continue in FY 2007.

Improvements were made in the Laboratory's Lessons Learned program, with the August roll-out of a new web-based database for sharing lessons learned. The program should mature and expand in FY 2007. Self-assessment results indicate that approximately 75% of the divisions are implementing corrective actions from the previous year in a timely manner.

The Laboratory completed all five Environmental Management System goals for FY 2006, and met the goal for completion of waste minimization, emission reduction, and resource conservation projects.

5.1 Provide a Work Environment that Protects Workers and the Environment

For Objective 5.1, LBNL achieved a numerical score of 3.9, the equivalent of an A. Objective 5.1 has four measures, each with associated targets.

Injury Case Rates

LBNL has performed well in reducing injury rates, meeting its FY 2006 target goals for days away, restricted or transferred (DART) and total recordable cases (TRC). The DART rate goal was 0.5, which LBNL met with a rate of 0.24. The TRC rate goal was 1.17, which LBNL met with a rate of 1.09. This was a significant improvement from FY 2005, when LBNL did not meet the goal.

To improve the chances of meeting the goal, at the end of FY 2005, LBNL performed a detailed analysis of injury data from the previous year, and developed and implemented a strategy which has effectively improved safety: The Laboratory has strengthened its safety management program, aggressively addressed situations that were the major contributors to injuries (ergonomics and material handling), and focused on divisions and work groups with the greatest safety challenges (Facilities, Engineering, construction, and administrative personnel).

Environmental Compliance

LBNL received two minor regulatory violations in FY 2006, as a result of an inspection by the California Department of Toxic Substances Control.

Radiological Incidents

There were two reportable radiological incidents in FY 2006. In December, LBNL submitted a Price Anderson Amendments Act Noncompliance Tracking System report for inadequacy in shielding control procedures at the Advanced Light Source (ALS). In January, the Nuclear Materials Management and Safeguards System (NMMSS) quarterly inventory reported a thorium rod as

"material unaccounted for". The rod had been listed in the laboratory's NMMSS records since 1985, and listed as being in secure storage in Bldg. 71 since 1993. The discovery of the missing rod was the result of an effort by the Laboratory to improve on procedures for assuring material accountability. After a thorough search, the rod was discovered two weeks later, labeled and packaged in a properly posted radioactive material controlled area at the lab. The item was properly inventoried and stored.

5.2 Provide Efficient and Effective Implementation of Integrated Safety, Health and Environment Management

For Objective 5.2, LBNL achieved a numerical score of 3.1, the equivalent of a B+. Objective 5.2 has four measures, each with associated targets. Other available performance information has been used as appropriate.

The effectiveness of the LBNL Integrated Safety Management System (ISMS) has been evaluated through four performance measures, through two major reviews, the January 2006 Peer Review and the September 2006 McCallum-Turner Review, and, as stipulated in contract clause I.83, through an independent evaluation by the DOE Berkeley Site Office (BSO) of the effectiveness of Laboratory safety management systems.

In December 2005, because of a number of leading indicators suggesting weaknesses in the LBNL execution of ISMS, BSO directed the University of California to conduct a review to identify deficiencies in the Laboratory's implementation of ISMS and make recommendations for improvement. The result was the January 2006 Peer Review, which identified issues related to line management execution of ES&H responsibilities, ineffective ES&H assurance mechanisms, inadequacies in the processes for educating managers, supervisors, and coordinators on their safety responsibilities, a reactive posture with respect to ES&H, and work / hazard controls. In June, LBNL submitted the Peer Review Corrective Action Plan (CAP) to a DOE Independent Validation Team. The Validation Team issued their Validation Report in August, noting that potential fundamental issues with the LBNL ISMS were evident. While the CAP identified actions necessary to improve safety at LBNL, the Validation Team concluded that the actions were probably not sufficient to assure continual systematic improvement. The Team recommended that LBNL consider a robust independent assessment of its ISMS, which led to the September 2006 McCallum Turner Review. The McCallum Turner review recognized that while there is an overall framework for safety at the institutional level, there are deficiencies in ISMS at LBNL. Some examples mentioned in the close-out included high variability in safety leadership across the institution, variability in work planning and feedback, insufficient rigor in hazard controls, lack of flow-down of requirements in safety documents, and weaknesses in the self assessment processes.

Three of the four performance measures for this objective relied on the results of division self-assessments. (The three measures that are based upon self-assessment results are related to hazard identification, analysis, and categorization; effectiveness of ES&H communication between management and staff; and involvement of managers and staff in ES&H feedback and improvement activities.) The self-assessments provide much useful information at the division level, but should not be relied on by themselves for an accurate picture of Laboratory safety performance overall.

The Self Assessment processes at LBNL are not rigorous in terms of comprehensive and effective measurement of organizational performance, and lack a look across the institution, to see how well safety practices are integrated across the Laboratory. The LBNL publication ES&H Self-Assessment Program (LBNL/PUB 5344, Rev. 4, September 2006) provides the framework for the LBNL self-assessment process. It focuses on the division level and below; there isn't a mechanism to review lab performance at a higher (institutional) level. For example**,** "PY06 (Performance Year) Division Self-Assessment Performance Criteria" expectations are all stated at the division level, so they focus attention downward. As a result, there is no place for anyone, such as an individual division in their "Annual ES&H Self Assessment Report for PY2006", to describe institutional issues related to the identification and control of hazards. Nowhere is there mention of the safety vulnerabilities related to

the use of subcontractors, for example, which is a recognized concern at LBNL. It isn't clear from the self-assessment questionnaire and guidance, whether the Laboratory's self-assessment processes consistently ensure identification of hazards that may not fall under the areas listed in the guidance.

Nevertheless, the self-assessment process is a good starting point for getting a sense of the health of line safety programs at the Laboratory, and many excellent safety practices, as well as deficiencies, have been documented across the divisions.

Safety-Related Training

Commitment to safety training is evident in the accomplishments for FY 2006. The Laboratory exceeded its targets in completion of required safety training, training of scientific division managers and supervisors, and root cause analysis. Principal investigators, supervisors, and managers have become more involved in the ES&H training program than in past years, and have been more actively performing their safety responsibilities. This line management accountability and responsibility to complete required training may be a contributing factor in the Laboratory meeting DART and TRC goals.

Effectiveness of the process to identify, analyze, and categorize hazards associated with all work.

LBNL evaluated its ability to identify and categorize hazards (Integrated Safety Management (ISM) core function 2, "identify hazards") in the 4th quarter of the fiscal year, through the LBNL FY 2006 division self-assessments. In the self-assessments, eleven of the sixteen divisions scored a satisfactory rating for their identification and inventory of hazards associated with division projects, programs, and operations. This result indicates that for five of sixteen divisions, or thirty percent of the laboratory divisions, hazard identification and inventory is less than satisfactory. This is consistent with the ongoing recognition that there are weaknesses across the institution in the identification and control of hazards. Some of the issues are related to the high threshold for requiring formal work authorizations, the adequacy of hazard identification processes in times of change (changing scope, moves and departures, etc.), and identification (and control) of hazards when dealing with a large number of guests and visitors, including students and subcontractors. The Laboratory has made progress in improving its identification of hazards, but more work remains to be done to ensure hazards are consistently and adequately identified so they can be adequately controlled. Control of hazards is discussed below, since it wasn't included in the targets for this measure.

Effectiveness of ES&H communication between management and staff

In general, division self-assessment results indicate that within divisions, LBNL managers have satisfactory communications related to ES&H through safety meetings, electronic newsletters, active division safety committees, and through updating roles and responsibilities in division ISM Plans. Some divisions have been communicating much more than others regarding safety, using a variety of methods to get the message across. Training classes have also contributed to improved effectiveness in safety communications. However, the self-assessment process is largely a validation of data, and doesn't evaluate the effectiveness of the communications between management and staff, nor does the self-assessment process evaluate the effectiveness of other ES&H communications across the Laboratory, or with visitors and guests, including students and subcontractors, beyond their involvement within a particular division.

Over the course of the year, senior management has recognized that full communication and understanding of expectations for safety ownership, has not fully permeated the LBNL organization, and is quickly responding to address this. For example, supervisor training has been developed and is being delivered that provides clear expectations for safety performance. The laboratory has significantly increased attention to safety. LBNL managers also recognize the importance of clearly defined roles and responsibilities and safety expectations in high level policies. Management is on an aggressive schedule to clarify roles and responsibilities in high level documents, and ensure consistency across them. Much improvement is being made in safety communications.

Involvement of managers and staff in ES&H feedback and improvement activities.

In the area of feedback, the Laboratory's Lessons Learned (LL) program has improved in the past year, with the introduction of a web-based, subscriber-driven system for automatic sharing of LL by subject area. A process is in place and seems to be used. There have been significant improvements in the number, quality and distribution of LL, such as regular articles in "Today at Berkeley Lab". An area for improvement is that documentation of the program is not current or complete. In addition, sources of lessons learned are limited; for example, the Occurrence Reporting and Processing System (ORPS) has not been used, Usage and effectiveness aren't monitored, to provide feedback for improvement. An excellent but underutilized source of "feedback" is in the safety committees. In these meetings, which include representation from across the Laboratory, valuable information is shared informally, issues are identified, and usually recorded in meeting minutes. Other sources of lessons learned should be included in the LL program. For example, it would be beneficial if there were a broader sharing of findings and lessons learned from the division self assessments, so they could be utilized by other divisions. Many good ideas come from these groups, which, if implemented, have the potential to significantly improve safety at the Laboratory. Based on these observations, ISMS is not yet effectively and consistently being implemented in the area of Lessons Learned. This is expected to change as the program is expanded and formalized.

In the area of "improvement", LBNL relies on their institutional Corrective Action Tracking System (CATS) to identify findings and monitor progress of corrective actions, i.e., as a key part of their institutional assurance system. Division self-assessment results indicate that approximately seventy-five percent of the divisions are implementing corrective actions from the previous year's self-assessment in a timely manner. However, in a variety of areas, not all non-compliances are entered into CATS, and some entries are not made in a timely manner. This makes it difficult not only to ensure actions are completed in a timely manner, but also to perform trending and analysis, and identify areas for improvement. For example, findings from DOE reviews in November and December 2005 were not entered until April 2006, four months after identification. In another case, a key safety position that required formal identification was vacated in February 2006, the requisite memo identifying their replacement wasn't issued until late May, but the corrective action wasn't entered into CATS until August. Findings from an April review weren't entered until June. Variability in usage of CATS, and varying interpretations and enforcement of the requirements for using CATS across the institution make it impossible to know the magnitude of the timeliness issue.

Timeliness is not the only issue with CATS. Corrective actions from other reviews, such as the Advanced Light Source (ALS) shielding incident and the Materials Sciences Division are not tracked in CATS, nor are actions from the Hoisting and Rigging Assessment, Electrical Safety Expectations review, Occurrence Reporting and Processing System (ORPS), Penetration Permit violations and Radiation Safety. The DOE O 226.1, Implementation of Department of Energy Oversight Policy, requires the contractor to have "a comprehensive and integrated contractor assurance system … to identify and address program and performance deficiencies, opportunities for improvement, provide the means and requirements to report deficiencies to the responsible managers and authorities, establish and effectively implement corrective and preventive actions, and share lessons learned across all aspects of operations." CATS isn't yet effectively meeting these requirements; it was developed for different purposes. However, it is becoming a critical element in maintaining compliance with DOE O 226.1 and with 10 CFR 851. In order for CATS to be a useful management tool, LBNL needs to ensure complete and timely entry of findings into the system, and to periodically assess CATS for its completeness, timeliness, and effectiveness in meeting institutional needs. A comprehensive contractor assurance system is not yet fully implemented at LBNL.

ISMS Effectiveness

According to the DOE ISMS Guide, DOE and the contractor are responsible for a number of efforts to maintain and improve the effectiveness of the ISMS and to perform an annual review (DOE G 450.4-1b, ISMS Guide, volume 1, Chapter IV, Maintaining an Approved ISMS). As mentioned above, the

LBNL ISMS has been evaluated against performance measures, and also through independent external reviews. The DOE BSO has also reviewed ISMS implementation effectiveness in general, and in certain areas beyond the established performance measures and targets. The following paragraphs discuss ISMS implementation institutionally, and then within certain technical ES&H programs.

Core Functions 1-3, Work Planning and Control: In November 2005, to respond to a memo from DOE Under Secretary Garman regarding Defense Nuclear Safety Board Recommendation 2004-1, Commitments 23 and 25, BSO requested LBNL to perform an assessment of work planning and control (Commitment 23), and feedback and improvement (Commitment 25) at the work activity level, and provide action plans based on the results of the assessments. The response from LBNL was unsatisfactory, and lacked a rigorous assessment of work planning and control, or feedback and improvement, at LBNL. LBNL committed to address the assessment areas in the Peer Review Corrective Action Plan (CAP). The LBNL Peer Review CAP still did not clearly answer the questions. In August, LBNL provided BSO a crosswalk between the CAP and the criteria from the original assessment request from HQ. While the memo provides a first step towards correlating the original lines of inquiry with proposed corrective actions, it does not appear from the CAP and supporting documentation that the Laboratory has adequately and comprehensively identified and addressed issues in work planning and control at LBNL. ISMS is not effectively and reliably implemented in the area of work planning and control. LBNL needs to demonstrate improvement in assessing its performance, and in developing corrective actions that effectively improve performance in these areas.

Core Function 5, Feedback and Improvement: As stated above, the LBNL response on Recommendation 2004-1, Commitment 25 (feedback and improvement) was unsatisfactory because it lacked the requisite rigor. Another example of weakness in feedback and improvement is in Corrective Action Management: Laboratory corrective action monitoring, closure, and validation processes are inconsistent in effectiveness. For example, the EH&S Division collaborated effectively with Facilities to complete over 2,000 OSHA corrective actions on schedule and within budget. On the other hand, the validation of those corrective actions is over three months behind schedule, since the Lab failed the original validation in August. A follow-up validation is pending. Another example of weaknesses in corrective action processes, is reflected in the process the Laboratory is using to complete actions from the January Peer Review CAP. The large number of actions makes management unwieldy, at best. The format of the CAP and the lack of clarity of end state definition make it extremely challenging to determine whether the proposed corrective actions address the root causes, whether the root causes are indeed comprehensive, and whether implementation of the corrective actions will lead to the desired end state. LBNL needs to ensure BSO has sufficient opportunities for involvement and feedback on the proposed Corrective Action Plan from the McCallum Turner Review, which is supposed to incorporate the corrective actions from the Peer Review CAP. Corrective actions must tie into institutional Quality systems and processes in order to address the root causes of the safety issues at LBNL.

Feedback and Improvement systems aren't consistently effective in other areas, as well. For example, in May, BSO raised concerns regarding the presence of peeling lead paint in several laboratories in Building 70A. The situation has not been resolved, even though in one room the lead paint was falling into a Radiological Material Area. Although the issue was partially addressed beginning in May, it has still not been fully resolved.

Institutional Integration
The June DOE Validation of the January 2006 Peer Review identified keys to reaching the next phase toward safety excellence. They included strengthened systematic and integrated work planning and control processes, and increased "systems thinking". An area needing improvement in integration is welding. In August 2005, BSO requested LBNL review the site's welding program in accordance with a memo from HQ/SC. Responsibilities for welding activities at LBNL are split between the Facilities Division, the Engineering Division, and the Industrial Hygiene Group. The lack of clear roles and responsibilities for welding at LBNL resulted in delays; an initial welding self-assessment report was submitted to BSO in March 2006. The April 2006 DOE technical validation of the Welding Assessment included findings which indicated that clear roles and responsibilities have not been

established for welding, and that there's a lack of an integrated welding program. DOE also identified deficiencies in the assessment report, itself. The Laboratory subsequently provided an acceptable response to those concerns. The assessment recommended clarification of responsibilities, but in the months since, the issue remains open**.** The Laboratory has made progress in integration during the year, especially in partnerships among the Environment, Health, and Safety, Facilities, and Engineering Divisions, and is encouraged to continue improving its integrated work planning efforts.

Most ES&H technical programs have, in general, effectively implemented ISMS, although there are concerns that the Laboratory doesn't perform technical ES&H self-assessments of the various functional programs. This was identified in the Peer Review, and is being addressed through the Peer Review Corrective Action Plan.

Radiation Protection: The Radiation Protection program is functioning well in controlling exposures (occupational and public) and radioactive material releases; radioactive material controls are effective. Responses to problems have been prompt; the Radiation Protection Group investigates all radioactive incidents and positive exposures, and uses the results to improve operations. Areas for improvement: the Radiation Protection Plan is not current, but is being updated; and radiation control implementation at the ALS has been a problem. A Corrective Action Plan was developed, and many actions have been reported as complete, although not yet verified by BSO. The remaining actions are on schedule for completion. Staffing of the Radiation Protection Group is a continuing concern. In general, the Radiation Protection Program is effective and implements ISMS.

Emergency Preparedness: The Laboratory has a well-run, effective Emergency Preparedness program. Laboratory management is fully involved in training and exercises. Training is well-planned and effective, and staff is small but knowledgeable. Significant improvements were made in the area of continuity of operations. Systems are in place and effective.

Training: Training is another area of strength in FY 2006. The training completion rate for required training was 93%; fifteen new ES&H courses were developed and implemented, eight of them web-based, including a user training module for Molecular Foundry users. A new ESH&S course for supervisors has contributed to increased safety awareness. LBNL continuously improves the content of newly established courses by first delivering courses on a pilot basis and then utilizing the feedback to refine the course for Laboratory-wide application. When appropriate, courses are tailored to specific organizations, and involve line managers in the instruction. Commitment to safety training has been evident; training has been a significant contributor to the effectiveness of the LBNL ISMS.

Environmental Protection: The Environmental Management System (EMS) has been well-executed in FY 2006. The Laboratory has attended to writing and implementing safety procedures, and kept the program on schedule while generally meeting safety requirements. The Waste Management Group developed a streamlined process for disposal of mixed and low level radioactive waste; as a result, when funds became available, the waste was shipped more quickly. There remain weaknesses with compliance in Satellite Accumulation Areas. In general, ISMS is effectively implemented in the environmental area.

Security: The Security Program has been strengthened since the FY 2004 DOE Security Survey through the successful completion of corrective actions, addition of well-qualified staff, and by updating the Site Security Plan. Safety needs are integrated with security requirements. For example, safety planning was an integral part of the Blackberry Gate project. Access control changes are coordinated with Fire Protection engineers before they are implemented, to avoid conflicts with safety. LBNL still needs to determine what security requirements should go into Contract 31. In general, ISMS is being implemented in the security program.

Industrial Hygiene: It is more difficult to conclude that ISMS is effectively implemented in the area of Industrial Hygiene. The welding program (discussed above), for example, has not been managed as an integrated program, and lacks independent oversight; an independent oversight program is being developed in FY2007. The welding program is functioning at a reduced level, in activities and staff.

Occupational Medicine: Human Subjects and Animal Care, Biosafety, and Occupational Medicine are well-run programs. The Human Subjects and Animal Care Committees are staffed with knowledgeable experts, and perform thorough reviews of projects and protocols, including field visits and interactions with researchers, to ensure any concerns are satisfactorily addressed. LBNL has a good, well-run biosafety program which was strengthened during the performance period, as a result of an audit by the U.S. Center for Disease Control. Health Services, with its highly qualified staff, provides a well-run Occupational Medicine program. Health Services received three-year accreditation from the Accreditation Association for Ambulatory Health Care, Inc. Health Services keeps TRC and DART rates low by managing the treatment of minor injuries on site, rather than sending employees off site. Early intervention and treatment may help avoid recordable cases of injuries; there is an opportunity for LBNL to do more to keep its rates low through the engagement of Health Services. These programs are supporting effective implementation of the LBNL ISMS.

Laser Safety: There have been significant improvements to the Laser Safety Program in FY 2006. BSO found some serious deficiencies in the Laser Safety program in November 2005, which resulted in shutdowns of certain laboratories, and the development of a corrective action plan. Since that time, LBNL has shown significant improvement in the formalization of its laser safety program. LBNL completed and Oak Ridge has validated seven recommendations from July 2005, ten corrective actions from December 2005, five Occurrence Report corrective actions, and four corrective actions from May 2006. LBNL hired a new, well-qualified Laser Safety Officer who, with the Laser Safety Program Manager and the Industrial Hygiene Group Leader, has collaborated with other Laboratory organizations, the scientists, and DOE to improve laser safety at LBNL. New Activity Hazard Document processes in place have improved hazard analyses, procedures and processes have been upgraded and documented, and inspections are performed to verify controls are in place. The Laser Safety Program is generally effective and implementing ISMS.

Occurrence Reporting and Processing System: There are weaknesses in ORPS implementation at LBNL. While most LBNL staff with ORPS responsibility have been trained, not all people responsible for reporting events up the chain for ORPS consideration, are sufficiently knowledgeable regarding their responsibilities. This is a repeat weakness from the last several years. Quarterly analysis of recurring events is limited to a restricted number of data sources, and doesn't consider accidents, injuries, and "near misses", which would provide a much more useful analysis. This is a repeat finding from previous years. It's not obvious that line managers have the requisite knowledge to determine ORPS reportability; this has resulted in delays and possible omissions. LBNL should consider assessing ORPS implementation to identify opportunities to improve timeliness and to reduce confusion over reporting.

Supervisors and staff are discouraged from using ORPS because the current system penalizes reporting. This is a repeat weakness. Required actions (Notification Report, Final Report) on most occurrence reports are on time, though most are completed right at the deadline. Ten to fifteen percent of corrective actions were completed behind schedule. Most ORPS have associated Lessons Learned, but there's no evidence of them being distributed throughout the Laboratory, even though they have Laboratory-wide benefit. (Repeat finding) The Laboratory doesn't usually follow its own PUB-3000 procedures for investigation of potentially reportable occurrences, instead using ad hoc processes. An approved process is used to investigate only Occurrences determined to be Severity Category 1, 2, or R. Although significant parts of ISMS are being implemented, there are also significant gaps, indicating that ISMS is not fully integrated into the Laboratory Occurrence Reporting program.

Quality Assurance; LBNL doesn't have an approved Quality Assurance Plan (QAP) in accordance with DOE O 414.1C, Quality Assurance. Elements of the QAP are in place, such as an instrument calibration plan. However, in a July review of Quality Assurance (QA), the reviewers were unable to determine what senior management position was responsible for QA. It appears that there are insufficient resources allocated to QA, resulting in little QAP development. Individuals responsible for QA don't appear to be well-versed in QA. The Laboratory continues to do a good job investigating situations involving potential suspect/counterfeit parts, and in getting staff trained. While the

overwhelming majority of work is performed within controls, there have been problems in electrical safety and penetration permit implementation. It should be noted that the Laboratory reviewed its penetration permit program following a series of "near hits", and has already made improvements to the program. There isn't a formal system or process to review the effectiveness of the QA program. In conclusion, the Laboratory QA program is not fully functioning. There is no QAP meeting current DOE requirements, although one is being prepared. Some improvements are needed in applying QA controls, and in staffing.

5.3 Provide Efficient and Effective Waste Management, Minimization, and Pollution Prevention

For Objective 5.3, UC-LBNL achieved a numerical score of 3.9, the equivalent of an A. Objective 5.3 has two measures, each with associated targets.

LBNL completed all five Environmental Management System (EMS) goals for FY 2006, and completed 2.75 waste minimization, emission reduction, and resource conservation projects based on a rating system that counted smaller projects as less than a full point**.** The Laboratory met the performance measure.

Follow-up from FY 2005 Evaluation of LBNL

The FY 2005 Annual Performance Evaluation and Appraisal of LBNL established three expectations of LBNL related to safety performance:

1. A path forward for program improvements and certification based on a comprehensive assessment of its safety management program and staffing.

   LBNL completed two reviews of its safety management program during FY 2006. The first, the Peer Review, was limited in scope due to time constraints. The McCallum Turner review was more comprehensive, but only completed in September, so it's too early to evaluate how well the Laboratory will be able to identify a clear path forward. In FY 2006, the Laboratory has not indicated its path forward towards certification. LBNL needs to work closely with BSO as it develops its action plan from the McCallum Turner Review, and ensure a definitive path towards certification is laid out and implemented. It is also recommended that as LBNL provides quarterly status against its Performance Measures, it should also keep BSO regularly informed on the status of this recommendation.

2. Adequate staffing and resources are allocated to implement all of LBNL's ES&H programs.

   LBNL has done a good job of recruiting and retaining highly talented ES&H staff to implement its ES&H programs. BSO encourages LBNL to continue providing the resources needed to ensure a robust safety program, and looks forward to significant improvements in safety management over the coming year.

3. Lessons Learned Process Improvement Team is completed and the corrective action plan implemented.

   As mentioned above, the Lessons Learned Program has made significant improvements over the past year, and corrective actions were implemented. LBNL should continue to expand the program, and continuously work to improve its effectiveness.

ELEMENT	Letter Grade	Numerical Score	Objective Weight	Total Points	Total Points
5.0 Sustain Excellence and Enhance Effectiveness of Integrated Safety, Health, and Environmental Protection					
5.1 Provide a Work Environment that Protects Workers and the Environment	A	3.9	35%	1.37	
5.2 Provide Efficient and Effective Implementation of Integrated Safety, Health and Environment Management	B+	3.1	35%	1.09	
5.3 Provide Efficient and Effective Waste Management, Minimization, and Pollution Prevention	A	3.9	30%	1.17	
Performance Goal 5.0 Total					3.4[1]

Table 5.1 – 5.0 Goal Performance Rating Development

Total Score	4.3-4.1	4.0-3.8	3.7-3.5	3.4-3.1	3.0-2.8	2.7-2.5	2.4-2.1	2.0-1.8	1.7-1.1	1.0-0.8	0.7-0
Final Grade	A+	A	A-	B+	B	B-	C+	C	C-	D	F

Table 5.2 – 5.0 Goal Final Letter Grade

6.0 Deliver Efficient, Effective, and Responsive Business Systems and Resources that Enable the Successful Achievement of the Laboratory Mission(s)

The Contractor sustains and enhances core business systems that provide efficient and effective support to Laboratory programs and its mission(s).

The weight of this Goal is 25%**.**

The Deliver Efficient, Effective, and Responsive Business Systems and Resources that Enable the Successful Achievement of the Laboratory Mission(s) Goal measured the Contractor's overall success in deploying, implementing, and improving integrated business systems that efficiently and effectively support the mission(s) of the Laboratory.

For FY 2006, Lawrence Berkeley National Laboratory (LBNL) achieved the target for Goal 6 by successfully demonstrating there are efficient and effective business systems in place to ensure meeting the mission of the Laboratory. For the five systems evaluated: financial management; acquisition and property management; human resource management; internal audit and information management; and, technology transfer and commercialization of intellectual assets, the overall objective score for the five measures were averaged.

For FY 2006 the combined numeric score is 3.9 which translates to a grade of "A" and is based on the following accomplishments for each management system.

6.1 Provide an Efficient, Effective, and Responsive Financial Management System(s)

[1] Actual score earned was 3.6 which was adjusted by the Contracting Officer to 3.4 due to information available concerning needed improvements in the implementation of the Integrated Safety Management System at the Laboratory.

Objective 6.1 is a measure of the effectiveness of the financial management systems of the Laboratory. A balanced scorecard model is used to measure performance in four activities: the ethics/governance/compliance activities; financial activities; people activities; and internal business activities. The balanced scorecard activities were determined in order to evaluate essential financial activities and required 86.8 points out of 100 points possible to be graded at the "meets expectations" (3.1 – 3.4 numeric score, B+ grade score) level.

LBNL has been assessed a numeric score of 3.7, for a letter rating of "A-" for 2006 under the Financial Management functional area. Financial Management was evaluated under one measure focused on achievement of eight Balanced Scorecard Plan activities reflective of an effective Financial Management System. In evaluating the overall objective of the measure, BSO considered the self assessment rating of the Balanced Scorecard, along with all other factors that ensure that LBNL has an efficient, effective and robust Financial Management System.

The Laboratory continues to improve its financial practices, which includes the development and implementation of a new Budget System. With new systematic integrated controls, more effective and efficient funding and cost controls will mitigate errors and allow easier and more frequent access.

The Office of the Chief Financial Officer (OCFO) continued its efforts in developing and producing financial policies and procedures for the lab. They completed eight new policies, which cover all areas of the financial practices. These policies provide financial management guidance to all employees on compliance, requirements, DOE regulations and best practices.

The OCFO improved training this year by providing the required tools for a basic understanding of effective financial management. A comprehensive 3-day *Core Financial Management Training* class was developed and conducted for financial employees. This course is required for all OCFO employees and will be offered to general Laboratory employees in the future.

The OCFO continues to support the DOE system priorities and initiatives, by being diligent in supporting Standard Accounting and Reporting System (STARS), continuing to work through reconciliation issues, and maintaining financial integrity.

While the Financial Management Balanced Scorecard Plan produced an "outstanding" score there are two issues outside of the Balanced Scorecard Plan activities that raised notable concern. Although 94.8 percent of all active accounts were reconciled, one travel account was not resolved throughout the fiscal year. The BSO discussed this issue on several occasions with LBNL, and while some progress was made to resolve it, LBNL has not identified when they expect to complete the reconciliation. We believe additional management emphasis is necessary to produce further performance improvements.

More importantly is the second item which pertains to the under accrual of the $2M of performance fee that occurred during the transition from Contract 98 to Contact 31. The OCFO identified the problem early in the fiscal year, and University of California Office of the President (UCOP) provided a solution for covering the shortfall. Although UCOP identified a source of funds to cover the shortfall, LBNL would have been required to collect the funds through an increased overhead rate had the funds not been provided by UCOP. Furthermore, DOE could have been anti-deficient, with costs exceeding available funding. Ultimately, to prevent a violation of statute, a contract modification was issued that limited the fee payable to the University for performance through September 30, 2006 to $4 million, a reduction of nearly $2 million was needed.

These two issues are considered significant enough to reduce the LBNL Balanced Scorecard rating to a numeric score of 3.7, and a letter rating of "A-".

6.2 Provide an Efficient, Effective, and Responsive Acquisition and Property Management System(s)

Objective 6.2 is a measure of the effectiveness of the procurement and property management systems of the laboratory. Each system uses a balanced scorecard model to measure performance in four

perspectives: a customer perspective; internal business perspective; learning and growth perspective; and financial perspective. Each system used its own balanced scorecard based on the guidance from Headquarters and required 86.8 points out of 100 points possible to be graded at the "meets expectations" (3.1 – 3.4 numeric score, B+ grade score) level. To obtain the overall objective score, the assessments for the two systems were averaged. For fiscal year 2006 the combined numeric score is 3.9 which translates to a grade of "A" and is based on the following accomplishments in each system:

Acquisition Management (Procurement)

LBNL Procurement, measured against the objective standards in Appendix B, earned 95 points on its Balanced Scorecard against the meets expectation score of 86.8 points. For FY 2006, performance under this functional area has resulted in a numeric score of 4.0 ("A" grade score). The Procurement Manager's continuous communication and attention to issues raised in the FY 2005 assessment resulted in significant improvements worth mentioning.

Through the implementation of strategic sourcing, LBNL was able to achieve four of the six socioeconomic goals. LBNL's continuous plan to strengthen oversight of its key suppliers while maintaining the involvement of the right mix of small businesses, produced excellent results.

The Procurement Standard Practices (SPs) were updated. This was a significant undertaking by LBNL. The accomplishment of this task ensures that LBNL is working with up-to-date policies and procedures.

The Procurement organization committed to the development of a training program. With the current changes in staff, and the results of assessments, the training program will assist with workforce planning requirements, composition and competencies skills.

All of the above are great indicators that LBNL's acquisition management system is headed in the right direction.

While performance in total exceeded expectations, there were areas where BSO believes additional management emphasis may yield further performance improvements. One of the elements of a credible procurement performance measurement and management system, is the level of competency, independence, and objectivity of those assessing the operation of the systems. Although LBNL ensured that all purchasing activities comply with good business management practices as evidenced in this year's results, the unresolved issue of identifying the correct issue when assessing transactions is an open item of which LBNL is aware and working to correct. The identification of correct issues and root causes is necessary to strengthen and correct internal controls. The training of the Procurement staff in this regard should be a priority for LBNL next year.

Property Management

The Property Management System showed continuing strong achievement against the targets of the balanced scorecard, with only the recording of receipt of property acquired via purchase card within 72 hours as being under the national target of 98 percent at 80 percent. This was the result of a single point failure on a single transaction and was not indicative of a system failure. The management of subcontractor property, which was a failure during the last rating period was done at 100 percent accuracy which exceeded the national target of 98 percent. The Laboratory also exceeded its motor vehicle utilization standards, but because the standards used were not consistent with prevailing DOE policy and the DOE Inspector General (IG) issued a report critical of vehicle utilization at the Laboratory, the Laboratory did not take full credit for its achievement in fleet utilization. Based on achievement against the balanced scorecard plan, the DOE has assessed performance at a score of 3.7, the "A-" grade level.

While performance exceeded expectations, there are challenges on the horizon that imperil perceived performance of the property management system. The Department has issued a new directive on

property management, DOE Order 580.1. The Laboratory has not completed a full assessment of its property systems' compliance with this directive. For instance, the sensitive items listing used by the Laboratory is not yet consistent with the requirement of the order to include certain classes of items, irrespective of cost, or having any deviations be approved by the Department's Property Executive.

There were also several audits conducted or released during FY 2006, that found a basis to criticize elements of the Laboratory's property management systems. The DOE IG released an audit critical of motor vehicle management department-wide, but cited concern with LBNL utilization based on sampling conducted at LBNL. Corrective actions and validations are needed to resolve the concerns expressed by this audit and restore credibility to the Laboratory's fleet management activities. The Laboratory's Internal Audit Services group also performed audits of personal property controls and personal property accounting, that disclosed numerous issues that were not serious enough to cause concern with the validity of results reported on the balanced scorecard, but that need to be addressed in order to maintain data integrity and system credibility. If the audit issues and DOE Order 580.1 compliance are not successfully addressed during FY 2007, there will be a negative impact to the assessment of performance for property management; irrespective of actual performance against the Balanced Scorecard Plan.

6.3 Provide an Efficient, Effective, and Responsive Human Resources Management System

LBNL achieved a numeric score of 4.0, for a letter rating of "A" for 2006 under the Human Resources functional area. Human Resources (HR) was evaluated under one measure focused on achievement of eleven Balanced Scorecard activities, reflective of an effective Human Resources Management System. Consistent with the approach taken since FY 2003, LBNL was expected to accomplish the Balanced Scorecard activities through application of a standards-based assessment in which current practices are evaluated against identified national standards or best practices and responsive actions are taken as necessary to achieve those standards.

The extent to which LBNL progressed toward achieving implementation of national standards/best practices for each of the eleven activities, determined the overall performance level under the Human Resources measure, with "B+" anticipating "Implementation" of two activities, "Transition" of six activities, and "Gap Analysis" of 11 activities. Assessment of each activity under the four Balanced Scorecard Categories, resulted in LBNL achieving "Implementation" of eight activities and "Transition" of three activities, far exceeding the target for "B+" and resulting in a rating of "A".

The following are LBNL's most notable accomplishments for FY 2006:

Customer Service – Acting HR Heads met with key Laboratory management customers to obtain direct feedback on HR's ability to meet Laboratory business needs. They identified the need to restructure the resources applied to the General Science Division, and the need to provide more consistency in recruitment laboratory-wide, leading to assignment of recruiters into HR Centers they service, development of standardized guidance on recruitment, and tailored Recruitment Plans for each HR Center.

Electronic Process Improvement Project (E-PIP) – Of the three processes impacted by this multi-year project to eliminate burdensome paper-based transactions, LBNL has progressed two processes as far as possible pending upgrade to the PeopleSoft System.

Science and Engineers Compensation Design Project – LBNL has designed an alternative pay administration program for Scientists and Engineers, replacing the use of maturity curves with a job-content based methodology.

Accreditation of the Human Resources Program – LBNL HR staff have been active participants in the University of California pilot initiative to establish accreditation standards against which Laboratory and campus human resources departments can be assessed, and a self-assessment program through which accreditation will be achieved.

Berkeley Laboratory Institute (BLI)– LBNL has significantly expanded the BLI beyond the framework established in FY 2005, providing supervisory courses, leadership/management development programs, general workforce development courses and a series for scientists/engineers.

6.4 Provide Efficient, Effective, and Responsive Management Systems for Internal Audit and Oversight; Quality; Information Management; and Other Administrative Support Services as Appropriate

Objective 6.4 is a measure of the efficiency and effectiveness of the internal audit and information management activities of the Laboratory. Internal Audits (IA) used a balanced scorecard model to measure performance in four perspectives: a customer perspective; internal business perspective; learning and growth perspective; and financial perspective. Information Management used a baseline approach to managing activities surrounding applications development. To obtain the overall objective score, the assessments for the two systems were averaged. For FY 2006 the combined numeric score is 3.8 which translates to a grade of "A" and is based on the following accomplishments for each management system:

Internal Audit

LBNL has successfully met or exceeded all of its performance targets for FY 2006 under the Internal Audit functional area achieving a numeric grade of 3.7, for a letter rating of "A-" for this performance objective.

Customer Perspective: A survey process was developed to request feedback from the users of its products. Internal Audit completed the process ahead of schedule and, therefore, exceeds the target for this measure.

Internal Business Processes – There were thirteen reports completed in FY 2006 out of sixteen planned for a completion rate of 81 percent. However, one additional audit is being carried forward in addition to two more that are already included in the FY 2007 Audit Plan. Internal Audit meets the target for this measure.

Financial Perspective – The average direct Internal Audit hours of effort for FY 2006 was about 89 percent, exceeding the target for this measure.

Learning and Growth – Internal Audit staff completed the training hours required to maintain its professional certifications, exceeding the target for this measure.

Information Management

LBNL achieved a numeric score of 4.0, for a letter rating of "A" under the Information Management functional area.

LBNL exceeded the B+ target to document that a process is in place for tracking cost and schedule Enterprise Computing Steering Committee (ECSC) projects. LBNL developed a tracking mechanism and used it to report progress to the ECSC. This tracking was reported on a quarterly basis. LBNL is also in the process of ensuring that this information is accessible to all stakeholders via the ECSC website. Other activities to enhance this project tracking system were also accomplished in FY 2006 i.e., the development of project communication and status reporting standards and the establishment of project change control management guidelines.

6.5 Demonstrate Effective Transfer of Technology and Commercialization of Intellectual Assets

LBNL achieved a numeric score of 4.3, for a letter rating of "A" for 2006 under this functional area. LBNL had to meet two measures. The first measure was to report invention disclosures to DOE within

2 months as required under their Managing and Operating (M&O) Contract. The Laboratory was expected to have an 88 percent compliance rate; however, LBNL reported 83 inventions with 98.8 percent compliance within 2 months. This exceeds expectations. The second measure was to evaluate the income received in the Laboratory's licensing of technology. To meet expectation, LBNL was going to generate $1.2M in royalty income; the Laboratory reported $2.93M in royalty income and therefore exceeds expectation.

ELEMENT	Letter Grade	Numerical Score	Objective Weight	Total Points	Total Points
6.0 Deliver Efficient, Effective, and Responsive Business Systems and Resources that Enable the Successful Achievement of the Laboratory Mission(s)					
6.1 Provide an Efficient, Effective, and Responsive Financial Management System(s)	A-	3.7	30%	1.11	
6.2 Provide an Efficient, Effective, and Responsive Acquisition and Property Management System(s)	A	3.8	30%	1.14	
6.3 Provide an Efficient, Effective, and Responsive Human Resources Management System	A	4.0	20%	.80	
6.4 Provide Efficient, Effective, and Responsive Management Systems for Internal Audit and Oversight; Quality; Information Management; and Other Administrative Support Services as Appropriate	A	3.8	10%	.38	
6.5 Demonstrate Effective Transfer of Technology and Commercialization of Intellectual Assets	A+	4.3	10%	.43	
				Performance Goal 6.0 Total	3.9

Table 6.1 – 6.0 Goal Performance Rating Development

Total Score	**4.3-4.1**	**4.0-3.8**	**3.7-3.5**	**3.4-3.1**	**3.0-2.8**	**2.7-2.5**	**2.4-2.1**	**2.0-1.8**	**1.7-1.1**	**1.0-0.8**	**0.7-0**
Final Grade	A+	A	A-	B+	B	B-	C+	C	C-	D	F

Table 6.2 – 6.0 Goal Final Letter Grade

7.0 Sustain Excellence in Operating, Maintaining, and Renewing the Facility and Infrastructure Portfolio to Meet Laboratory Needs

The Contractor provides appropriate planning for, construction and management of Laboratory facilities and infrastructures required to efficiently and effectively carry out current and future S&T programs.

The weight of this Goal is 20 percent.

The Sustain Excellence in Operating, Maintaining, and Renewing the Facility and Infrastructure Portfolio to Meet Laboratory Needs goal measured the overall effectiveness and performance of the Contractor in planning for, delivering, and operations of Laboratory facilities and equipment needed to ensure required capabilities are present to meet today's and tomorrow's complex challenges.

The rating for Goal 7.0 is 3.7 (A-). Both Objectives 7.1 and 7.2 were rated equally at 3.7. Noteworthy performance includes maintenance expenditures, National Environmental Protection Act (NEPA) compliance, B51 Bevatron Demolition and Molecular Foundry project management and Seismic Safety planning.

7.1 Manage Facilities and Infrastructure in an Efficient and Effective Manner that Optimizes Usage and Minimizes Life Cycle Costs

The rating for Objective 7.1 is 3.7, based on performance against three measures; one for maintenance and utilities management, a second for energy management and a third for real property management.

Maintenance and Utilities Management

Maintenance management was evaluated based on meeting Maintenance Investment Index (MII) and Asset Condition Index (ACI) goals and completion of maintenance related studies and reports. The MII goal set at the beginning of the year for unburdened maintenance expenditures was 2 percent of Replacement Plant Value (RPV). At mid-year, BSO and Lawrence Berkeley National Laboratory (LBNL) agreed to apply fully burdened funds to the MII goal in accordance with accepted accounting principles. Maintenance expenditures met the original target for FY 2006 and by crediting fully burdened maintenance expenditures to the MII calculation a MII of 2.60 percent was achieved. The ACI goal was achieved and maintenance reports completed. Utilities management was measured on five tasks, such as, a Peak Load Management Plan and reduction of utility demand charges. Four of the five tasks were completed which met expectations.

Energy Management

Energy Management was evaluated based on completion of LBNL's Energy Management Performance Agreement (EMPA) initiatives, energy use reduction and response to the President's Directive on Energy Conservation following Hurricanes Katrina and Rita. LBNL exceeded expectations by completing all 10 EMPA initiatives. As required by the Energy Policy Act of 2005, sites are expected to reduce energy usage per square foot by at least two percent for the previous year's usage. LBNL reported a FY 2006 reduction in energy use of 4.11 percent, however, this cannot be validated due to possible database errors, faulty meters and inconsistent meter readings.

In response to the President's Directive on Energy Conservation following Hurricanes Katrina and Rita, a target was set to implement 11 of 20 DOE recommended energy conservation activities and achieve energy savings in excess of 50 percent of the projected savings. The LBNL Facilities Division completed four of these activities. LBNL managers and employees were encouraged through an energy conservation presentation to management and an article in a publication of Today at LBNL to

implement 12 other energy conservation activities. Savings were reported to exceed 50 percent of the projected savings but they cannot be validated.

One of the 12 energy conservation activities "Don't idle engines or motor vehicles" was not adequately implemented. On several occasions, government buses and vehicles were left unattended and idling in open access areas (e.g. in Cafeteria parking lot). In addition to the poor energy conservation example this sets, it is also seen as a safety hazard. Savings from the implementation of the other 11 energy conservation activities could not be quantified.

The Facilities Division's Reduction in Force (RIF) has had an adverse impact on the LBNL Energy Management Program. The Facilities Division Deputy and Plant Operations Manager were transferred, leaving the Facilities Director to act in their place and the LBNL Energy Database Manager was included in the RIF. In November 2006, the Facilities Director resigned. Although Energy Management and the President's Directive on Energy Conservation objectives were reportedly met, the meter readings were not taken on a regular basis and errors in the electricity usage database are suspected. DOE expects increased emphasis and improvement in the Energy Management Program in FY 2007.

Real Property Management

Real Property Management was evaluated based on five specific tasks. The expectation set was completion of four of the five tasks. LBNL exceeded expectations by completing all five tasks, including population on new Facilities Information Management System data elements per Executive Order 13327 and identification of unsuitable, excess space.

7.2 Provide Planning for and Acquire the Facilities and Infrastructure Required to support Future Laboratory Programs

The rating for Objective 7.2 is 3.7, based on performance against three measures; one for integrated site planning, a second for construction project management and a third for seismic safety planning.

Integrated Site Planning

The Ten Year Site Plan for LBNL was well coordinated with Office of Science (SC), BSO and LBNL managers. The plan met SC's requirements and was effective in explaining the integration of LBNL's initiatives with SC's mission.

National Environmental Protection Act (NEPA) documentation was prepared in support of various LBNL projects in a comprehensive and timely manner. Public comments were sought and thoroughly considered in the development of project concepts and designs.

Construction Project Management

LBNL Construction Project Management had several extraordinary accomplishments this year. LBNL responded to several significant Building 51 and Bevatron Demolition project findings by: a) developing a new project team with more demolition and disposal (D&D) and large DOE project experience, b) hiring a new technical support contractor and c) revamping the demolition sequence. These efforts led to a lower cost estimate ($12 million Total Project Cost (TPC)) and an earlier estimated completion date (15 months earlier).

The Molecular Foundry successfully achieved Critical Decision 4a (CD-4a) Approval. Due to efficient and effective management the project has been able to purchase additional equipment while staying within budget and is currently on schedule for CD-4b.

At mid year the schedule for the LBNL User Support Building was accelerated and a new performance task added. For the first time LBNL will use a "Design-Build" acquisition strategy for this project.

Under an accelerated schedule, LBNL successfully prepared all the necessary CD-1, CD-2 and CD-3 documentation for this project.

LBNL's Earned Value Management System (EVMS) was reviewed by DOE's Office of Engineering and Construction Management in partnership with the Defense Contract Management Agency. As required by DOE, the EVMS process and organization was certified in January 2006 as compliant with American National Standards Institute (ANSI)/Electronic Industries Alliance (EIA) Standard 748-A (1998), Earned Value Management Systems.

General Plant Project proposal are now reviewed by a LBNL executive committee in order to validate their support of mission needs and establish funding priorities. In FY 2006, projects have been managed in accordance with scope, schedule and cost baselines and construction started on an important new Animal Care Facility. LBNL reported a reduction in project management costs of small to medium projects from 17 percent of TPC to 6 – 8 percent of TPC.

The LBNL Oakland Scientific Facility Power Upgrade Project experienced an over-obligation condition that occurred when multiple project components were bid and awarded in excess of the DOE authorization. This was a single incident, but lessons learned should be identified and implemented. Two subjects to consider are; a) effectiveness of monthly status report information and b) use of contractors as Project Managers.

Seismic Safety Planning

The majority of seismic planning efforts were completed ahead of schedule in FY 2006 and CD-1 documentation was prepared and approved in support of the first of five seismic safety upgrade line item projects. In addition, LBNL developed funding proposals and supporting justification which were included in the Ten Year Site Plan and presented to the Associate Director of SC's Office of High Energy Physics, who acts at the landlord for the LBNL site.

ELEMENT	Letter Grade	Numerical Score	Objective Weight	Total Points	Total Points
7.0 Sustain Excellence in Operating, Maintaining, and Renewing the Facility and Infrastructure Portfolio to Meet Laboratory Needs					
7.1 Manage Facilities and Infrastructure in an Efficient and Effective Manner that Optimizes Usage and Minimizes Life Cycle Costs	A-	3.7	50%	1.85	
7.2 Provide Planning for and Acquire the Facilities and Infrastructure Required to support Future Laboratory Programs	A-	3.7	50%	1.85	
				Performance Goal 7.0 Total	3.7

Table 7.1 – 7.0 Goal Performance Rating Development

Total Score	4.3-4.1	4.0-3.8	3.7-3.5	3.4-3.1	3.0-2.8	2.7-2.5	2.4-2.1	2.0-1.8	1.7-1.1	1.0-0.8	0.7-0
Final Grade	A+	A	A-	B+	B	B-	C+	C	C-	D	F

Table 7.2 – 7.0 Goal Final Letter Grade

8.0 Sustain and Enhance the Effectiveness of Integrated Safeguards and Security Management (ISSM) and Emergency Management Systems

The Contractor sustains and enhances the effectiveness of integrated safeguards and security and emergency management through a strong and well deployed system.

The weight of this Goal is 8%.

The Sustain and Enhance the Effectiveness of Integrated Safeguards and Security Management (ISSM) and Emergency Management Systems Goal measured the Contractor's overall success in safeguarding and securing Laboratory assets that supports the mission(s) of the Laboratory in an efficient and effective manner and provides an effective emergency management program.

For Goal 8.0, Lawrence Berkeley National Laboratory (LBNL) achieved a numerical score of 4.1, the equivalent of an A+. Goal 8.0 has four objectives with a total of 10 measures. The objective related to protection of classified information doesn't apply because the Laboratory does no classified work under its contract.

In FY 2006, LBNL performed exceptionally well in each area under this goal. In the area of emergency management, the Laboratory accomplished or exceeded all measures in a timely and proactive manner. Key documents and plans were completed with extensive teamwork, diligence, and high quality. The new fire alarm monitoring system was successfully connected with the Regional Emergency Communications Center located at Lawrence Livermore National Laboratory. All twelve members of the Laboratory's Emergency Response Organization completed required training and at least one exercise.

During FY 2006, the LBNL Cyber Security program was exceptionally successful. Repeated recognition from the Office of Science is evidence of the great strides and accomplishments the Laboratory has made in this area. Numerous audits were conducted in the area of Cyber Security in which the LBNL program has repeatedly been deemed robust and effective.

LBNL has also improved its methods to ensure the Laboratory provides an efficient and effective system for the protection of special nuclear material. The Laboratory developed and received approval for Environment Health and Safety (EH&S) Procedure 740, implementing DOE Nuclear Material Control and Accountability requirements, underwent a peer review of its safeguards program and procedure, and completed all corrective actions ahead of schedule. The Laboratory also continued to control and maintain Special Nuclear Material in accordance with safeguard processes and activities. All inventories, reports, and renewals were completed and submitted on time, and Radiological Work Authorization renewals and retraining were completed as required.

8.1 Provide an Efficient and Effective Emergency Management System

For Objective 8.1, LBNL achieved a numerical score of 4.0, the equivalent of an A. Objective 8.1 has three measures.

The Laboratory completed an external audit to the National Fire Protection Association (NFPA) 1600 in October 2005, and completed all resulting corrective actions ahead of schedule. Included in the corrective actions were the updates or completion of high level emergency management documents, including the Master Emergency Program Plan, Emergency Preparedness Program Strategic Plan, and the Business Continuity Plan (BCP). Included with the BCP was an action plan and tool kit to document essential business processes.

The Laboratory exceeded the goal (11) by training all 12 primary members of the Emergency Response Organization, and installed an end-of-line fire alarm system by the end of March, well before

the deadline of September 2006. All 12 primary members of the Emergency Operations Center participated in at least one exercise (target was 11).

8.2 Provide an Efficient and Effective System for Cyber-Security

For Objective 8.2, LBNL achieved a numerical score of 4.1, the equivalent of an A+. Objective 8.2 has three measures.

The LBNL Cyber Security Program was exceptionally successful in FY 2006. Repeated recognition from the Office of Science is evidence of the great strides and accomplishments the Laboratory has made in this area. Numerous audits were conducted in the area of Cyber Security in which the LBNL program has repeatedly been deemed robust and effective.

The contractor demonstrated their commitment to improvement by conducting numerous reviews (eight completed, versus the target of two), and by timely completion of corrective actions; none were overdue.

The Laboratory also integrated security practices into the culture by deploying a computer security training program to regular employees, and exceeding targeted completion rates for regular and targeted employees; the training was also taken by 349 guests. There was strong positive feedback on the course content, as well.

The Laboratory conducted risk assessments on all six enclaves in FY 2006. BSO signed an agreement that the evaluation met requirements.

8.3 Provide an Efficient and Effective System for the Protection of Special Nuclear Materials, Classified Matter, and Property

For Objective 8.3, LBNL achieved a numerical score of 4.0, the equivalent of an A. Objective 8.3 has four measures.

The Laboratory developed and received approval for EH&S Procedure 740, implementing DOE Nuclear Material Control and Accountability requirements. The procedure was fully implemented ahead of schedule, and is currently in use. The Laboratory also underwent a peer review of its safeguards program and procedure. A corrective action plan was developed, and all corrective actions were completed ahead of schedule.

The Laboratory also continued to control and maintain Special Nuclear Materials in accordance with safeguard processes and activities. All 17 inventories, reports, and renewals were completed on time, and the four quarterly nuclear material inventories and four quarterly reports were submitted as required. The nine Radiological Work Authorization renewals and retraining were completed for those authorizations governing the use and/or storage of material controlled through the Nuclear Materials Management and Safeguards System.

8.4 Provide an Efficient and Effective System for the Protection of Classified and Sensitive Information

Objective 8.4 does not apply. LBNL does not have classified or sensitive information.

ELEMENT	Letter Grade	Numerical Score	Objective Weight	Total Points	Total Points
8.0 Sustain and Enhance the Effectiveness of Integrated Safeguards and Security Management (ISSM)					
8.1 Provide an Efficient and Effective Emergency Management System	A	4.0	20%	0.80	
8.2 Provide an Efficient and Effective System for Cyber-Security	A+	4.1	65%	2.67	
8.3 Provide an Efficient and Effective System for the Protection of Special Nuclear Materials, Classified Matter, and Property	A	4.0	15%	0.60	
8.4 Provide an Efficient and Effective System for the Protection of Classified and Sensitive Information	N/A	N/A	0%	0	
				Performance Goal 8.0 Total	4.1

Table 8.1 – 8.0 Goal Performance Rating Development

Total Score	4.3-4.1	4.0-3.8	3.7-3.5	3.4-3.1	3.0-2.8	2.7-2.5	2.4-2.1	2.0-1.8	1.7-1.1	1.0-0.8	0.7-0
Final Grade	A+	A	A-	B+	B	B-	C+	C	C-	D	F

Table 8.2 – 8.0 Goal Final Letter Grade

APPENDIX 1

ASCR Laboratory Appraisal Summary
Lawrence Berkeley National Laboratory (LBNL)

Mission Accomplishment

LBNL plays a key role in simulation efforts with many significant contributions to computational science, applied mathematics, networking and high performance computing (HPC). LBNL researchers are leading five SciDAC projects, including the SciDAC Outreach Center, and participating in many more – these large collaborations with significant cross-fertilization to other disciplines were extremely competitive (<10% success rate). LBNL is the world leader in key areas of applied mathematics for High Performance Computing (CFD, Reacting flows, optimization, Adaptive Mesh refinement (AMR)) and advanced network research with many notable contributions in FY06 (see bullets). For example, Phil Colella was elected to the National Academy of Science in 2004 and Alexander Chorin is widely influential with many modern methods based on his work. LBNL researchers are invited to give many talks at the SciDAC annual meeting and other significant conferences related to computational science and high performance computing. LBNL researchers have made many important contributions to related publications and are world leaders in many areas critical to ASCR missions.

- ***The Nobel Prize in Physics***. George Smoot won the Nobel Prize in Physics for 2006 for work that was supported by NERSC and LBNL computing staff. The Nobel Prize is awarded to no more than three people regardless of the size of the team that contributed to the discovery. ASCR recognizes the entire team for their joint accomplishment.
- ***The SciDAC Outreach Center***. The Outreach Center is an innovative experiment to extend the impact of SciDAC investments and has greatly exceeded our expectations such that we are now referring INCITE proposals that need assistance to the Outreach Center. We have also received unsolicited compliments from Intel for both the resource and David Skinner, the

center Director. This has been accomplished with very little funding or direction by leveraging the outstanding NERSC resources for user support and the significant LBNL involvement in both SciDAC1 and SciDAC2.

- ***Scientific Data Management.*** Ultrascale computing and high-throughput experimental technologies have enabled the production of scientific data about complex natural phenomena. However, answers to fundamental questions about the nature of those phenomena remain largely hidden in the massive quantities of produced data. One goal of the Scientific Data Management Center (ORNL; North Carolina State University; LBNL) is to provide a scalable high performance statistical data analysis framework to help scientists perform interactive analyses of these raw data to extract knowledge. They have developed an open source parallel statistical analysis package, called Parallel R, that lets scientists employ a wide range of statistical analysis routines on high performance shared and distributed memory architectures without having to deal with the intricacies of parallelizing these routines. Benefits have been demonstrated in Climate models and Computational Biology efforts.

- ***Simulating a Flame in Three Dimensions***. Researchers at LBNL have developed the most impressive direct numerical simulation (DNS)-style combustion simulations to date. These laboratory-scale simulations of turbulent premixed methane combustion used 20 chemical species, 84 reactions, and no models for turbulence or turbulence chemistry interactions. For the first time researchers have been able to compare full-field images of entire laboratory-scale turbulent flames with views of the same produced by computer simulations uncompromised by turbulence models. The simulations captured with remarkable fidelity some major features of the experimental data, such as flame-generated outward deflection in the unburned gases, inward flow convergence, and a centerline flow acceleration in the burned gases. The simulation results were found to match the experimental results within a few percent. This agreement directly validated both the computational method and the chemical model of hydrocarbon reaction and transport kinetics in a turbulent flame. This advance has the potential to greatly increase our understanding of how fuels behave in the complicated environments inside turbulent flames. The work was featured on the cover of the Proceedings of the National Academy of Sciences.

- ***Supernova Combustion in the Distributed Burning Regime.*** Astrophysicists modeling entire stars need to know what is going on at scales their models can't resolve. For example, astrophysicists had predicted that in the late stage of a supernova explosion, the flame front burns further out from the center and the lower density of the star causes it to burn less vigorously and become more unstable due to increased turbulence and mixing of fuel and ash. This represents a different mode of combustion known as a "distributed burning regime." Using the Adaptive Mesh Refinement (AMR) combustion codes and running simulations for 300,000 processor hours at NERSC, the Supernova Science Center team, supported through SciDAC, was able to create the first-ever three-dimensional simulations of such an event.

- ***Unified Parallel C implements one-sided messages to improve scientific software performance on high performance computers.*** Partitioned Global Address space languages offer an alternative to message passing programming on high end systems. LBNL and University of California groups recently demonstrated that the languages can effectively leverage modern network hardware to provide performance that is faster than the two-sided send/receive models for some machines and computations. One example is the communication-intensive 3D Fast Fourier Transform (FFT), important to many scientific simulations. The compilers for these languages are highly portable and support interoperability with the Message Passing Interface (MPI), Fortran, and C/C++ languages.

- ***Improving model accuracy and performance.*** The SciDAC Performance Engineering Research Center (PERC), led by LBNL, has developed statistical methodologies for modeling application performance as a function of its input parameters. These methods provide estimates not only of performance but also of the model accuracy, allowing the user to continue refining the model until sufficient accuracy is achieved. It has been demonstrated that these techniques can be applied to computer architecture sensitivity studies, reducing by two orders of magnitude the number of cycle accurate simulations required to determine the best choices for architectural parameters such as cache size.
- ***Cyber Security Leadership.*** LBNL network security program, Bro, is being adopted by other laboratories and universities and LBL leadership in cyber security has raised awareness and changed the thinking of the community about robust cyber security for open science.
- ***Applied Math Accomplishments:***
  - John Bell et al. have performed detailed simulations of ultra-lean hydrogen combustion that elucidates the stabilization mechanism for cellular flames.
  - John Bell et al. have developed a hybrid adaptive algorithm that combines continuum and microscopic models while preserving the effect of fluctuations from the microscopic scales at the continuum level.
  - Alexandre Chorin et al. have developed stochastic modeling methods for systems without separation of scale, such as the ones that occur in hydrodynamics, plasmas, geophysics, and neuronal networks, opening new avenues for computer modeling of complex systems.
  - Alexandre Chorin et al. have developed new multiscale Monte Carlo methods that preserve detailed balance exactly are have applied them to study spin glasses, which have applications in neurology, meteorology, and oceanography.
  - Phil Colella et al. have developed an all-speed formulation for gravitationally stratified flows that can simulate atmospheric flows and preserve the acoustics and gravity waves — without the time-step limitations associated with those waves.
  - Phil Colella et al. have developed a fourth-order accurate AMR algorithm for Poisson's equations, which represents a first step toward higher-order AMR algorithms.
  - James Sethian et al. have developed a numerical model of two-phase viscoelastic flow, which can be used to simulate a wide collection of nanoscale devices and flow phenomena with applications ranging from ink jet plotters to plasma screens to automated drug design.
  - James Sethian et al. have built new and fast algorithms to reconstruct seismic velocities inside the Earth from data obtained from surface recordings of reflected waves, leading the way towards determining the Earth's substructure and locating petroleum resources.
  - James Sethian et al. developed an interface transport algorithm to track copper electroplating in semiconductor manufacturing, which occurs when materials are manufactured using superconformal electrodeposition.
  - James Sethian et al. developed an implicit finite element method for moving interfaces that produces high sub-grid resolution for problems involving combustion, fluid mixing, and semiconductor manufacturing.
  - Juan Meza and Chao Yang have developed a new algorithm for directly minimizing the total energy functional, associated with large atomistic systems such as nanostructures, that converges rapidly and can be several times faster than existing methods (part of Nanoscience project).
  - Andrew Canning et al. implemented a new preconditioner and eigensolver in the

ESCAN code for electronic structure calculations that are used to simulate nanowires composed of layers of InP and InAs, which are being proposed as single electron memory devices (part of Nanoscience project).

- ***Application Performance Work Gets "Best Paper".*** LBNL researches completed an analysis of application performance on an important set of moder HEC computer architectures, including the IBM Power 5, AMD Opteron, IBM BG/L and the Cray X1E. Overall results provided key insights into the potential for the selected applications to utilize next generation petascale systems and on the reengineering necessary to incorporate additional levels of parallelism. The paper documenting these results has received a best paper award at the 2007 IEEE International Parallel and Distributed Processing Symposium, a key international conference on parallel computing.
- ***American Society of Mechanical Engineers Timoshenko Medal.*** An LBNL researcher was awarded the 2005 Timoshenko Medal "for seminal contributions to nearly every area of solid and fluid mechanics, including fracture mechanics, turbulence, stratified flows, flames, flow in porous media, and the theory and application of intermediate asymptotics." The Timoshenko Medal was established in 1957 and is conferred in recognition of distinguished contributions to the field of applied mechanics. Instituted by the Applied Mechanics Division, it honors Stephen P. Timoshenko, world-renowned authority in the field, and it commemorates his contributions as author and teacher.
- ***IEEE Fernbach Award.*** An LBNL mathematician, John Bell, has been named recipient of the 2005 Sidney Fernbach Award. The award is given by the IEEE Computer Society for an outstanding contribution in the application of high performance computers using innovative approaches. The award was presented at the SC05 supercomputing conference in FY06.

Facilities

LBNL manages two major facilities for ASCR – ESnet and NERSC. NERSC is a world class capacity facility with exceptional user ratings and reputation and is widely regarded as the best managed computing facility in the world. User surveys rated NERSC as 6.7 out of 7 for FY06 with a high response rate. NERSC management is responsive to both users and ASCR balancing a wide array of requirements from a large user community within budget constraints. NERSC management has been equally adept at negotiating with vendors – greatly exceeding expectations for the NERSC upgrade. **NERSC exceed the ASCR Joule target for FY06 despite the hidden challenges due to increased numbers of processors and to successfully transitioning many large projects to the LCFs.**

The management of ESnet has been equally successful this year. ESnet has been completely restructured in FY06 to address the needs of extreme (5-9s) reliability and performance required by SC missions in particle and astrophysics and in climate and doing so at low cost. ASCR is particularly pleased with the partnership with Internet 2. LBNL has demonstrated continued world leadership in advanced networking technologies and management and is setting the international standard for research networks. These efforts are critical to the success of many of other SC programs efforts and have a broader impact in academia and industry.

NERSC

- As evidenced with a rating of 6.7 out of 7, NERSC users continue to be very satisfied with the facility. Users comment:
  - "NERSC runs a reliable computing service with good documentation of resources. I especially like the way they have been able to strike a good balance between the sometimes conflicting goals of being at the "cutting edge" while maintaining a high degree of uptime and reliable access to their computers."

  - "…am also impressed by the ease with which one can request (small) resources for a start up project. I recently requested some computing resources for a new project we are planning for and was up and running in a few days. This helps us tremendously in trying to reach our scientific goals. Having worked with a number of computer centers, I have to say that NERSC does this very well."
  - "NERSC is a very well managed center. The precision and uniformity of the user environment and support is outstanding. I am fairly new to NERSC (INCITE award) but it compares very favorably indeed with NSF centers. Our research is totally dependent on very large scale computation. I hope we will be able to work with NERSC in the future."

- NERSC is also archiving multiple terabytes of data from RHIC enabling BNL staff to focus on the research effort.

ESnet

- In FY 2006 ESnet successfully concluded a partnership with Internet2 that will enable it to meet the needs of the Office of Science for the next five years with a **16 to forty-fold increase in bandwidth.**
- ESnet in cooperation with Internet2 and Fermilab led the development of a plan to ensure that LHC Tier 1 to Tier 2 Center networking would be in place to support LHC data operations. The existence of this plan is critical to the success of U.S. participation in the LHC and would not have happened without ESnet leadership.
- The February 21, 2006 Lehman Review of ESnet concluded:
  - The close cooperation between ESnet and its sites for the past 20 years has produced a capable, smoothly operating network for DOE. ESnet has a long and successful history of partnering with many networks and will continue to manage Layer 2 and Layer 3 services. ESnet has demonstrated a continued and expanded excellence in working on the end-site management.
  - Critical to the current success of ESnet, has been the upper LBNL management level support, high quality of the ESnet staff, and the integrated approach to project and contract management.
  - The ESnet team did an outstanding job of analyzing current and future user requirements, proceeding to use the analysis to develop plans for both future Internet Protocol (IP) services and the Science Data Network (SDN). Similarly, the team demonstrated excellent understanding of current usage of the network, showing a variety of network usage views, including: top flows, top sites, and flow characteristics.
- The Committee noted the excellent record of accomplishment of ESnet with respect to resilience of operations. They noted that the track record during 9/11 and Katrina speaks to the quality of management planning and execution. Resilience in the future will be even more important. The "ESnet Services and Service Level Descriptions" was found to be extremely useful and well done.
- The Committee applauded the efforts made by ESnet personnel to participate in relevant international meetings and the development efforts being made in respect of network performance monitoring (perfSONAR) and real or virtual circuit switching (OSCARS). In the case of perfSONAR, ESnet staff are participating in the necessary global activity needed to ensure heterogeneous monitoring systems can be federated. The perfSONAR initiative now involves several important providers (including Internet2 and GEANT-GN2) and has adopted the GGF NM-WG interface as a first step towards common publication mechanism. SDN architecture would drive significant changes and continue to evolve in the interactions and interdependencies between network providers (WAN and campus) and end-user

Program Management

LBNL is a leader in HPC and computational science, making significant contributions to the vision, planning and coordination of these efforts and changing the thinking or direction of the community in areas such as applied math, visualization, advanced networking and simulations in materials, combustion and physics.. Planning for the upgrades to NERSC and ESnet have been excellent and LBNL has demonstrated significant strength in this area. Particularly noteworthy was the third party financing arrangement with UC for the new computing building. Also noteworthy was the Cray contract for the NERSC upgrade which greatly exceeded expectations and marked an impressive change in direction for the facility management. LBNL participation in Lehman reviews helps to transfer lessons learned to the other projects in SC and demonstrates the caliber of LBNL leadership in managing scientific computing resources. The combined efforts of ORNL, ANL, LBNL, PNNL and their site offices in developing the "Management Model for Delivering High Performance and Leadership Class Computing Systems for Scientific Discovery" (attached) has literally 'written the book' on management of scientific computing resources. Communications and coordination with ASCR have been excellent and the lab is responsive to program concerns.

- Bill Kramer and Lynn Rippe provided exceptional leadership and guidance in the areas of HPC acquisition, implementation and operation. They served on three Lehman reviews for Leadership Computing facilities in 2006. The LCF's continue to use Lynn as a consultant on lease-to-own 3rd party financing agreements.
- As part of a competitive procurement process, NERSC evaluated systems from a number of vendors using the NERSC Sustained System Performance (SSP) metric. The SSP metric, developed by NERSC, measures sustained performance on a set of codes designed to accurately represent the challenging computing environment at the Center.

BES Laboratory Appraisal Summary

BES Laboratory S&T Evaluation Worksheets

SC Laboratory: Lawrence Berkeley National Laboratory (LBNL)

Goal 1.0 Provide for Efficient and Effective Mission Accomplishment

The Contractor produces high-quality, original, and creative results that advance science and technology; demonstrates sustained scientific progress and impact; receives appropriate external recognition of accomplishments; and contributes to overall research and development goals of the Department and its customers.

Objective 1.1 Science and Technology Results Provide Meaningful Impact on the Field

BES $ Wt Score/Grade: 4.0 / A

The Condensed Matter Physics program at LBNL was reviewed in January 2006. Many of the research activities, including Superconductivity, Ultrafast Materials Science, Quantum Materials, and Magnetism, were deemed excellent and in some cases, world class. The Materials Chemistry program was reviewed in February 2005. Included among the projects supported in Materials Chemistry are world-class projects in carbon nanotubes, nanocrystals for solar energy conversion, and NMR instrument and technique development.

The Materials and Engineering Physics program at LBNL was last peer reviewed on site in FY 2004 with the next review scheduled for January 2007. The Electronic Materials Program continues to be world-class, extremely productive, and imaginative. Several new activities, including those in magnetic thin films and hydrogen fuel cells, were initiated in FY 2006. While the reviewers were highly complimentary on some components of these new activities, they also cautioned the need for improved coherence within the two new programs. An important recent research highlight includes the development

of the first nanofluidic "transistor" in which the flow of ions in solution can be controlled with external voltages.

Peer review of the Chemical Physics Program and Chemical Dynamics Beamline (CDB) was conducted jointly in FY 2006. The three elements of the Chemical Physics Program reviewed as follow: the effort in experimental reaction dynamics was evaluated as extraordinarily productive, innovative, and exhibiting excellent synergy among the principal investigators; the dynamical and structural theory program reviewed very well; the coalescence of three small projects focused broadly on condensed-phase chemical physics reviewed well, with varying emphases by the reviewers on results produced to date, the adventurous nature of the proposed research, and confidence in the talent of the investigators. The CDB at the Advanced Light Source was viewed as a facility dedicated to state-of-the-art investigations in combustion dynamics, aerosol chemistry, optical properties of nanoparticles, biomolecular energetics, spectroscopy, kinetics, and state-resolved chemical dynamics processes using tunable vacuum ultraviolet light for excitation or detection. The beamline director and his staff received rave reviews for the improvements made at the CDB during the past three years. The CDB is more productive, innovative, flexible, and user-oriented than at any time since its inception. Two other projects were reviewed in FY 2006: the LBNL-led collaborative project on scalable methods for electronic excitation and optical responses in nanostructures reviewed strongly and was renewed; the combustion chemistry project also got very solid reviews and was renewed. Ten new or renewal, individual principal investigator projects in geosciences and one renewal in physical biosciences were mail reviewed during the evaluation period. The former reviewed well; the overall program in geophysics and geochemistry will grow in the future. The biosciences project was praised for its accomplishments, but criticized for aspects of the proposed future directions.

Although not formally reviewed in FY 2006, research conducted in the catalysis; heavy element chemistry; analysis; atomic, molecular, and optical (AMO) sciences; and photochemistry programs continue to be extremely productive and demonstrate excellent scientific progress.

Objective 1.2 Provide Quality Leadership in Science and Technology

BES $ Wt Score/Grade: 4.0 / A

In general, all research projects supported at LBNL by the Materials Sciences and Engineering Division are deemed to be world-leading as determined by the most recent program reviews.

Many of the principal investigators within the Chemical Sciences Division at LBNL under review in FY 2006 were recognized by the reviewers as being world leaders in their fields. The reviews revealed multiple demonstrations of a willingness to undertake bold and innovative long-term research. Of particular note are the new and exciting research areas enabled by changes in the Chemical Dynamics Beamline, including a new project in nano-imaging of organics initiated in FY 2006, based on successful peer review under Notice 05-30. The collective set of BES supported geosciences principal investigators are well respected nationally. Many of the principal investigators in the areas of catalysis, actinide chemistry, laser spectroscopy, AMO sciences, and photochemistry are extremely highly regarded nationally and internationally.

Objective 1.3 Provide and sustain Science and Technology Outputs that Advance Program Objectives and Goals

BES $ Wt Score/Grade: 4.3 / Pass

The activities supported by the Materials Sciences and Engineering Division continue to produce a large number of excellent quality, peer reviewed journal articles.

Objective 1.4 Provide for Effective Delivery of Science and Technology

BES $ Wt Score/Grade: 4.3 / Pass

The activities supported by the Division of Materials Sciences and Engineering have been effective in transmitting the results to the community.

Goal 2.0 Provide for Efficient and Effective Design, Fabrication, Construction and Operations of Research Facilities

The Contractor provides effective and efficient strategic planning; fabrication, construction and/or operations of laboratory research facilities; and is responsive to the user community.

Objective 2.1 Provide Effective Facility Design(s) as Required to Support Laboratory Programs (i.e., activities leading up to CD-2)

BES $ Wt Score/Grade: 3.9 / A

LBNL's National Center for Electron Microscopy leads the DOE Transmission Electron Aberration-corrected Microscopy (TEAM) project. LBNL has primary responsibility for project management, controls, and direction, as well as technical leadership on stage design and column integration. Management of this complex Major Item of Equipment project, which involves four other research groups and two commercial vendors, has been exceptional throughout the design phase.

The User Support Building project is progressing fast with good planning and good management response.

Objective 2.2 Provide for the Effective and Efficient Construction of Facilities and/or Fabrication of Components (execution phase, Post CD-2 to CD-4)

BES $ Wt Score/Grade: 3.6 / A-

Construction of the Molecular Foundry, a nanoscience user facility, will be completed in December 2006 and is on schedule and being executed well. Conventional construction for the facility was completed and the building was formally accepted on schedule in the spring of 2006. Progress towards project completion through installation and commissioning of technical equipment proceeded during the remainder of FY 2006. Formal CD-4a approval for the Start of Initial Operations was signed in April 2006.

Objective 2.3 Provide Efficient and Effective Operation of Facilities

BES $ Wt Score/Grade: 3.9 / A

The Advanced Light Source (ALS) continues to excel in it high-profile scientific output and operational reliability. Under Dr. Janos Kirz's leadership the ALS completed former Director Chemla's original strategic plan and developed a new plan working closely with the ALS user community and the ALS Scientific Advisory Committee. The plan consists of three main components: source upgrade, replacement of older insertion devices, and new beamlines. The ALS will begin to incorporate top-off operational periods in 2007 which will double the time averaged current and reduce beam emittance by a factor of 5. Rodger Falcone, University of California at Berkeley physics professor and veteran ALS user, succeeded Dr. Kirz as ALS Director in September 2006.
The National Center for Electron Microscopy (NCEM) is transitioning from a BES-supported laboratory research program at LBNL to a stand-alone user facility that is expected to exemplify both scientific excellence and first-rate service to the broad community of users. The NCEM underwent its first operational review as a stand-alone user facility in April 2006, and management is addressing the needed changes. The Molecular Foundry, a Nanoscale Science Research Center, began initial operations in FY 2006 with partial-year funds and has successfully initiated user research programs and high-quality scientific work within the new facility, leading to well-regarded scientific accomplishments.

Objective 2.4 Utilization of Facility to Grow and Support Lab's Research Base and External User Community

BES $ Wt Score/Grade: 3.3 / B+

The ALS is effectively used by the research programs at LBNL. User mechanisms and appropriate efforts to take advantage of the Molecular Foundry appear to be well underway as the facility entered initial operations in FY 2006; initial operations review will not take place until FY 2007. Access balancing and outreach for NCEM are being attended to but need substantial work as documented by the FY 2006 operations review. The strong resident research community has been an asset, but also sometimes a constraint on broad access and optimal use.

Goal 3.0 Provide Effective and Efficient Science and Technology Program Management

The Contractor provides effective program vision and leadership; strategic planning and development of initiatives; recruits and retains a quality scientific workforce; and provides outstanding research processes, which improve research productivity.

Objective 3.1 Provide Effective and Efficient Stewardship of Scientific Capabilities and Program Vision

BES $ Wt Score/Grade: 3.8 / A

The Materials Sciences and Engineering program at LBNL is very responsive to the Department's mission in basic science and provides a strong underpinning to mission needs and applications in ceramics, electronic materials, and nanotechnology. LBNL has been a leader in formulating new applications and research in nanoscale materials with programs in areas such as buckeyballs, nanotubes, and photoconversion.

Research within the LBNL Chemical Sciences Division at LBNL reviewed in FY2006 is effective in its use of the scientific capabilities of LBNL. Each project has a well defined scientific objective, most have world-class principal investigators, and synergism among principal investigators has improved in some areas. Successful recruiting of junior staff, particularly to the Ultrafast X-ray Science Laboratory, is a positive sign. Management supports a vision of excellence in science that is borne out through nationally and internationally known scientists.

The research facilities at this laboratory are performing as worldwide leaders in their respective fields.

Objective 3.2 Provide Effective and Efficient Science and Technology Project/Program Planning and Management

BES $ Wt Score/Grade: 3.6 / A-

In FY 2006, in order to address the need for greater program coherence, LBNL was directed to develop a management plan for all activities supported by the Materials Sciences and Engineering Division. The laboratory will need to show how the various subtasks of the project interact, and how the overall program is managed. The LBNL program has been successful in attracting funds from other sources; however, there is a noted tendency to steer BES-funded research in directions that are more appropriate to other agencies, e.g., NIH. The laboratory should be more cognizant of clearly delineating research that has no bearing on the basic research or mission needs of the DOE.

The laboratory is encouraged to become more fully engaged in BES scientific workshops, especially those that address the fundamental energy challenges of the future.

Despite improvements in synergism in some areas, projects within the LBNL Chemical Sciences Division still tend to be stand-alone and principal investigator-driven. The Division lacks an overarching strategic plan that delineates its role within a broader vision for LBNL.

The program management and planning at the scientific users facilities is a model to follow by other laboratories.

Objective 3.3 Provide Efficient and Effective Communications and Responsiveness to Customer Needs

BES $ Wt Score/Grade: 3.5 / A-

Communications with BES materials program management has improved; however, the laboratory often does not respond to requests for information in a timely manner. The laboratory also should continue to improve on conveying pertinent research results, and be fully communicative on changes in research directions and personnel by consulting with and obtaining prior approval from BES. Communications with BES management in the LBNL Chemical Sciences and Geosciences Divisions is appropriate. The responsiveness of the laboratory to BES scientific users facilities management is prompt and effective.

BER Laboratory Appraisal Summary

Fiscal Year 2006	**BER**
Lawrence Berkeley National Laboratory	**Justification**
Goal #1 Mission Accomplishment	
Objectives	
1.1 Impact	LBNL is the most successful and productive laboratory in conducting BER life sciences programs in GTL, Low Dose and in DNA sequencing. BER Life Sciences funds approximately $66M of fundamental research in these program areas. LBNL researchers are developing innovative and ground-breaking projects on developing high throughput approaches to characterize and image with high resolution multi-molecular complexes. These projects substantially contribute to the fundamental science underpinning the GTL program, as well as produce technology strategies and data that is disseminated to the wider scientific community. Several of these projects were reviewed in FY06 by their respective project Advisory Committees, comprised of independent scientific experts, and were given high marks for very good progress. LBNL GTL-supported research on microbial systems biology has been prominently featured in high-impact factor journals. Noteworthy publication from LBNL scientists documented important advances in community analysis of microbial populations from the Oak Ridge Field Research Center. Similarly, several publications documented the role of LBNL geophysics in monitoring subsurface activities associated with environmental remediation. LBNL is commended for a Best Student Paper award in EOS for research supported by ERSD. The environmental synchrotron science program at the ALS is helping many ERSD investigators to take advantage of the facility/capability.

1.2 Leadership	LBNL researchers display tremendous leadership for several programs within the Life and Medical Sciences Division. Dr. Mina Bissell, the Distinguished Scientist for the Life and Medical Sciences Division, was awarded the Ted Couch Lectureship in Cancer Research for her significant contributions to cancer research. Dr. Mary Helen Barcellos-Hoff serves as the Chief Scientist for the Low Dose Radiation program, and has assisted with program planning and recruitment of personnel to the LBNL low dose radiation program. Dr. Jay Keasling organized the highly successful Synthetic Biology Workshop 2.0, bringing together an international group of scientists to discuss recent findings and future directions for this nascent area of interest for the GTL program. Many LBNL researchers serve as organizers or co-chairs of scientific meetings and conferences, both setting the agenda, selecting session speakers and topics, and also serving as keynote speakers. LBNL provides important leadership to the program in the areas of environmental microbiology and geosciences with emphasis on field applications. LBNL hosts the ERSD Distinguished Scientist – Terry Hazen. Dr. Hazen has published regularly on diverse topics with application to the program; continues to conduct important research for the program and integrates well with other DOE program offices. PI's are providing scientific leadership in the application of synchrotron capabilities to environmental remediation science. LBNL remains a relatively minor player in BER's climate change research. LBNL lacks sufficient core capabilities to be considered a leader in any area of BER's climate change research program.
1.3 Output (productivity)	LBNL researchers demonstrate significant productivity, in the form of peer-reviewed publications in well-respected, high-profile scientific journals; many of these publications have been featured on the journal covers, affording an additional element of visibility to the corresponding DOE-supported research. The GTL data generated by LBNL researchers is made widely available to the entire GTL research community, to assist with modeling refinement and validation.
1.4 Delivery	Pass – PI's are well integrated throughout the program providing support to the program in general as well as to specific funded projects. The geophysics group has been effective at integrating with the ERSD field activities. PI's have been effective in their interactions with and support of other funded investigators wishing to utilize the ALS.
Goal #2 Design, Fabrication, Construction and Operation of Facilities	
Objectives	
2.1 Design of Facility	
2.2 Construction of Facility/Fabrication of Components	The soft x-ray microscopy station for biological research at the Advanced Light Source was completed in FY2006 according to cost/schedule performance milestones.

2.3 Operation of Facility	The JGI is a multi-lab operation, LBNL has taken the major role in management. Notable JGI achievements include: JGI sequencing output has steadily increased to approximately 3 Gb per month, or one human genome equivalent per month. The cost of sequencing has steadily decreased, to the point where today it is essentially 1/10 cent per base pair or $1 per kilobase (roughly equivalent to $5,000 for low throughput coverage of a microbial genome). In November, 2005, a subcommittee of BERAC reviewed the operations and science of the JGI and returned a very strongly positive assessment. In February 2006, the JGI held its first User Meeting and over 200 scientists attended to present work derived from JGI sequencing efforts. The 2007 User Meeting is expecting over 250 attendees, so many that a new location had to be identified and reserved for the event.
2.4 Utilization of Facility to Grow and Support Lab's Research Base	The number of JGI collaborations has steadily increased as they take on more sequencing projects for university and outside collaborators. Further, JGI has reached out to initiate the Laboratory Sequencing Program which, in one year, now has more than a dozen active projects underway. The new ALS soft x-ray microscopy station has attracted widespread interest and there are several research projects already being carried out using it by investigators from outside the Laboratory.
Goal #3 Program Management	
Objectives	
3.1 Stewardship of Scientific Capabilities and Programmatic Vision	Important support for synchrotron capabilities and science, both of which are important to the program. However, Climate change research does not appear to be an area LBNL plans to grow to develop a core capability. The number of climate change researchers at LBNL is sub-critical to be considered a core capability. The recent JGI review lauded LBNL's management of the inter-laboratory operation of JGI.
3.2 Program Planning and Management	Science conducted for BER is consistent with both the LBNL overall mission and the specific workplans for each project. Programs are effective and well managed, reflecting an effective laboratory management program. However, there is no evidence of program planning at LBNL to establish a core capability in any area of BER's climate change research program.
3.3 Program Management-Communication & Responsiveness (to HQ)	Overall, BER finds LBNL management to be extremely responsive and proactive in terms of alignment to program goals and priorities. LBNL environmental science staff have made important contributions to the program in terms of representation at national meetings and the organization of communications within the program. Susan Hubbard is effective and proactive in representing the environmental science program to BER and vice versa.

FES Laboratory Appraisal Summary

NARRATIVE ASSESSMENT OF SCIENCE AND TECHNOLOGY AT LAWRENCE BERKELEY NATIONAL LABORATORY

Objective 1.1 Science and Technology Results Provide Meaningful Impact on the Field

Rating: 3.9

Assessment: LBNL is the lead institution for the Virtual National Laboratory (VNL) for Heavy Ion Beam Science. The other member institutions of the VNL include LLNL and PPPL. Under LBNL leadership, the VNL has produced 110 peer reviewed publications in the past one and a half years, of which 22 publications were from LBNL. The accomplishments of the Heavy Ion Fusion Science (HIFS)-VNL, communicated by these publications, have changed the way the High Energy Density Physics (HEDP) research community thinks about using beam pulse compression and unique control of ion beam deposition properties to improve measurements of warm dense matter properties, an important, discovery-rich branch of high energy density physics. This research field has been featured as one of the 15 thrust areas identified by the US National Task Force on High Energy Density Physics. Thirty-eight of the 110 peer-reviewed publications in the VNL involve advances outside the field in atomic physics (heavy ion stripping and ionization cross sections), warm dense matter physics (part of HEDP), and general accelerator science (e-cloud effects). Thirty one invited talks given by the VNL at major meetings, of which 12 were delivered by LBNL, in fusion, high energy physics, and warm dense matter, demonstrate the wide impact of the HIFS-VNL research over the past year and a half.

Objective 1.2 Provide Quality Leadership in Science and Technology

Rating: 4.2

Assessment: Under the scientific leadership of LBNL, the HIFS-VNL has been willing to pursue novel approaches and innovative solutions to problems. The invention of neutralized drift compression has led to an unprecedented 60 X longitudinal compression of a high intensity ion beam. A novel type of pulse line ion accelerator has also been invented.

Objective 1.3 Provide and Sustain Science and Technology Outputs that Advance Program Objectives and Goals.

Rating: Pass

Under the leadership of LBNL, the HIFS-VNL has published 110 total peer-reviewed publications in 2005 and to date in 2006 with the following breakdown with 22 contributed by scientists at LBNL. Of those 110, about 30 % are in fields outside of heavy ion fusion. Also, 30% of those publications are associated with invited papers at major scientific conferences.

Objective 1.4 Provide for Effective Delivery of Science and Technology

Rating: Pass

Assessment: LBNL has met all of its quarterly milestones and yearly targets. It has communicated its progress to DOE with weekly progress reports. It has documented this progress through a large number of peer-reviewed publications. It has been responsive to all requests for information from DOE.

Objective 2.1 Provide Effective Facility Design(s) as Required to Support Laboratory Programs (i.e. activities leading up to CD-s)

Assessment: N/A

Objective 2.2 Provide for the Effective and Efficient Construction of Facilities and/or Fabrication of Components (execution phase, Post CD-2 to CD-4)

Assessment: N/A

Objective 2.3 Provide Efficient and Effective Operation of Facilities

Assessment: N/A

Objective 2.4 Utilization of Facility to Grow and Support Lab's Research Base and External User Community

Assessment: N/A

Objective 3.1 Provide Effective and Efficient Stewardship of Scientific Capabilities and Program Vision

Rating: 4.2

Assessment: The Program Advisory Committees for the heavy ion beam program, consisting of 12 highly regarding accelerator and fusion experts, have conducted seven reviews on the quality of research in the program, on an average of twice a year. The PAC reports indicate that LBNL has quickly, appropriately, and effectively made a major re-direction of its research to meet new DOE objectives to support high energy density physics and cross-cutting accelerator beam science, while preserving core-competencies necessary for future facilities such as the IB-HEDPX, which is on the DOE list for a start in 2015. The LBNL has made great improvements in the capabilities of its existing facilities and equipment exploiting innovative new experimental techniques such as neutralized drift compression. This high risk approach has paid off in spectacular advances in heavy ion beam science and application to high energy density physics.

Objective 3.2 Provide Effective and Efficient Science and Technology Project/Program Planning and Management

Rating: 3.9

Assessment: LBNL has advanced the state of the art in beam driven high energy density physics by making hard decisions in a timely manner to focus the VNL resources onto the new DOE goals for high energy density physics. LBNL management voluntarily closed down a test stand at one of its labs when necessary to optimize remaining resources.

Objective 3.3 Provide Efficient and Effective Communications and Responsiveness to Customer Needs

Rating: 4

Assessment: LBNL has provided requested information from the DOE program office when asked, usually within a few days turnaround time, sometimes within less than 24 hours when required. LBNL management initiates phone calls to the DOE program manager whenever there is a pending or emerging issue to seek guidance, or to avoid surprises. These communications between LBNL and the DOE have been very effective.

HEP Laboratory Appraisal Summary

Science and Technology Goals and Objectives

Goal 1.0 Provide for Efficient and Effective Mission Accomplishment (45%)

The Contractor produces high-quality, original, and creative results that advance science and technology; demonstrates sustained scientific progress and impact; receives appropriate external recognition of accomplishments; and contributes to overall research and development goals of the Department and its customers.

Objectives:

1.1 Science and Technology Results Provide Meaningful Impact on the Field
Weights: 30% Score: 4.1 (A+)

1.2 Provide Quality Leadership in Science and Technology
Weights: 30% Score: 3.7 (A-)

1.3 Provide and sustain Science and Technology Outputs that Advance Program Objectives and Goals
Weights: 30% Score: 4.3 (pass)

1.4 Provide for Effective Delivery of Science and Technology
Weights: 10% Score: 4.3 (pass)

LBNL has world leading programs in cosmology, collider physics, detector development, superconducting magnets, and laser driven electron accelerators. All programs have performed up to their high standards this year, but the laser acceleration program stands out by achieving another breakthrough. Last year they demonstrated the acceleration of "beam quality" electron pulse to 70 MeV. The energy spread was a smaller than their ability to measure it, so that these pulses are candidates for use in a real accelerator. This year they followed that success with the acceleration of a similarly high quality electron pulse to 1 GeV in a plasma channel of only 3.3 cm.

LBNL physicists received several prestigious prizes for their work in cosmology. George Smoot will share the 2006 Nobel Prize in Physics for his work on the anisotropy of the cosmic microwave background. Saul Perlmutter shares the 2006 Shaw Prize in Astronomy for his work on the acceleration of universe measured with supernovae.

LBNL also received an R&D 100 award for their work on restoring antique audio recordings. This work was a spin-off from the detector development work done by the Physics Division.

Goal 2.0 Provide for Efficient and Effective Design, Fabrication, Construction and Operations of Research Facilities (20%)

The Contractor provides effective and efficient strategic planning; fabrication, construction and/or operations of Laboratory research facilities; and is responsive to the user community.

Objectives:

2.1 Provide Effective Facility Design(s) as Required to Support Laboratory Programs (i.e., activities leading up to CD-2)
Weights: 80% Score: 3.4 (B+)

2.2 Provide for the Effective and Efficient Construction of Facilities and/or Fabrication of Components (execution phase, Post CD-2 to CD-4)
Weights: 20% Score: 3.4 (B+)

2.3 Provide Efficient and Effective Operation of Facilities
Weights: 0% Score:

2.4 Utilization of Facility to Grow and Support Lab's Research Base and External User Community
Weights: 0% Score:

LBNL is involved in two major design efforts. The first is the Supernova Acceleration Probe which is a candidate for the Joint Dark Energy Mission of NASA and DOE. The other is the Daya Bay reactor neutrino experiment to measure $\sin(\theta_{13})$. Both efforts are making satisfactory progress. SNAP has been conducting a through research and development program to develop new light sensors for the experiment. Both the rad-hard CCDs and the new infrared detectors have reached a state of maturity that they can be used to satisfy the design requirements. SNAP has put together a management team to carry out the design of the experiment. They have effectively supported DOE's efforts to plan the project.

Daya Bay reactor neutrino experiment is a joint US-China proposal that would address the mission need for a measurement of the neutrino mixing angle, $\sin(\theta_{13})$. The LBNL group in the Daya Bay collaboration includes both Kam-Bui Luk, the cospokesman of the collaboration and William Edwards, the acting project manager. The Daya Bay group has just passed a review of the scientific reach of the experiment, and will now proceed to CD-1.

The major fabrication effort (post CD-2) at LBNL is the ATLAS project being built at CERN. LBNL has met all of their milestones on time and on budget.

Goal 3.0 Provide Effective and Efficient Science and Technology Program Management (35%)

The Contractor provides effective program vision and leadership; strategic planning and development of initiatives; recruits and retains a quality scientific workforce; and provides outstanding research processes, which improve research productivity.

Objectives:

3.1 Provide Effective and Efficient Stewardship of Scientific Capabilities and Program Vision
Weights: 40% Score: 3.6 (A-)

3.2 Provide Effective and Efficient Science and Technology Project/Program Planning and Management
Weights: 40% Score: 3.3 (B+)

3.3 Provide Efficient and Effective Communications and Responsiveness to Customer Needs
Weights: 20% Score: 3.4 (B+)

The development of new detector technologies and advancing the state of the art in superconducting magnets has been a core competency of LBNL for years. In recent years this has resulted in major contributions to the Babar, CDF, and ATLAS silicon vertex detectors. The Microsystems Laboratory has been critical to these efforts and is now contributing to the development of CCD detectors for SNAP and the Dark Energy Survey. LBNL has also developed technology for cosmic microwave background (CMB) measurements and is developing highly integrated detectors to search for the polarization of the CMB.

The superconducting magnet group has managed to preserve a lean but well integrated group that has expertise on all aspects of superconducting magnet development from conductor development to magnet fabrication and through testing.

Management of the research program has been effective in a difficult budget environment. Priority has been given to those efforts that match national priorities and utilize LBNL's strengths. Communications with headquarters have been useful and productive.

NP Laboratory Appraisal Summary

(NP ADDENDUM – SUPPORTING WRITEUP)
FY 2006 LABORATORY APPRAISAL
SCIENCE AND TECHNOLOGY

Laboratory: Lawrence Berkley National Laboratory (LBNL)

NP Program: Office on Nuclear Physics (NP)

Goal #1. Provide for Efficient and Effective Mission Accomplishment

The Contractor produces high-quality, original, and creative results that advance science and technology; demonstrates sustained scientific progress and impact; receives appropriate external recognition of accomplishments; and contributes to overall research and development goals of the Department and its customers.

1.1 Science and Technology Results Provide Meaningful Impact on the Field

Within the low energy program, the Sudbury Neutrino Observatory (SNO) experiment (solar neutrinos) and the KamLAND experiment (reactor and geo-neutrinos), where LBNL staff play prominent roles, have had a very high impact in the area of neutrino physics. LBNL researchers have a strong weak interactions program studying 14-O superallowed beta decay and beta-neutrino correlations in 21-Na decay. The heavy elements programs are once again becoming world-leading in the physics and chemistry of heavy elements and searches for superheavy elements, especially by making a systematic study of hot fusion for heavy element production. In the area of nuclear structure, staff is pursuing studies of the proton-neutron interaction in N = Z nuclei. Researchers are leading the effort in developing and fabricating the next generation gamma ray tracking array which will be the next-generation research tool (GRETINA) for studying nuclear structure and astrophysics at the National low energy user facilities. To date, project performance for the GRETINA Major Item of Equipment has been within cost and schedule plans.

The LBNL research staff have an excellent collaboration with National Reconnaissance Office (NRO) and USAF for the development of the capabilities of the 88-Inch Cyclotron and its infrastructure for the testing the radiation hardness of microelectronics that are deployed in space applications.

Within the relativistic heavy ion program, the scientific and technical contributions of the Relativistic Nuclear Collisions (RNC) group at LBNL continue to be significant. Its staff has provided outstanding scientific, technical and management leadership in the RHIC STAR program. RNC scientists have appeared as lead authors on a large fraction of STAR publications, demonstrating a high level of productivity especially in its areas of expertise on bulk properties of matter, short-lived probes and jet suppression in heavy ion collisions.

The group has continued to maintain a very active and semi-permanent presence at BNL in support of the STAR experiment and its detector upgrade R&D program – particularly, the Heavy Flavor Tracker (HFT) detector upgrade which should enable the measurement of open charm (D_0, D_s, D^+, Λ_c and their anti-particles). The RNC group leads this ambitious and challenging R&D project to build a high resolution pixel vertex detector based on CMOS technology. A technical effort is directed in the design of new STAR TPC front-end electronics that will speed up the read-out by a factor of 10. RNC scientists are also leading the development of an experimental program that will extend the present hard probes program in ALICE at the LHC. Specifically, the design and construction of an electromagnetic calorimeter has made significant progress. The Parallel Distributed Systems Facility (PDSF) is the STAR data analysis center operated jointly by NERSC and the RNC group at LBNL. This resource is used by the entire STAR collaboration and it continues to have a significant impact on the collaboration's scientific productivity. Overall, the RNC group is considered to be among the two strongest in the national laboratory heavy ion research program.

Within the Theory Program, LBNL scientists have had significant impact in relativistic heavy ion physics, providing support for interpretations of STAR data at the Relativistic Heavy Ion Collider (RHIC). No other theory group at any of the national laboratories has had as much impact on the RHIC program as the LBNL group has had. The continuing positive interaction between the theory group and the experimental RNC group greatly enhances the effectiveness of LBNL scientists in the area of RHIC physics. The past work on interpretations of RHIC data constitutes a

significant achievement of the nuclear theory program, and the planned work is an essential component of the NP research portfolio.

Within the Nuclear Data program, a small group of LBNL scientists plays a significant role in the national nuclear data effort that provides evaluated nuclear structure and decay data to the basic research and applied physics communities. The importance of this effort has been recently reaffirmed, as the nuclear data activities are important for counter-terrorism efforts. Additions to staff this year are expected to maintain the historical effort of The Isotopes Project, but it also suggest a likely new thrust in the direction of nuclear data needs for the advanced fuel cycle initiative.

1.2 Provide Quality Leadership in Science and Technology

LBNL researchers have significant scientific leadership in the national neutrino physics program including the ongoing SNO and KamLAND experiments, future neutrino-less double beta decay experiments, and in the development of the NSF funded Deep Underground Science and Engineering Laboratory. They are among the world leaders in heavy element chemistry and physics, and are one of two groups in the world that are at the forefront of the development of large segmented germanium array spectrometers. Several LBNL scientists are in leadership roles in the national nuclear physics community and in overall Nuclear Physics program planning.

Relativistic Nuclear Collisions (RNC) Group has provided scientific and technological leadership on the STAR and ALICE experiments at RHIC and LHC, respectively. LBNL scientists have published many papers in the top scientific journals. RNC staff includes: the deputy spokesperson of the STAR experiment; the lead scientist on the R&D of the silicon pixel Heavy Flavor tracker upgrade identified in the BNL Mid-Term Strategic plan; the deputy project manager of the ALICE electromagnetic calorimeter project, and other Physics Working Group leadership positions.

Important scientific and technical achievements during the last year, in which the RNC staff played a major role, include: investigation of Mach Cones using di-hadron correlation shapes in Au+Au collisions; ϕ-meson production in Au+Au collisions; the study color charge dependence of the energy loss and the fragmentation functions at high transverse momentum; yields and/or elliptic flow of single electrons, K^0_s, Λ, d and ^{3}He in Au+Au collisions; the study of nucleon spin with jets and hyperons; the continued R&D and simulations of the Heavy Flavor pixel tracker and its readout and data sparsification system; development and study of mechanical concepts for support, cooling, thin beam pipe technology and installation; the DOE ALICE EMCAL Review; and the project engineering for the construction of the ALICE EMCAL Support Structure.

The RNC group has demonstrated a willingness to pursue novel, high-risk technology approaches which, if successful, would significantly advance the development of super-thin pixel detectors.

1.3 Provide and sustain Science and Technology Outputs that Advance Program Objectives and Goals

The low energy researchers have a commendable record of publication in refereed journals with 54 in nuclear structure/astrophysics, 17 in neutrino science, and 12 in accelerator physics. Research at the 88-Inch Cyclotron facility has resulted in 4 PhD theses.

The high rate of scientific publications is testimony for a very productive heavy ion group. RNC scientists continue to play a leading role in high-impact RHIC publications. Invited talks at

international conferences demonstrate a high level of recognition of the group's research and technical advancements by the scientific community

1.4 Provide for Effective Delivery of Science and Technology

Research by LBNL researches addresses a number of Nuclear Physics program performance milestones in nuclear structure and astrophysics, as well as in fundamental interactions and neutrinos. The NRO and USAF view the 88-Inch Cyclotron as their "facility of first choice" for their applied research programs.

The high rate of scientific publications by the RNC group is a testimony its efficiency and effectiveness in delivering the science. The Parallel Distributed Systems Facility (PDSF) operated by the RNC group is an essential resource utilized the entire STAR data analysis efforts. This resource has continued to sustain the STAR collaboration's ability to effectively and efficiently deliver the science.

Goal #2. Provide for Efficient and Effective Design, Fabrication, Construction and Operations of Research Facilities

The Contractor provides effective and efficient strategic planning; fabrication, construction and/or operations of Laboratory research facilities; and is responsive to the user community.

2.1 and 2.2: Not Evaluated

2.3. Provide Efficient and Effective Operation of Facilities.

The operations of the 88-Inch Cyclotron are supported for an in-house Nuclear Physics program, and partially supported by the NRO and USAF. The 88-Inch Cyclotron provided more hours than they had planned, with high reliability for their local basic research program and for applied users. The NRO and USAF utilized approximately 40% of the beamtime; approximately three quarters of that time was for the so-called cocktail beams that enable efficient changes of beam species for their applications.

2.4. Utilization of Facility to Grow and Support Lab's Research Base and External User Community.

The 88-Inch Cyclotron is utilized for nuclear physics and chemistry research, to test and develop segmented germanium array technology and methods, and for the NRO and USAF applied programs where LBNL has provided special capabilities attuned to their needs. The facility is developing capabilities relevant to science for Stockpile Stewardship such as neutron beams, and instrumentation for particle-gamma-ray coincidence studies that are relevant to science for Stockpile Stewardship and possibly advance fuel cycles.

Goal #3. Provide Effective and Efficient Science and Technology Program Management

The Contractor provides effective program vision and leadership; strategic planning and development of initiatives; recruits and retains a quality scientific workforce; and provides outstanding research processes, which improve research productivity.

3.1 Provide Effective and Efficient Stewardship of Scientific Capabilities and Program Vision

LBNL scientific and technical staff continues excellent operation of 88-Inch Cyclotron and its infrastructure and are building on their strength in ion sources for accelerators. The staff continues a strong stewardship of heavy element chemistry, essentially the only such program in the U.S. The scientific staff is identifying and developing of capabilities that may be used for science related to Stockpile Stewardship and advanced fuel cycles. They continue to plan for new instrumentation capabilities such as GRETA. The 88-Inch Cyclotron research staff has developed a ten-year facility and science plan.

3.2 Provide Effective and Efficient Science and Technology Project/Program Planning and Management

The LBNL low energy group is planning to maintain and build on present successes in neutrino physics, heavy element physics and chemistry, and for nuclear structure and astrophysics. They have plans that enable them to continue to be responsive to the NRO and USAF with the new capabilities they need throughout the period covered by the MOA. The low energy group is proactive in pursuing science relevant to applied areas.

3.3 Provide Efficient and Effective Communications and Responsiveness to Customer Needs

LBNL management provides a strong laboratory manager's briefing. The group has provided the most recent Laboratory internal review report of their program and documentation of their self evaluation in lieu of a regular Office of Nuclear Physics program review. LBNL expresses strong interest in an S&T-like review of their program on a yearly basis.

WDTS Laboratory Appraisal Summary

LBNL SC Lab Appraisal for 2006 (narrative assessment supporting ratings)

November 15, 2006

Goal 1.0
LBNL's Center for Science and Engineering (CSE) does a superior job in managing the Workforce Development programs. Their strength lies in the fact that over the recent few years and especially in 06 they achieved all program deliverables and creatively leveraged the WD programs to extend science ed to students and teachers well beyond those for which they are provided funding. CSE has developed a cooperative learning environment at the lab by designing programs that collaborative learning and facilitate interaction among participants from different programs. They also use the programs and the internship/fellowship at the lab to encourage culture improvement such as safety and the importance of ongoing scientific exchange between PIs and the scientific community outside the lab,

Goal 3.0
CSE is a highly motivated well managed team that works continually to integrate science education and workforce development into the research mission of the lab. CSE has successfully advanced the education

culture at the lab and has successfully collaborated with local and state school systems and builds on those links to extend the venture of science education.

EERE Laboratory Appraisal Summary

U.S. Department of Energy
Office of Energy Efficiency and Renewable Energy

Performance Evaluation of the University of California for
Management and Operations of Science and Technology at the

Lawrence Berkeley National Laboratory
(Contract No. DE-AC03-76SF00098)

For the Period October 1, 2005 – September 30, 2006

October 31, 2006

Executive Summary

The Office of Energy Efficiency and Renewable Energy (EERE) participates in the award-fee evaluation process to assess the performance of a National Laboratory in the area of science and technology. This requirement originates from the annual "Standards of Performance-based Fee" clauses negotiated between the U. S Department of Energy (DOE) and a contractor managing and operating (M&O) a National

Laboratory. Existing contracts call for annual evaluations. The result of the evaluation — the overall weighted score for the science and technology goals awarded by all DOE programs — determines the percentage of the available performance-based fee that the M&O contractor earns.

EERE prepared this evaluation as its input to the DOE award-fee evaluation of the University of California's performance for the management and operation of the Lawrence Berkeley National Laboratory (LBNL). It assesses LBNL's performance of work for programs in EERE from October 1, 2005, to September 30, 2006.

Each reporting EERE program evaluated LBNL's performance using the Performance Goals specified by DOE. The overall grade for each Performance Goal or Objective represents a weighted average of grades received from EERE program offices. The computation uses each program=s FY 2006 obligations at LBNL as of August 31, 2006, as the weighting factor.

Four of the ten EERE programs, namely Building Technologies (BTP), FreedomCAR and Vehicle Technologies (FCVT), Geothermal Technologies (GTP), and Industrial Technologies (ITP), each having obligated $1.0 million or more to LBNL, were asked to submit evaluations.

For LBNL, EERE arrived at an overall grade of "A-" for two Performance Goals, namely Accomplish Mission, and Effective Science and Technology Research Project and Program Management, and "B+" for one Performance Goal, namely, Effective and Efficient Operation of Facilities. Where the programs gave grades of "B+" or higher, the programs believe that LBNL=s performance in this factor translates to substantive performance and results for the program. The table below shows the ratings awarded by the reporting EERE program.

Letter Grades by Performance Goal	GOAL 1: ACCOMPLISH MISSION	GOAL 2: EFFECTIVE AND EFFICIENT OPERATION OF FACILITIES	GOAL 3: EFFECTIVE SCIENCE AND TECHNOLOGY RESEARCH PROJECT AND PROGRAM MANAGEMENT
BUILDING TECHNOLOGIES PROGRAM	B	B	B
FREEDOMCAR AND VEHICLE TECHNOLOGIES PROGRAM	A+	A	A+
GEOTHERMAL TECHNOLOGIES PROGRAM	A	N/A	A
INDUSTRIAL TECHNOLOGIES PROGRAM	A	N/A	A
OVERALL EERE GRADE	A-	B+	A-

Introduction

This evaluation has been prepared as part of the DOE's contractual obligation to assess the University of California's performance for the management and operation of science and technology at LBNL. Specifically, it assesses LBNL=s support of EERE's program offices in science and technology and its ability to assist these program offices in maintaining the overall EERE mission: to strengthen America=s energy security, environmental quality, and economic vitality through public-private partnerships.

This evaluation report, covering the period from October 1, 2005, through September 30, 2006, comprises five sections. The first section highlights the given performance goals, objectives, and measures provided to each DOE EERE technical program office. The second addresses the process followed to grade the laboratory's performance. The third section presents the overall grades resulting from the evaluation. The fourth section lists key achievements and areas of concern. The fifth and final section provides guidance for the next performance period.

Performance Goals, Objectives, and Measures

This evaluation focuses on grading the contractor's performance against Performance Goals as described below. Each evaluator measures progress against these Performance Goals using a set of Performance Objectives and Performance Measures, defined as follows:

- Performance Goal: This is a general overarching statement of the desired outcome for each major performance area.
- Performance Objective: An objective is a statement of desired results for an organization or activity within a major performance area.
- Performance Measure: A performance measure provides a reviewer a quantitative or qualitative method for characterizing performance to assist in assessing achievement of the corresponding Performance Objective.

The Performance Goals and Performance Objectives used by EERE, for the most part, adopt the standardized versions of goals and objectives defined by the Office of Science, as stated in the following:

- Goal 1: Accomplish Mission
  - Objective 1.1: Accomplish Mission
  - Objective 1.2: Leadership
  - Objective 1.3: Produce high-quality, original, and creative results that advance science and technology (recognition of Science and Technology breakthroughs)
  - Objective 1.4: Delivery

- Goal 2: Effective and Efficient Operation of Facilities
  - Objective 2.1: Provide effective and efficient operation of facilities supporting the EERE program

- Goal 3: Effective Science and Technology Research Project and Program Management
  - Objective 3.1: Effective program vision and leadership
  - Objective 3.2: Effective and efficient science and technology project and program planning and management
  - Objective 3.3: Efficient and effective communications and responsiveness to EERE and EERE Project Management Center needs

EERE also adjusted the Performance Measures under Goal 1 to include success in meeting program milestones and other criteria appropriate to applied research. EERE uses only one Performance Objective under Goal 2, namely the effective and efficient operation of facilities to support EERE programs.

evaluation processes: Letter grades and averaging

EERE programs assigned a letter grade to each performance goal. Each letter grade translated into a numeric grade, using the evaluator=s Input Rating Scale, for example 4.3 = A+, 3.9 = A, 3.3 = B+.

EVALUATOR'S INPUT RATING SCALE											
Grade	A+	A	A-	B+	B	B-	C+	C	C-	D	F
Score	4.3	3.9	3.6	3.3	2.9	2.6	2.4	1.9	1.4	0.9	0.4

After collecting the grades, EERE weighted them against specific program obligations for FY 2006 at LBNL, as reported in the DOE Standard Accounting and Reporting System report as of August 31, 2006. See the table below for total funding allocations for each EERE program.

PROGRAM OFFICE	FY 2006 OBLIGATIONS AT LBNL AS OF 8/31/2006 ($ THOUSANDS)

BUILDING TECHNOLOGIES PROGRAM	$7,674
FREEDOMCAR AND VEHICLE TECHNOLOGIES PROGRAM	$6,625
GEOTHERMAL TECHNOLOGIES PROGRAM	$1,360
INDUSTRIAL TECHNOLOGIES PROGRAM	$1,082
TOTAL	**$16,831**

EERE then computed a weighted average grade for each Performance Goal (Objective).

The following example illustrates the algorithm used to compute a weighted average.

A	B	C	D	E
PROGRAM	LETTER GRADE	NUMERICAL SCORE	FY 2006 OBLIGATIONS	WEIGHTED SCORE
One	A+	4.3	$2,000,000	8,600,000
Two	A	3.9	$20,000,000	78,000,000
Three	B+	3.3	$6,000,000	19,800,000
SUM			$28,000,000	106,400,000
WEIGHTED AVERAGE (SUM OF COLUMN E/SUM OF COLUMN D)				3.80

EERE converted the computed average back to a letter grade using the following scheme:

AVERAGE SCORE TO LETTER GRADE CONVERSION TABLE											
Score	4.16 - 4.30	3.76 - 4.15	3.46 - 3.75	3.16 - 3.45	2.76 - 3.15	2.46 - 2.75	2.16 - 2.45	1.66 - 2.15	1.16– 1.66	0.6 - 1.15	<0.6
Grade	A+	A	A-	B+	B	B-	C+	C	C-	D	F

Outcome by Performance Goal

EERE graded the University of California=s performance for FY 2006 as "A-" for two Performance Goals, namely Accomplish Mission, and Effective Science and Technology Research Project and Program Management, and "B+" for one Performance Goal, Effective and Efficient Operation of Facilities. The following tables highlight the adjectival ratings issued by each of the program offices. Please note that the table presents this aforementioned data per Performance Goal.

Letter Grades by Performance Goal	GOAL 1: ACCOMPLISH MISSION	GOAL 2: EFFECTIVE AND EFFICIENT OPERATION OF FACILITIES	GOAL 3. EFFECTIVE SCIENCE AND TECHNOLOGY RESEARCH PROJECT AND PROGRAM MANAGEMENT
BUILDING TECHNOLOGIES PROGRAM	B	B	B
FREEDOMCAR AND VEHICLE TECHNOLOGIES PROGRAM	A+	A	A+
GEOTHERMAL TECHNOLOGIES PROGRAM	A	N/A	A
INDUSTRIAL TECHNOLOGIES PROGRAM	A	N/A	A
OVERALL EERE GRADE	A-	B+	A-

Selected Examples of Achievements and Deficiencies

EERE, in the order of each Performance Goal, has highlighted selected major achievements recognized throughout FY 2006. It also addresses certain areas within the LBNL research and development (R&D) environment needing management attention.

GOAL 1: ACCOMPLISH MISSION WITH THE FOLLOWING OBJECTIVES:

$ Sustained scientific progress and impact
$ Leadership (as recognized by science and technology accomplishments)
$ Advance science and technology with high-quality, original research, and creative results
$ Advance the research, development, and demonstration goals of EERE and its stakeholders

Significant Achievements

Building Technologies Program

LBNL continued its project on the development of a low-cost highly insulating window. This novel concept was fully tested. Furthermore, with the help of SAGE Electrochromics Inc., LBNL developed the first integrated highly insulating dynamic full-scale window prototype. LBNL used stage gating techniques to narrow down the final design concepts. While there is considerable work ahead to commercialize this product, the FY 2006 achievements regarding windows are significant.

LBNL exhibits cutting edge R&D capability with its commercial building control and monitoring work. The work is coordinated with similar work funded by the California Energy Commission and the New York State Energy Research and Development Authority. LBNL is able to foresee the potential impacts caused by changing the ways buildings will be built and operated.

FreedomCAR and Vehicle Technologies Program

LBNL is the lead laboratory for a multi-million dollar, multi-university exploratory battery research program — the Batteries for Advanced Transportation Technology program — and contributes diagnostic expertise to the DOE's Advanced Technology Development program. The investigators at LBNL are highly regarded, world-class scientists who perform leading edge research toward understanding the fundamental issues impeding the development of electric, hybrid, and fuel cell vehicle batteries. LBNL's contributions are critical to the FCVT program realizing its mission goals, specifically:

$ LBNL developed a new method of coating electrode active materials with carbon (a necessary step in all Li-ion battery materials) using chemical vapor deposition microwaves that promises to enhance the quality of the coatings and lesson the cost of this critical step.

$ LBNL reported on a completely new investigation of the interfacial properties of advanced high-power batteries by studying the formation of the solid electrolyte interface and its change with cycling using Fourier transform infrared spectroscopy. The results of this investigation have, for the first time, identified some of the compounds that comprise this critically important part of the Li-ion battery, and may lead the way towards longer living and higher performing batteries.

Geothermal Technologies Program

CPS 17465-11175: Gas and Isotope Geochemistry. LBNL delineated a systematic regional trend in helium isotope geochemistry across the Basin and Range in western United States. The Basin and Range is a promising area for geothermal power plant development and LBNL's research provides a map for delineating fault systems characterized by high, deep permeability. This research will help focus geothermal exploration for commercial-size geothermal resources on high probability areas throughout the

Basin and Range. This original research has generated much interest in the geothermal community and was very highly rated in the last Exploration subprogram peer review.

CPS 17464-11178: 3-D Magnetotelluric Imaging. LBNL refined state-of-the-art magnetotelluric geophysical methods and produced a 3-D resistivity model of the Coso geothermal system in California that clearly shows the controlling geological structures influencing well production. Furthermore, it was demonstrated that by extending data set and modeling capability to lower frequency (0.3 Hertz), it enhances the ability to locate subsurface fluids, as defined by electrical conductivity contacts, which is critical for well placement in exploration and development of commercial geothermal systems.

Industrial Technologies Program

DOE's goal in the ITP Best Practices subprogram is to reach and influence 50,000 plants to save more than 2.5 percent energy for each. LBNL's effort has helped DOE reach its goals. LBNL has continued its successful development and implementation of public/private partnerships that form the core of the ITP Technology Delivery subprogram. ITP's private sector partners laud the laboratory for timeliness and accuracy in its delivery of energy management best practices. The laboratory has managed the creation of a database of the largest energy using industrial companies in the United States, an activity that has proven essential to the ITP Technology Delivery strategy.

Notable Achievements

Building Technologies Program

LBNL continues to have an extremely high reputation for providing highly valued science and technology support for the window industry. For example, during several very high level meetings where the windows industry complained about the independent non-profit window rating organization, the industry applauded LBNL's independent work and encouraged them to become even more involved in providing its unbiased support to the industry. In FY 2006, LBNL will complete the technical algorithm and software development work for the suite of Windows 6 fenestration simulation rating tools. These tools offer dramatic reduction in test burden for manufacturers during their design and eventual product rating procedures. The new tools provide expanded capability for a range of commercial fenestration products that previously could not be simulated and were required to be tested.

One of LBNL's notable achievements is the development of an improved residential air duct leakage testing method that allows real-time analysis of leaks.

LBNL serves on the American Society of Heating, Refrigerating, and Air-Conditioning Engineers and American Society of Testing and Materials committees, chairs the International Energy Agency Air Infiltration and Ventilation Center steering group, and has published six technical reports and four journal papers.

FreedomCAR and Vehicle Technologies Program

LBNL researchers are world-class, recognized experts in the field of electrochemistry. In FY 2006, they have published over 20 papers in peer-reviewed journals.

LBNL researchers developed and demonstrated a novel method of measuring the diffusivity of Li-ions in a wide-range of liquid electrolytes. Other researchers have acknowledged "the most time-consuming quantity to measure accurately is the diffusion coefficient," and noted that work aimed at streamlining this process would be useful.

Geothermal Technologies Program

CPS 17464-11186: Remote Sensing of Localized Strain. In collaboration with Lawrence Livermore National Laboratory, LBNL developed a technique for imaging concentrated strain in the Earth's crust using interferometric synthetic aperture radar observations from an orbiting satellite. Using this technique,

changes in fault-fluid interactions that result in increased crustal strain were imaged and mapped on a regional scale facilitating exploration for geothermal systems.

Industrial Technologies Program

Working with the Process Heating Steering committee, LBNL updated the Process Heating Sourcebook that now includes electric-based process heating technology.

Significant Deficiencies

Building Technologies Program

The lighting research and development (LR&D) element of the BTP is focused on solid state lighting, with activities largely in physics, chemistry, and electrical engineering of semiconductors (applied research for breakthroughs). LBNL's work on the Integrated Building Energy Controls and High Dynamic Range Image-Based Controls tasks do fall within the broad range of EERE's mission, but are not a good fit with LR&D. Neither task is related to semiconductor science/engineering or advancing pre-commercial technology in a "push the envelope" sense for their respective areas. Most activities are late-stage product development or demonstration (more suited for private companies).

LBNL's performance on appliance standards is average. First drafts of work are getting better, but LBNL still needs to improve the draft standards to get a quality product on time and on budget to DOE.

Goal 2: Effective and Efficient Operation of Facilities WITH THE OBJECTIVE OF EFFECTIVE AND EFFICIENT OPERATION OF FACILITIES.

Significant Achievements

FreedomCAR and Vehicle Technologies Program

Energy storage technologies, especially batteries, are critical enabling technologies for the development of advanced, fuel-efficient, light- and heavy-duty vehicles and are, thus, key components of the DOE's Energy Strategic Goal. LBNL has recently upgraded their cell making laboratory, enhancing both the quality and consistency of the lab-built cells, enabling more rigorous evaluation of novel materials, and enhancing their ability to support the university researchers' efforts.

Notable Achievements

Building Technologies Program

LBNL upgraded its optics lab capability in FY 2005. This lab continued to function at very high efficiency and thus funding from private industry was sufficient to pay for most of the glazing optical data assessments. Issues such as backlogs with industry were no longer the case as in years with the old equipment.

LBNL lost the test facility for Delta-Q tests but was able to use field tests to continue most of the work, thus demonstrating success in planning Delta-Q test work without increased cost or reduced output.

Significant Deficiencies

Building Technologies Program

Beyond the control of the windows research group, the laboratory decided to move the sputtering chamber that is used to deposit a variety of experimental hydride layers on glass substrates. This work is critical for the Reflective Hydride Electrochromic project which LBNL won an R&D 100 Award in FY 2004. However, the move was poorly coordinated and the result was that the facility was shut down for an exceptionally long time. This resulted in significant delays for planned milestones in mid-FY 2006. LBNL has been working to make up the schedule, but the milestones will still be late.

GOAL 3: EFFECTIVE SCIENCE AND TECHNOLOGY RESEARCH PROJECT / PROGRAM MANAGEMENT with the following objectives:

$ Sustained scientific progress and impact.
$ Leadership (as recognized by science and technology accomplishments).
$ Advance science and technology with high-quality, original research, and creative results.
$ Advance the research, development, and demonstration goals of EERE and its stakeholders.

Significant Achievements

Building Technologies Program

Coordination of commercial buildings controls work with other efforts funded separately makes management far more difficult. LBNL's success in managing the work and the vision necessary to undertake this work is of the highest standard.

FreedomCAR and Vehicle Technologies Program

Investigators at LBNL manage a major FCVT program that concentrates on exploratory research into advanced materials for electrochemical energy storage. As part of this program, LBNL oversees and/or directs the research of 23 principal investigators at LBNL, two other national labs, plus eight academic and one commercial institution.

Each year DOE holds a full merit review meeting, at which outside experts from the auto industry, universities, and commercial enterprises review and score the projects that LBNL manages. Each year, the LBNL management has been exemplary in implementing the changes identified by DOE management through this process.

Finally, the managers at LBNL have consistently sought out the most qualified principal investigators for specific research tasks regardless of where they are employed.

Geothermal Technologies Program

LBNL has worked closely and productively with the Lawrence Livermore National Laboratory on the Remote Sensing of Localized Strain project and cooperates effectively with members of geothermal industry to acquire field data for research activities.

LBNL showed leadership and professionalism in the ongoing close-out activities by promptly providing to Headquarters (HQ) GTP cost data and other pertinent information required for an efficient close-out that preserves the fruits of past research. LBNL also participated frankly and succinctly in HQ close-out meetings dealing with changes to personnel and research activities.

LBNL has shown visionary thinking in its proposal to extract heat from geothermal reservoirs by using water instead of carbon dioxide. This proposed use of carbon dioxide may also have the added benefit of sequestering carbon dioxide away from the atmosphere.

Industrial Technologies Program

LBNL has provided important assistance to the ITP Best Practice activity. They have been a major contributor to the delivery of near-term energy efficiency practices to the industrial sector, and have provided critical support to the Secretary's initiative on the *Save Energy Now* campaign. This campaign is helping industry to identify achievable energy savings in their plants. LBNL has demonstrated highly effective planning and management of projects. This includes excellent transfer of results to private companies. Budget management has been exceptional. Below is a list of LBNL achievements in

supporting the DOE ITP Best Practices program goal to reach and influence 50,000 plants to save more than 2.5 percent energy for each:

- $ Developed Energy Savings Assessment Management System that allows tracking of results of *Save Energy Now* energy savings assessments.
- $ Refined the Best Practices Tracking System database to more accurately measure impact of the manufacturing plant's use of DOE Best Practices tools and resources.
- $ Updated the Large Energy Users database that is a database of the largest 4,000 manufacturing plants in the United States.
- $ Prepared quarterly reports tracking the new manufacturing plants impacted by ITP/EERE resources. This information is integral to the ITP and the Best Practices program to report on one of its JOULE targets.

Notable Achievements

Building Technologies Program

Considering a range of issues that have included key personnel having serious medical problems, delays in DOE funding, fluctuating budget levels, and more focused DOE research plans in accordance with our multi-year plan, LBNL has adapted quite well and has transitioned from a predominantly technology support organization to both technology development and technology support for windows. LBNL has shown significant leadership in assisting DOE plot a course for the next generation of windows that can become net energy producers rather than energy losers.

For windows research, LBNL had higher than expected uncosted funding levels entering into FY 2006, and thus DOE had to rescind funding. LBNL managed the situation well, especially considering the issue of sub-contractors, and will have carryover funding levels below DOE guidelines at the start of FY 2007.

Although not advancing science, the Integrated Building Energy Control System technology was embedded into commercially available dimming ballast with ELB Electronics, Inc. This late-stage product development action shows that LBNL is successful in transitioning this task out of the lab into private industry products.

The High Dynamic Range Image-Based Controls task has met a key requirement — photometric documentation of complex scenes by a non-expert in less than five minutes. Relative to assisting in lighting design, this achievement puts the technology close to transitioning to industry for final product development.

Coordination of commercial buildings controls work with that funded by other entities makes its management far more difficult. LBNL's success in managing the work and the vision necessary to undertake this work is indeed of the highest standard.

LBNL is acknowledged as a leader and a resource to industry groups involved in improving energy efficiency in ventilation as evidenced by talks and papers LBNL presented. LBNL gave a presentation to the "White House Summit on Federal Sustainable Buildings" related to ventilation.

FreedomCAR and Vehicle Technologies Program

All quarterly reports are delivered on time. Guidance for future work is distributed to principal investigators in a timely fashion.

Geothermal Technologies Program

LBNL's research substantially supports the GTP's goal of doubling the geothermal exploration success rates for wells drilled in greenfield areas. LBNL has aligned their research precisely with GTP's Multi-Year Program Plan (MYPP) and has strong core capabilities to help GTP achieve its MYPP goals.

Notable Deficiencies

Building Technologies Program

Building Technologies Program management changed the reporting requirements for the National Laboratories to a quarterly basis, and the windows Technology Development Manager (TDM) still requested a brief monthly report. While these reports are being prepared in accordance with the TDM guidelines, they could be improving timeliness.

Project management of appliance standards is improving after several discussions with DOE management. Overall, LBNL is starting to move in the right direction but it will take time to quantify the magnitude of this change in direction and to confirm these improvements as being permanent.

Significant Deficiencies

Building Technologies Program

Four out of five deliverable reports on the Integrated Building Energy Control System and the High Dynamic Range Image-Based Controls tasks are late in FY 2006, as of August. The quarterly reporting of progress and spending is simply not working. Events occur and are reported well after the fact. This leaves the TDM with little control and limited current knowledge to take action.

Guidance for the Next Performance Period

Performance Expectations for the National Laboratory for the Next Performance Period (for example, anticipated accomplishments and level of work, areas of concentration, and remedial actions).

Building Technologies Program

LBNL needs to complete the stage gating activities for the reflective hydride windows research project and then DOE will determine if this project has the true potential to achieve the second-generation electrochromic performance that is needed to offer dramatic cost reductions.

LBNL should continue to pursue possible partnerships with private industry for the commercialization of highly insulated windows.

LBNL should continue to find ways to further leverage the technology support work through private industry investments in windows research.

With the air duct ventilation Delta-Q work and the air cleaning work winding down, there will be a need to articulate a good plan for future residential and commercial ventilation R&D to compete successfully for limited research dollars.

LBNL should continue to develop projects and statements of work in the context of Stage Gate requirements and evaluations.

FreedomCAR and Vehicle Technologies Program

It is anticipated that investigators will follow recommended DOE guidance and continue to make excellent progress.

Geothermal Technologies Program

At the time of this evaluation, the President's FY 2007 request for the GTP was zero dollars. The House mark is $5 million, and the Senate mark is $22.5 million. Due to the large uncertainty in future funding for the GTP, HQ GTP expects that LBNL will close out geothermal activities in a timely manner and provide final reports to HQ and to Oak Ridge's Office of Science and Technical Information for addition to the geothermal database. If the GTP receives significant funding in FY 2007, selected geothermal research activities may continue at LBNL.

Industrial Technologies Program

Continued contributions to the public/private partnerships are the central feature of the ITP Technology Delivery subprogram. Continue contribution to the documentation of actions relevant to the DOE and EERE missions and to improving industry energy efficiency and productivity.

Input on Concerns for Laboratory Management (discussion of potential problem areas):

Building Technologies Program

LBNL needs to do a better job preparing items for reporting to DOE's management. While the TDM notes that it is difficult to find items from a very technical based research program that are of interest to a general DOE audience, throughout the course of these projects there should be ample opportunity for such reporting.

RW Laboratory Appraisal Summary

LAWRENCE BERKELEY NATIONAL LABORATORY'S PERFORMANCE EVALUATION AND APPRAISAL REPORT FY 2006

1.0 Provide for Efficient and Effective Mission Accomplishment (Quality, Productivity, Leadership, & Timeliness of Research and Development)

The Provide for Efficient and Effective Mission Accomplishment Goal measured the overall effectiveness and performance of the Contractor in delivering science and technology results which contributed to and enhanced the DOE'S mission of protecting our national and economic security by providing world-class scientific research capacity and advancing scientific knowledge by supporting world-class, peer-reviewed scientific results, which were recognized by others.
Overall score: 4.175
Grade: A+

1.1 Science and Technology Results Provide Meaningful Impact on the Field

The weight of this Goal is 25 percent.

For the last 20 years, the Lawrence Berkeley National Laboratory's (LBNL) Earth Sciences Division (ESD) has significantly contributed to many aspects of the site characterization and performance assessment efforts of Yucca Mountain for the Office of Civilian Radioactive Waste Management (OCRWM). LBNL's research has been focused on the 600-m-thick unsaturated zone. Prior to the Yucca Mountain studies, most published research in unsaturated zone was confined to near-surface flow and transport processes in relation to the soil vadose zone. LBNL's studies at Yucca Mountain-published widely in peer-reviewed journals, including two special issues of Journal of Contaminant Hydrology-have greatly advanced the knowledge of flow and transport in thick, fractured, unsaturated rocks, and brought LBNL the recognition in the scientific research community as the leader in fundamental understanding, testing, analysis, and modeling of unsaturated flow and transport in fractured porous media. Within OCRWM, LBNL's scientific contribution to the waste disposal program is highly valued, and LBNL's scientific judgment is trusted. LBNL has frequently been selected to represent the Yucca Mountain project to external oversight panels and review boards.

During the 2006 performance period, LBNL staff have participated in development of the technical bases for projecting long term (>10,00 years) performance of a geologic repository for spent nuclear fuel and high-level radioactive waste. LBNL staff is primary authors of reports on Unsaturated Zone Flow and Transport reports that will be referenced in the repository License Application. The work has been timely, accurate, and of high quality.

At the establishment of the Science and Technology Program (S&T) in OCRWM, the director of ESD was appointed to be the Head of the Natural Barriers Thrust, one of three science thrusts in the S&T program. The Thrust Lead has assembled a balanced portfolio of projects to develop outstanding core competencies and scientific excellence in exploratory, high-risk research that is expected to result in greatly improved repository performance at reduced cost.

In addition to leading the Natural Barrier Thrust, LBNL's ESD staff is investigators for 10 research projects within the S&T program. The results of the LBNL S&T projects have the potential to change the current view of the capability of the natural system at Yucca Mountain to isolate the radioactive waste in a geological repository. Examples of significant ongoing studies include: (1) developing new understanding of field-scale matrix diffusion coefficients over those derived from laboratory studies; (2) analog studies are developing a greater understanding of the drift-shadow concept, which may

result in significantly delayed release of radionuclides from the emplacement drifts to the rocks; (3) preliminary results from a study of coupled thermal-hydrological processes within the drift indicates that natural convection removes moisture from the waste packages, thus reducing the potential for corrosion of waste packages and engineered components; (4) the development of a fully coupled, state-of-the-art thermal, hydrological, chemical (THC) model will enhance our ability to realistically delineate THC processes in the rock and the emplacement drifts; and (5) field observation indicated localized fast transport in the fractured volcanic tuff at Yucca Mountain.
Overall score: 4.2

1.2 Provide Quality Leadership in Science and Technology

The weight of this Goal is 25 percent.

As the S&T program Natural Barriers Thrust Lead, LBNL has assembled a balanced portfolio of projects to develop (1) outstanding core competencies in understanding the natural system, and (2) scientific excellence in exploratory, high-risk research that are expected to result in greatly improved repository performance. The corresponding scientific challenges-reflected in an S&T call for proposals-has attracted participation from universities and other research institutions.

Projects led by LBNL staff are pursuing innovative solutions to high-level waste isolation, taking on high-risk/high-payoff research problems. The LBNL research related to the concept of a drift shadow, description of the thermally driven coupled processes within emplacement drifts, and field and laboratory studies on transport parameters and retardation processes, are providing a strong scientific basis for the capability of Yucca Mountain to effectively isolate radionuclides from the accessible environment. In 2006, LBNL scientists made several presentations to the Nuclear Waste Technical Review Board, and received complimentary responses for addressing the Board's concerns. Similarly, the S&T program was favorably received by the U.S. Nuclear Regulatory Commission Advisory Board. Both advisory boards recognize that the natural barriers program led by LBNL plays an important role in resolving outstanding waste isolation issues.
Overall score: 3.9

1.3 Provide and Sustain Science and Technology Outputs that Advance Program Objectives and Goals

The weight of this Goal is 25 percent.

The OCRWM program is focused on successful submittal of a license application in 2008, defense of the application and receipt of a construction authorization to allow a repository for spent nuclear fuel and high-level radioactive waste to open by 2018. The work performed by LBNL is a key part of that work. The LBNL investigators working on the OCRWM program have done an outstanding job in completing the work necessary to achieve the program goals.

In 2006, each of the Targeted Thrusts in the S&T program assembled external experts to conduct an independent review of the S&T projects to evaluate program accomplishments and to provide advice on program direction and emphasis. Every LBNL S&T project has received high marks on the independent peer reviews. The LBNL project results obtained during the two years since the inception of the S&T program have been published in multiple conference proceedings and have been submitted to peer-reviewed journals. All LBNL S&T projects were showcased in two special sessions at the International High-Level Nuclear Waste Management Meeting in April 2006.
Grade: Pass (Numerical grade: 4.3)

1.4 Provide for Effective Delivery of Science and Technology

The weight of this Goal is 25 percent.

All projects within the LBNL-led Natural Barriers Thrust met expected goals and milestones. Despite

reduced FY 2006 funding, LBNL and the Natural Barrier Thrust delivered quarterly reports of excellent quality on time and met established milestones. LBNL also coordinated and published the S&T annual report, a volume of over 200 pages. The annual report was widely distributed to the Nuclear Waste Program and the scientific community. Research results were effectively disseminated through peer-reviewed journal articles, conference proceedings, meetings, and presentations to review boards.
Grade: Pass (Numerical grade: 4.3)

3.0 Provide Effective and Efficient Science and Technology Research Project/Program Management

Overall score: 3.86
Grade: A

The Provide Effective and Efficient Science and Technology Research Project/Program Management Goal measured the Contractor's overall leadership in executing S&T programs. Dimensions of program management covered included: (1) providing key competencies to support research programs to include key staffing requirements; (2) providing quality research plans that take into account technical risks and identify actions to mitigate risks; and (3) maintaining effective communications with customers to include providing quality responses to customer needs.

3.1 Provide Effective and Efficient Stewardship of Scientific Capabilities and Program Vision

The weight of this Goal is 40 percent.

LBNL contributes and participates in the OCRWM S&T program in two ways. First, LBNL scientists are PIs for multiple S&T projects. Second, the director of LBNL's Earth Sciences Division serves as the Head of the Natural Barriers Thrust Area in the S&T Program. For its role as the Natural Barriers Thrust Lead, LBNL collaborated with the other Thrust Area (Source Term and Material Management) Leads to develop outstanding core competencies as well as scientific excellence in exploratory, high-risk research that is expected to result in greatly improved repository performance, which is vital to the S&T program mission. Similarly, the emphasis of the Thrust Area portfolio on advanced understanding of the natural system (with the view to reduce uncertainty in the prediction of the repository performance), and the success in attracting excellent scientists from universities, indicates effective and efficient stewardship of scientific capabilities as well as program vision.
Overall score: 3.9

3.2 Provide Effective and Efficient Science and Technology Project/Program Planning and Management

The weight of this Goal is 20 percent.

LBNL, as the Natural Barriers Thrust Lead, developed a Thrust portfolio that is (1) aligned with the S&T vision of advanced science, and (2) targets research in those areas that have the highest potential pay-off in repository performance. LBNL worked closely with the DOE management of both the S&T and the mainline repository development programs. In spite of budget reduction in FY 2006, the productivity of the projects in the Natural Barriers Thrust was excellent through realignment of project priorities by the Thrust Lead, and the morale of the PIs remained high. The thrust received an excellent review from the peer review panel in February 2006.
Overall score: 3.9

3.3 Provide Efficient and Effective Communications and Responsiveness to Customer Needs

The weight of this Goal is 40 percent.

LBNL as the Natural Barriers Thrust Lead was always responsive to customer requests for information. The responses were thorough and correct and provided in a timely manner. The

communication channels between the Natural Barriers Thrust Lead and S&T DOE management was excellent. The LBNL thrust lead initiated a communication with the S&T DOE management on emerging issues. For example, when preliminary results from field measurement indicated the possibility of localized fast paths in the saturated zone, the customer was promptly informed, and plans for a path forward were developed based on thorough discussions between the LBNL PIS, the LBNL Natural Barriers Thrust Lead, and the customers, and resources were made available to address this important issue.

Overall score: 3.8

Fiscal Year 2006
Lawrence Berkeley National Laboratory

Office of Science Input Sheet - Objective Scoring and Weightings

	ASCR			BES		
		Weights			Weights	
	Objective Score	Goal / Objective	Funding	Objective Score	Goal / Objective	Funding
Goal #1 Mission Accomplishment		40%	20.9%		30%	31.5%
Objectives						
1.1 Impact	4.2	40%		4	50%	
1.2 Leadership	4.2	30%		4	20%	
1.3 Output (productivity)	4.3	15%		4.3	15%	
1.4 Delivery	4.3	15%		4.3	15%	
Goal #1 Score (calculated)	**4.23**			**4.09**		
Goal #2 Design, Fabrication, Construction and Operation of Facilities		40%	22.8%		50%	34.4%
Objectives						
2.1 Design of Facility	0	0%		3.9	10%	
2.2 Construction of Facility/Fabrication of Components	0	0%		3.6	30%	
2.3 Operation of Facility	4.2	90%		3.9	45%	
2.4 Utilization of Facility to Grow and Support Lab's Research Base	4.2	10%		3.3	15%	
Goal #2 Score (calculated)	**4.2**			**3.72**		
Goal #3 Program Management		20%	20.9%		20%	31.5%
Objectives						
3.1 Stewardship of Scientific Capabilities and Programmatic Vision	4.2	35%		3.8	40%	
3.2 Program Planning and Management	4.2	35%		3.6	30%	
3.3 Program Management-Communication & Responsiveness (to HQ)	4	30%		3.5	30%	
Goal #3 Score (calculated)	**4.14**			**3.65**		

Fiscal Year 2006

Lawrence Berkeley National Laboratory

	BER			FES		
		Weights			Weights	
	Objective	Goal		Objective	Goal	
	Score	Objective	Funding	Score	Objective	Funding
Goal #1 Mission Accomplishment		25%	20.7%		70%	1.5%
Objectives						
1.1 Impact	4	30%		3.5	30%	
1.2 Leadership	4	20%		3.7	30%	
1.3 Output (productivity)	4.3	20%		4.3	20%	
1.4 Delivery	4.3	30%		4.3	20%	
Goal #1 Score (calculated)	**4.15**			**3.88**		
Goal #2 Design, Fabrication, Construction and Operation of Facilities		50%	22.7%		0%	0.0%
Objectives						
2.1 Design of Facility	0	0%		0	0%	
2.2 Construction of Facility/Fabrication of Components	0	0%		0	0%	
2.3 Operation of Facility	4	90%		0	0%	
2.4 Utilization of Facility to Grow and Support Lab's Research Base	4	10%		0	0%	
Goal #2 Score (calculated)	**4**			**0**		
Goal #3 Program Management		25%	20.7%		30.0%	1.5%
Objectives						
3.1 Stewardship of Scientific Capabilities and Programmatic Vision	4	20%		3.7	35%	
3.2 Program Planning and Management	4	30%		3.5	35%	
3.3 Program Management-Communication & Responsiveness (to HQ)	4	50%		3.6	30%	
Goal #3 Score (calculated)	**4**			**3.6**		

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	HEP			NP		
		Weights			Weights	
	Objective Score	Goal Objective	Funding	Objective Score	Goal Objective	Funding
Goal #1 Mission Accomplishment		45%	13.0%		45%	5.5%
Objectives						
1.1 Impact	4.1	30%		3.9	40%	
1.2 Leadership	3.7	30%		3.8	30%	
1.3 Output (productivity)	4.3	30%		4.3	15%	
1.4 Delivery	4.3	10%		4.3	15%	
Goal #1 Score (calculated)	**4.06**			**3.99**		
Goal #2 Design, Fabrication, Construction and Operation of Facilities		20%	14.4%		25%	6.0%
Objectives						
2.1 Design of Facility	3.4	80%		0	0%	
2.2 Construction of Facility/Fabrication of Components	3.4	20%		0	0%	
2.3 Operation of Facility	0	0%		3.4	85%	
2.4 Utilization of Facility to Grow and Support Lab's Research Base	0	0%		3.5	15%	
Goal #2 Score (calculated)	**3.4**			**3.415**		
Goal #3 Program Management		35%	13.0%		30%	5.5%
Objectives						
3.1 Stewardship of Scientific Capabilities and Programmatic Vision	3.6	40%		3.6	40%	
3.2 Program Planning and Management	3.3	40%		3.5	40%	
3.3 Program Management-Communication & Responsiveness (to HQ)	3.4	20%		3.3	20%	
Goal #3 Score (calculated)	**3.44**			**3.5**		

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	WDTS			
		Weights		Goal Score
	Objective Score	Goal Objective	Funding	
Goal #1 Mission Accomplishment		65%	0.2%	
Objectives				
1.1 Impact	3.7	25%		
1.2 Leadership	3.7	30%		
1.3 Output (productivity)	4.3	30%		
1.4 Delivery	4.3	15%		
Goal #1 Score (calculated)	**4.19**			**4.12**
Goal #2 Design, Fabrication, Construction and Operation of Facilities		0%	0.0%	
Objectives				
2.1 Design of Facility	0	0%		
2.2 Construction of Facility/Fabrication of Components	0	0%		
2.3 Operation of Facility	0	0%		
2.4 Utilization of Facility to Grow and Support Lab's Research Base	0	0%		
Goal #2 Score (calculated)	**0**			**3.87**
Goal #3 Program Management		35%	0.2%	
Objectives				
3.1 Stewardship of Scientific Capabilities and Programmatic Vision	3.8	20%		
3.2 Program Planning and Management	4.1	40%		
3.3 Program Management-Communication & Responsiveness (to HQ)	4	40%		
Goal #3 Score (calculated)	**4**			**3.77**
Total S&T Score (calculated)	**4.1865**			

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All Programs Input Sheet - Objective Scoring and Weightings

	SC			EERE		
		Weights			Weights	
	Objective Score	Goal Objective	Funding	Objective Score	Goal Objective	Funding
Goal #1 Mission Accomplishment	**87.43%**	37%	93.33%	**8.88%**	70%	4.71%
Objectives						
1.1 Impact				0	0%	
1.2 Leadership				0	0%	
1.3 Output (productivity)				0	0%	
1.4 Delivery				0	0%	
Goal #1 Score (calculated)	**4.12**			**3.6**		
Goal #2 Design, Fabrication, Construction and Operation of Facilities		39%	100%		0%	0.0%
Objectives						
2.1 Design of Facility				0	0%	
2.2 Construction of Facility/Fabrication of Components				0	0%	
2.3 Operation of Facility				0	0%	
2.4 Utilization of Facility to Grow and Support Lab's Research Base				0	0%	
Goal #2 Score (calculated)	**3.87**			**3.3**		
Goal #3 Program Management	**91.79%**	24%	93.33%	**5.80%**	30%	4.71%
Objectives						
3.1 Stewardship of Scientific Capabilities and Programmatic Vision				0	0%	
3.2 Program Planning and Management				0	0%	
3.3 Program Management-Communication & Responsiveness (to HQ)				0	0%	
Goal #3 Score (calculated)	**3.77**			**3.6**		

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	RW Weights			Chk sum	Goal Score	Goal Weight	Weighted Goal Score
	Objective	Goal					
	Score	Objective	Funding				
Goal #1 Mission Accomplishment	**3.69%**	70%	1.96%	100.0%			
Objectives							
1.1 Impact	0	0%					
1.2 Leadership	0	0%					
1.3 Output (productivity)	0	0%					
1.4 Delivery	0	0%					
Goal #1 Score (calculated)	**4.12**				**4.10**	**0.37**	**1.52**
Goal #2 Design, Fabrication, Construction and Operation of Facilities		0%	0.0%	100.0%			
Objectives							
2.1 Design of Facility	0	0%					
2.2 Construction of Facility/Fabrication of Components	0	0%					
2.3 Operation of Facility	0	0%					
2.4 Utilization of Facility to Grow and Support Lab's Research Base	0	0%					
Goal #2 Score (calculated)	**0**				**3.87**	**0.39**	**1.51**
Goal #3 Program Management	**2.41%**	30%	1.96%	100.0%			
Objectives							
3.1 Stewardship of Scientific Capabilities and Programmatic Vision	0	0%					
3.2 Program Planning and Management	0	0%					
3.3 Program Management-Communication & Responsiveness (to HQ)	0	0%					
Goal #3 Score (calculated)	**3.89**				**3.76**	**0.24**	**0.90**
						Overall S&T Grade	**3.93**

Weights for Presentation	Goal 1	Goal 2	Goal 3	Funding		Percentage
ASCR	**20.9%**	**22.8%**	**20.9%**	SC	$333,372,000	93.33%
BES	**31.5%**	**34.4%**	**31.5%**	EERE	$16,831,000	4.71%
BER	**20.7%**	**22.7%**	**20.7%**	RW	$7,000,000	1.96%
FES	**1.5%**	**0.0%**	**1.5%**		$357,203,000	100.00%
HEP	**13.0%**	**14.1%**	**13.0%**			
NP	**5.5%**	**6.0%**	**5.5%**			
WDTS	**0.2%**	**0.0%**	**0.2%**			
EERE	**4.7%**	**0.0%**	**4.7%**			
RW	**1.96%**	**0.0%**	**1.96%**			