

Program Announcement To DOE National Laboratories LAB 06-11

Terrestrial Carbon Processes Research

SUMMARY: The Office of Biological and Environmental Research (OBER) of the Office of Science (SC), U.S. Department of Energy (DOE), hereby announces its interest in receiving proposals for carbon cycle research that will improve the understanding of terrestrial carbon processes (TCP) and aid carbon cycle predictions related to climate change. Research to improve understanding of carbon processes includes attention to mechanisms that control net CO₂ exchange between the atmosphere and terrestrial biosphere. This includes studies of carbon metabolism and transformations involving plant and soil components of ecosystems that collectively are important for quantifying terrestrial carbon sources and sinks. The scope includes CO₂ exchange measurements (e.g., AmeriFlux), experiments on the CO₂ effects on terrestrial ecosystem carbon processes (e.g., Free-Air- CO₂-Enrichment, FACE), and research on mechanisms of soil carbon transformation, and terrestrial carbon cycle modeling and integration. TCP measurements and experiments are expected to produce spatial and temporal carbon process information for mechanistic and prognostic models. Modeling research is expected to use this information for ecosystem carbon cycle modeling, and for integrated and inverse analysis of carbon cycle behavior. In addition, TCP results are used for improving and testing carbon cycle models, and the information contributes to more comprehensive modeling approaches for predicting atmospheric CO₂ change. It is also important for proposed scientific investigations of terrestrial carbon processes to point out how the research intends to address DOE/Climate Change Program performance measures.

DATES: Potential researchers are encouraged (but not required) to submit a brief Letter-of-Intent by February 17, 2006. The Letter-of-Intent will provide advance information on general scope of planned research, and will aid the Program Manager to plan the peer-review.

Full proposals submitted in response to this Announcement must be submitted to the DOE Electronic Proposal Management Application (ePMA) system (<https://epma.doe.gov>) no later than 8:00 p.m., Eastern Time, March 21, 2006, to be accepted for merit review and to permit timely consideration for award in Fiscal Year 2007. It is important that the entire peer reviewable proposal be submitted to the ePMA system as single PDF file attachment.

Please see the "Addresses" section below for further instructions on the methods of submission for the full proposal.

ADDRESSES: Letters-of-Intent, referencing Program Announcement LAB 06-11 should be sent by e-mail to: roger.dahlman@science.doe.gov. Use "Program Announcement LAB 06-11 Letter-of-Intent" as the subject of the email.

A complete formal FWP in a single Portable Document Format (PDF) file must be submitted through the DOE ePMA system (<https://epma.doe.gov>) as an attachment. To identify that the FWP is responding to this program announcement, please fill in the following fields in the "ePMA Create Proposal Admin Information" screen as shown:

Proposal Short Name:

Fiscal Year:

Proposal Reason:

Program Announcement Number: Lab 06-11 *

Program announcement Title: Terrestrial Carbon Processes Research, DOE Research Program Announcement *

Proposal Purpose:

Estimated Proposal Begin Date:

HQ Program Manager Organization:

* Please use the wording shown when filling in these fields to identify that the FWP is responding to this Program Announcement.

In order to expedite the review process, please submit a CD and two copies of the proposal and FWP using the following, by U.S. Postal Service Express Mail, any commercial mail delivery service, or when hand-carried to:

Karen Carlson-Brown
U.S. Department of Energy
Office of Biological and Environmental Research, SC-23.3/GTN
19901 Germantown Road
Germantown, MD 20874-1290
ATTN: Program Announcement LAB 06-11

In the proposal package, include an extra copy of the one-page abstract.

DOE National Laboratories should submit using ePMA as instructed above. Applicants from U.S. Colleges and universities, non-profit organizations, for-profit commercial organizations, state and local governments, and unaffiliated individuals should respond to Program Notice DE-FG02-06ER06-11 using Grants.gov. **Researchers from other Federal agencies** and Non-DOE Federally Funded Research and Development Centers (FFRDCs) should follow the format at http://www.science.doe.gov/grants/fed_prop.html and submit the proposal as a CD and two paper copies using the following, by U.S. Postal Service Express Mail, any commercial mail delivery service, or when hand-carried to:

Karen Carlson-Brown
U.S. Department of Energy
Office of Biological and Environmental Research, SC-23.3/GTN
19901 Germantown Road
Germantown, MD 20874-1290
ATTN: Program Announcement LAB 06-11

In the proposal package, include an extra copy of the one-page abstract.

FOR FURTHER INFORMATION CONTACT: Dr. Roger Dahlman, Climate Change Research Division, SC-23.3/Germantown Building, Office of Biological and Environmental Research, Office of Science, U.S. Department of Energy, 1000 Independence Ave., SW, Washington, D.C. 20585-1290, telephone: (301) 903-4951, e-mail: roger.dahlman@science.doe.gov, fax: (301) 903-8519. Communications related to the formal proposal should use "Program Announcement LAB 06-11 FORMAL" in the subject line.

The full text of Program Announcement LAB 06-11 is available via the Internet using the following web site address: <http://www.science.doe.gov/grants/grants.html>.

SUPPLEMENTARY INFORMATION: The goal of the TCP research is to provide scientific knowledge of terrestrial components of the global carbon cycle for (i) providing accurate predictions of atmospheric CO₂ change; (ii) quantifying terrestrial carbon sources and sinks and how they are changing in relation to other atmospheric, climatologic and hydrologic influences; and (iii) assessing terrestrial feedbacks on carbon cycle and climate. Ecosystems are the fundamental unit of TCP research. Using modeling and other extrapolation methods, TCP results are expected to extend to bioregion scales, and also contribute to continental scale analysis of carbon cycle problems that are analyzed by the North American Carbon Program (NACP), for example. The TCP component of DOE's Climate Change Research Program will consider proposals on measurements, experiments and modeling that provide improved quantitative and predictive understanding of the terrestrial carbon cycle processes that can affect atmospheric CO₂ changes and thereby affect the CO₂ forcing of climate.

The TCP Program has been formally reviewed by a Biological and Environmental Research Advisory Committee (BERAC) Panel (<http://www.sc.doe.gov/ober/berac/TCCRPreport.pdf>). In general, the BERAC Panel found the TCP carbon cycle research elements to be highly relevant and scientifically sound. Accordingly, the TCP Program will continue the current Program scope, with the objectives to (i) develop scientific understanding of terrestrial carbon processes and quantify mechanisms that regulate carbon balance of ecosystems and exchanges of CO₂ with the atmosphere; (ii) quantify current, forecast future, and assess uncertainty of carbon changes or CO₂ exchange between the atmosphere and ecosystems and in terrestrial carbon sources and sinks; (iii) elucidate responses of ecosystem carbon cycle processes to rising atmospheric CO₂ and other environmental factors; and (iv) model terrestrial carbon processes at many scales, and use terrestrial models coupled with atmosphere-ocean carbon models to estimate rate and timing of atmospheric CO₂ changes. BERAC Panel recommendations will be considered as projects are selected in this competition, and through coordination and management of Program research as appropriate.

Relevance of proposed research to DOE's mission will be gauged by the extent that proposed carbon cycle research products contribute to the long-term performance measure (LTM) of DOE's climate change research, which is "To deliver improved data and models for policy makers to determine safe levels of greenhouse gases for the earth's system. In general terms, this LTM expects carbon cycle research to determine the fate of excess CO₂ from human activities, to understand carbon cycle mechanisms and controls that affect CO₂ as a forcing agent, and to

quantify interactions between the carbon cycle and climate. In addition to the merit review criteria mentioned below, it will be important for the proposed research to identify how anticipated research products (i.e., from observations, experiments, modeling, integration) will contribute to the LTM.

Proposals are invited from DOE Laboratories for carbon cycle research on the above cited goals and objectives of the TCP Program. Lab proposals are encouraged to focus their unique capabilities for integrating experimental results, systematic observations and modeling in comprehensive analysis of terrestrial carbon processes and for simulations of terrestrial carbon cycle behavior in relation to changes of atmospheric CO₂ and climate. Labs are encouraged to mobilize their research facilities and computing capabilities in their proposals for advancing both carbon cycle science and enhancing the relevance of terrestrial carbon research products to the LTM. Integration of science and infrastructure resources is encouraged with both intra- and inter-Laboratory proposals that can include multi-investigator research. Integrated and interdisciplinary research proposals should primarily focus on the Program elements described below, i.e., Ameriflux, FACE experiments, soil carbon research, isotopic tracer studies, data management system, terrestrial carbon modeling, and terrestrial carbon science contributions to the NACP. As noted above, a formal FWP should accompany the proposal submission.

Proposed measurements should contribute to the AmeriFlux Network with special attention to the acquisition of flux and biological data from high-quality, strategically placed and productive research sites. Researchers should visit the web site (<http://public.ornl.gov/ameriflux/>) for further information on AmeriFlux science and strategic plans and for guidance on operational requirements of research sites. Taken from the web site, scientific questions that guide AmeriFlux over the next decade are: (i) What are the magnitudes of carbon storage and the exchanges of energy, CO₂ and water vapor in terrestrial ecosystems? and what are their spatial and temporal variability? (ii) How is this variability influenced by vegetation type, phenology, changes in land use, management and disturbance history? and what is the relative effect of these factors? (iii) What is the causal link between climate and exchanges of energy, CO₂ and water vapor for major vegetation types? (iv) What is the spatial and temporal variation of boundary layer CO₂ concentrations? how does this change with topography, climatic zone and vegetation? The web site also lists information on the distribution of existing locations, vegetation type and other characteristics of the current AmeriFlux Network. To minimize redundancy of locations in the Network, applicants should examine the current distribution and characteristics of AmeriFlux sites before proposing new locations; they should also refer to the Hargrove et. al., (2003) analysis of "representativeness" when assessing whether proposed new locations may add value to the Network. It is also important to explain how proposed new AmeriFlux locations will enhance or add value with respect to unique net ecosystem exchange (NEE)/net ecosystem production (NEP) data products; to providing carbon flux and process information for unique climate zones; and for the potential that a new site would offer for integrating its data products with other carbon cycle research, e.g., with NACP. In relation to AmeriFlux science questions listed above, proposed AmeriFlux-related research must demonstrate the capability for producing systematic high-quality flux and biological measurements useful for estimating NEE of CO₂, NEP, and gross primary production (GPP). Proposed investigations at AmeriFlux sites also should identify terrestrial carbon process research that will provide the scientific basis for interpreting uncertainties; evaluate climate- or CO₂-induced feedbacks; and explain how the

research results are relevant to the DOE Climate Change performance measure. With proposals that seek to sustain existing parts of the AmeriFlux network, priority will be placed on research that has a strong record of measurement performance and prompt delivery of data products to the AmeriFlux archive in form and content for use by the broader scientific community. Researchers are referred to the "AmeriFlux self-evaluation" report on the web site for information on expected operational and performance requirements. There is an established archive for reporting AmeriFlux data (see AmeriFlux web site for protocols), and supported projects will be expected to comply rigorously with reporting guidelines and standards. TCP is also interested in possible creation of an AmeriFlux "supersite" for experimentally evaluating site-specific questions on flux footprints; advection processes; methodology development and evaluation of biological vs NEE estimations of NEP and GPP; comparative studies of photosynthesis, respiration and other flux components; and for in-depth study of other scientific questions related to goals of AmeriFlux. Proposed non-AmeriFlux CO₂ measurements must be coordinated with science goals of AmeriFlux, and should explain how the observations relate to or enhance terrestrial carbon results produced by Network or other TCP research. (Ref, Hargrove, W. W., Forrest M. Hofman, and B.E. Law. December 2003. "New Analysis Reveals Representativeness of the AmeriFlux Network." *Eos Trans. AGU*, 84(48), 2003).

Proposals are solicited for continuation or modification of existing FACE experiments, or for creating new FACE-type experiments. General objectives of FACE research are to (i) understand the processes by which elevated CO₂ (e CO₂) influences carbon cycle dynamics; (ii) measure ecosystem level carbon cycle responses to e CO₂; (iii) understand feedbacks among carbon nutrient and water cycles in the context of e CO₂; (iv) provide validation data and understanding of mechanisms for models; and (v) provide facilities to investigators exploring secondary e CO₂ effects (e.g., biodiversity, community change, pest responses). Proposals will initially be reviewed for intrinsic scientific merit, and for the potential of experimental results to provide prognostic information for predictive modeling. Also, as recommended by the BERAC review panel (<http://www.sc.doe.gov/ober/berac/TCCRPreport.pdf>, see pp 3-4), and before continuation or implementation of FACE experiment components, a separate panel of experts will be convened to provide guidance to DOE on scope, continuity and future scientific direction of FACE research. Technical proposals submitted to this announcement will be a major item considered by the FACE panel. The BERAC Panel also recommended establishment of a data base for archiving results from all FACE experiments, and researchers should refer to a CDIAC website (http://cdiac.esd.ornl.gov/programs/FACE/data_needs_for_synthesis.html) for information on data delivery, including data management protocols and standards, that will enhance the use of FACE data by broader segments of the carbon cycle modeling and synthesis communities.

Both AmeriFlux Network research and the FACE experiments have evolved to the point of providing systematic data products, which need to be archived in "standardized" formats for use by the larger carbon cycle and climate research communities. Proposals are invited that demonstrate an architecture of an overall data management system for both AmeriFlux and FACE data, that provide expedient methods for inputting Network and experimental data, and that offer user friendly website access to "standardized" data files and meta data. Examples of data products to be included in the data management system are illustrated in the paragraphs above that describe AmeriFlux and FACE research (e.g., NEE, NEP, GPP, photosynthesis,

respiration, micromet, biomass and soil carbon, etc.). The data management system will interact closely with other elements of the TCP Program, and will work closely with carbon cycle and climate modelers to define priority parameters, and develop user friendly formats of archived data. In addition, the data management system would be expected to work closely with the NACP Information and Data Management System (<http://www.nacarbon.org/nacp/dm.html>), and support the development of a "flux network distributed thematic center" as a component of the "NACP Thematic and Data Central" concept.

As a potential long-term terrestrial sink for carbon, the goals of soil carbon research are to quantify rates and magnitudes of soil carbon accretion, and to understand processes and properties that control transformation of biomass into soil organic matter, including studies of stabilization mechanisms of the long residence time components. Research is also needed on these processes for different climate and vegetation conditions (i.e., as represented by AmeriFlux research sites) where results can be spatially scaled to estimate carbon changes across climate zones and bioregions. Products of research that focus on soil carbon processes (e.g., organic matter stabilization and dynamics, carbon turnover rates, root and microbial respiration, carbon/nitrogen/other relationships) should provide new insights on residence time and other carbon source or sink properties of ecosystem soil components. Priority will be placed on soil carbon research that is conducted at or closely linked to either AmeriFlux sites or FACE experiments. By associating soil carbon studies with coordinated carbon measurements at these sites and experiments, and in concert with the respective resident carbon cycle expertise, results are expected to add value to overall TCP research products. The intent of associating this research with existing sites and experiments is to enhance value of the research to TCP Program objectives, and the research products are expected to also aid model scaling and testing of terrestrial carbon processes, thereby improving quantitative prediction of regional scale carbon sources and sinks. Researchers must certify that resident coordinators have agreed to plans for soil carbon research by offsite scientists at their sites or experiments.

The BERAC Panel emphasized the need for integrated modeling and analysis of the carbon cycle and for an approach to build a "National Terrestrial Carbon Model (NTCM)" (<http://www.sc.doe.gov/ober/berac/TCCRPreport.pdf>, see pp 15-16). Although such an undertaking logically would require a broad base of Federal support, ideas are solicited here to begin building this capability. Candidate elements of this "design" that would be of interest to DOE are overall architecture of a NTCM, ecosystem carbon process model (including soil aspects), using models to extrapolate results from TCP investigations to the bioregion scales and the modeling of carbon and climate feedbacks that would possibly affect climate (research not of interest in this announcement would be formally coupled carbon-climate modeling). Modeling and integration employing the NTCM approach must also take full advantage of available AmeriFlux and FACE data products. Proposals should identify large computational requirements, if any.

Investigations using carbon isotopes are solicited as an approach for tracing carbon transformations, for quantifying rate and mass parameters of the terrestrial carbon cycle, and for improved understanding of controlling mechanisms. Priority will be placed on isotopic tracer research that is carried out in an ecosystem context in conjunction with research at AmeriFlux and FACE sites to realize mutual benefit from related measurements, and to coordinate with

other flux measurements, ecosystem soil carbon research and other in-residence carbon cycle expertise and modeling research at these locations. Researchers must certify that resident coordinators have agreed to plans for isotopic research by offsite scientists at their respective sites or experiments.

DOE's TCP research is an integral component of the U.S. Climate Change Science Program (CCSP) (<http://www.climatescience.gov/>), which is closely coordinated with other Federal research of the Interagency Carbon Cycle Research Program (<http://www.asd.ssc.nasa.gov/ccsp/>). TCP is specifically addressing questions 7.1, 7.4 and 7.5 of the Carbon Cycle element of the CCSP Strategic Plan (<http://www.climatescience.gov/Library/stratplan2003/final/default.htm>). Accordingly, TCP is placing increased attention on understanding the fate of CO₂ from emissions, on the role of the terrestrial biosphere as source or sink for carbon, and on understanding terrestrial carbon processes across North America, specifically as a part of the North American Carbon Program (NACP). DOE's carbon measurements (e.g., AmeriFlux), process experiments (e.g., FACE) and modeling and synthesis as solicited here are expected to contribute to the NACP Science Implementation Strategy (<http://www.nacarbon.org/nacp/documents/NACP-SIS-final-july05.pdf>), and researchers are strongly encouraged to identify how their proposed research will likely contribute to regional or continental scale NACP research. In general it is expected that TCP research contributes to understanding the underlying carbon cycle processes, and ecosystem scale modeling and prediction elements of NACP.

Letters-of-Intent

A brief (one-page) Letter-of-Intent is strongly encouraged (but not required) prior to submission of a full proposal. The Letter-of-Intent will serve notice of the intent to submit a formal proposal, and the following information will aid the Program Manager in structuring the peer-review process. The letter of intent should identify the institution; the Principal Investigator's name, telephone number, and e-mail address; the title of the proposed project; and names and institutions of any proposed collaborators. The Letter-of-Intent should include a narrative describing the research project objectives and methods of accomplishment.

Program Funding

It is anticipated that up to \$5,000,000 will be available for multiple projects to be initiated in Fiscal Year 2007, contingent on the availability of appropriated funds. Proposals may request project support for up to three years, with out-year support contingent on the availability of funds, progress of the research, and programmatic needs. Annual budgets are expected to range from \$100,000 to \$400,000 total cost for non-FACE science investigations. Based on funding experiences to date, it is estimated that maintenance-level data collection and reporting at established AmeriFlux sites would be of the order of \$125,000; the add-on for collection and reporting of biological data may double this estimate. Costs of research at cluster or "super" sites might range from \$300,000 to \$400,000. Costs for resident scientific studies at FACE sites would range from \$400,000 to \$500,000, which would not include facility operating costs. Upper limits of the cited ranges would include very nominal administrative support for off-site investigations conducted at AmeriFlux and FACE locations. Cost of modeling, integration and

data management projects is estimated at approximately \$200,000 per investigator not to exceed \$500,000, which does not include computing costs, if high performance computer time is required for large calculations. If needed and justified, it will be possible for carbon cycle projects to apply and compete for cpu time at no additional cost.

Submission Information

Full Proposal

The Project Description must not exceed 15 pages, including tables and figures, but exclusive of attachments. The proposal must contain an abstract or project summary, short vitae, and letters of intent from collaborators, if appropriate.

Full proposals adhering to DOE Field Work Proposal format (Reference DOE Order 412.1) are to be prepared and submitted consistent with policies of the investigator's laboratory and the local DOE Operations Office. Laboratories may submit proposals directly to the SC Program Office listed above. A copy should also be provided to the appropriate DOE Operations Office.

The instructions and format described below should be followed. You must reference Program Announcement LAB 06-11 on all submissions and inquiries about this program.

OFFICE OF SCIENCE GUIDE FOR PREPARATION OF SCIENTIFIC/TECHNICAL PROPOSALS TO BE SUBMITTED BY NATIONAL LABORATORIES

Proposals from National Laboratories submitted to the Office of Science (SC) as a result of this program announcement will follow the Department of Energy Field Work Proposal process with additional information requested to allow for scientific/technical merit review. The following guidelines for content and format are intended to facilitate an understanding of the requirements necessary for SC to conduct a merit review of a proposal. Please follow the guidelines carefully, as deviations could be cause for declination of a proposal without merit review.

1. Evaluation Criteria

Proposals will be subjected to formal merit review (peer review) and will be evaluated against the following criteria which are listed in descending order of importance:

Scientific and/or technical merit of the project

Appropriateness of the proposed method or approach

Competency of the personnel and adequacy of the proposed resources

Reasonableness and appropriateness of the proposed budget

The evaluation process will include program policy factors such as the relevance of the proposed research to the terms of the announcement and the Department's programmatic needs. External peer reviewers are selected with regard to both their scientific expertise and the absence of conflict-of-interest issues. Non-federal reviewers may be used, and submission of a proposal constitutes agreement that this is acceptable to the investigator(s) and the submitting institution.

2. Summary of Proposal Contents

- Field Work Proposal (FWP) Format (Reference DOE Order 5700.7C) (DOE ONLY)
- Proposal Cover Page
- Table of Contents
- Budget (DOE Form 4620.1) and Budget Explanation
- Abstract (one page)
- Narrative (main technical portion of the proposal, including background/introduction, proposed research and methods, timetable of activities, and responsibilities of key project personnel)
- Literature Cited
- Biographical Sketch(es)
- Description of Facilities and Resources
- Other Support of Investigator(s)
- Appendix (optional)

2.1 Number of Copies to Submit

A complete formal FWP in a single Portable Document Format (PDF) file must be submitted through the DOE ePMA system (<https://epma.doe.gov>) as an attachment. To identify that the FWP is responding to this program announcement, please fill in the following fields in the "ePMA Create Proposal Admin Information" screen as shown:

Proposal Short Name:

Fiscal Year:

Proposal Reason:

Program Announcement Number: Lab 06-11 *

Program announcement Title: Terrestrial Carbon Processes Research, DOE Research Program Announcement *

Proposal Purpose:

Estimated Proposal Begin Date:

HQ Program Manager Organization:

* Please use the wording shown when filling in these fields to identify that the FWP is responding to this Program Announcement.

In order to expedite the review process, please submit a CD and two copies of the proposal using the following, by U.S. Postal Service Express Mail, any commercial mail delivery service, or when hand-carried to:

Karen Carlson-Brown
U.S. Department of Energy
Office of Biological and Environmental Research, SC-23.3/GTN
19901 Germantown Road
Germantown, MD 20874-1290
ATTN: Program Announcement LAB 06-11

3. Detailed Contents of the Proposal

Adherence to type size and line spacing requirements is necessary for several reasons. No researcher should have the advantage, or by using small type, of providing more text in their proposals. Small type may also make it difficult for reviewers to read the proposal. Proposals must have 1-inch margins at the top, bottom, and on each side. Type sizes must be 11 point. Line spacing is at the discretion of the researcher but there must be no more than 6 lines per vertical inch of text. Pages should be standard 8 1/2" x 11" (or metric A4, i.e., 210 mm x 297 mm).

3.1 Field Work Proposal Format (Reference DOE Order 5700.7C) (DOE ONLY)

The Field Work Proposal (FWP) is to be prepared and submitted consistent with policies of the investigator's laboratory and the local DOE Operations Office. Additional information is also requested to allow for scientific/technical merit review.

Laboratories may submit proposals directly to the SC Program office listed above. A copy should also be provided to the appropriate DOE operations office.

3.2 Proposal Cover Page

The following proposal cover page information may be placed on plain paper. No form is required.

Title of proposed project
SC Program announcement title
Name of laboratory
Name of principal investigator (PI)
Position title of PI
Mailing address of PI
Telephone of PI
Fax number of PI
Electronic mail address of PI
Name of official signing for laboratory*
Title of official
Fax number of official
Telephone of official
Electronic mail address of official
Requested funding for each year; total request
Use of human subjects in proposed project:

If activities involving human subjects are not planned at any time during the proposed project period, state "No"; otherwise state "Yes", provide the IRB Approval date and Assurance of Compliance Number and include all necessary information with the proposal should human subjects be involved.

Use of vertebrate animals in proposed project:

If activities involving vertebrate animals are not planned at any time during this project, state "No"; otherwise state "Yes" and provide the IACUC Approval date and Animal Welfare Assurance number from NIH and include all necessary information with the proposal.

Signature of PI, date of signature

Signature of official, date of signature*

*The signature certifies that personnel and facilities are available as stated in the proposal, if the project is funded.

3.3 Table of Contents

Provide the initial page number for each of the sections of the proposal. Number pages consecutively at the bottom of each page throughout the proposal. Start each major section at the top of a new page. Do not use unnumbered pages and do not use suffices, such as 5a, 5b.

3.4 Budget and Budget Explanation

A detailed budget is required for the entire project period and for each fiscal year. It is preferred that DOE's budget page, Form 4620.1 be used for providing budget information*. Modifications of categories are permissible to comply with institutional practices, for example with regard to overhead costs.

A written justification of each budget item is to follow the budget pages. For personnel this should take the form of a one-sentence statement of the role of the person in the project. Provide a detailed justification of the need for each item of permanent equipment. Explain each of the other direct costs in sufficient detail for reviewers to be able to judge the appropriateness of the amount requested.

Further instructions regarding the budget are given in section 4 of this guide.

* Form 4620.1 is available at web site: <http://www.science.doe.gov/grants/Forms-E.html>

3.5 Abstract

Provide an abstract of less than 400 words. Give the project objectives (in broad scientific terms), the approach to be used, and what the research is intended to accomplish. State the hypotheses to be tested (if any). At the top of the abstract give the project title, names of all the investigators and their institutions, and contact information for the principal investigator, including e-mail address.

3.6 Narrative (main technical portion of the proposal, including background/introduction, proposed research and methods, timetable of activities, and responsibilities of key project personnel).

The narrative comprises the research plan for the project and is limited to **15 pages (maximum)**. It should contain enough background material in the Introduction, including review of the relevant literature, to demonstrate sufficient knowledge of the state of the science. The major part of the narrative should be devoted to a description and justification of the proposed project, including details of the methods to be used. It should also include a timeline for the major activities of the proposed project, and should indicate which project personnel will be responsible for which activities.

If any portion of the project is to be done in collaboration with another institution (or institutions), provide information on the institution(s) and what part of the project it will carry out. Further information on any such arrangements is to be given in the sections "Budget and Budget Explanation", "Biographical Sketches", and "Description of Facilities and Resources".

3.7 Literature Cited

Give full bibliographic entries for each publication cited in the narrative.

3.8 Biographical Sketches

This information is required for senior personnel at the institution submitting the proposal and at all subcontracting institutions (if any). The biographical sketch is limited to a maximum of **two pages** for each investigator.

To assist in the identification of potential conflicts of interest or bias in the selection of reviewers, the following information **must be provided in each biographical sketch**.

Collaborators and Co-editors: A list of all persons in alphabetical order (including their current organizational affiliations) who are currently, or who have been, collaborators or co-authors with the investigator on a research project, book or book article, report, abstract, or paper during the 48 months preceding the submission of the proposal. Also include those individuals who are currently or have been co-editors of a special issue of a journal, compendium, or conference proceedings during the 24 months preceding the submission of the proposal. If there are no collaborators or co-editors to report, this should be so indicated.

Graduate and Postdoctoral Advisors and Advisees: A list of the names of the individual's own graduate advisor(s) and principal postdoctoral sponsor(s), and their current organizational affiliations. A list of the names of the individual's graduate students and postdoctoral associates during the past five years, and their current organizational affiliations.

3.9 Description of Facilities and Resources

Facilities to be used for the conduct of the proposed research should be briefly described. Indicate the pertinent capabilities of the institution, including support facilities (such as machine shops), that will be used during the project. List the most important equipment items already available for the project and their pertinent capabilities. Include this information for each subcontracting institution (if any).

3.10 Other Support of Investigators

Other support is defined as all financial resources, whether Federal, non-Federal, commercial, or institutional, available in direct support of an individual's research endeavors. Information on active and pending other support is required for all senior personnel, including investigators at collaborating institutions to be funded by a subcontract. For each item of other support, give the organization or agency, inclusive dates of the project or proposed project, annual funding, and level of effort (months per year or percentage of the year) devoted to the project.

3.11 Appendix

Information not easily accessible to a reviewer may be included in an appendix, but **do not use the appendix to circumvent the page limitations of the proposal**. Reviewers are not required to consider information in an appendix, and reviewers may not have time to read extensive appendix materials with the same care they would use with the proposal proper.

The appendix may contain the following items: up to five publications, manuscripts accepted for publication, abstracts, patents, or other printed materials directly relevant to this project, but not generally available to the scientific community; and letters from investigators at other institutions stating their agreement to participate in the project (do not include letters of endorsement of the project).

4. Detailed Instructions for the Budget

(DOE Form 4620.1 "Budget Page" may be used).

4.1 Salaries and Wages

List the names of the principal investigator and other key personnel and the estimated number of person-months for which DOE funding is requested. Proposers should list the number of postdoctoral associates and other professional positions included in the proposal and indicate the number of full-time-equivalent (FTE) person-months and rate of pay (hourly, monthly or annually). For graduate and undergraduate students and all other personnel categories such as secretarial, clerical, technical, etc., show the total number of people needed in each job title and total salaries needed. Salaries requested must be consistent with the institution's regular practices. The budget explanation should define concisely the role of each position in the overall project.

4.2 Equipment

DOE defines equipment as "an item of tangible personal property that has a useful life of more than two years and an acquisition cost of \$25,000 or more." Special purpose equipment means equipment which is used only for research, scientific or other technical activities. Items of needed equipment should be individually listed by description and estimated cost, including tax, and adequately justified. Allowable items ordinarily will be limited to scientific equipment that is not already available for the conduct of the work. General purpose office equipment normally will not be considered eligible for support.

4.3 Domestic Travel

The type and extent of travel and its relation to the research should be specified. Funds may be requested for attendance at meetings and conferences, other travel associated with the work and subsistence. In order to qualify for support, attendance at meetings or conferences must enhance the investigator's capability to perform the research, plan extensions of it, or disseminate its results. Consultant's travel costs also may be requested.

4.4 Foreign Travel

Foreign travel is any travel outside Canada and the United States and its territories and possessions. Foreign travel may be approved only if it is directly related to project objectives.

4.5 Other Direct Costs

The budget should itemize other anticipated direct costs not included under the headings above, including materials and supplies, publication costs, computer services, and consultant services (which are discussed below). Other examples are: aircraft rental, space rental at research establishments away from the institution, minor building alterations, service charges, and fabrication of equipment or systems not available off-the-shelf. Reference books and periodicals may be charged to the project only if they are specifically related to the research.

a. Materials and Supplies

The budget should indicate in general terms the type of required expendable materials and supplies with their estimated costs. The breakdown should be more detailed when the cost is substantial.

b. Publication Costs/Page Charges

The budget may request funds for the costs of preparing and publishing the results of research, including costs of reports, reprints page charges, or other journal costs (except costs for prior or early publication), and necessary illustrations.

c. Consultant Services

Anticipated consultant services should be justified and information furnished on each individual's expertise, primary organizational affiliation, daily compensation rate and number of

days expected service. Consultant's travel costs should be listed separately under travel in the budget.

d. Computer Services

The cost of computer services, including computer-based retrieval of scientific and technical information, may be requested. A justification based on the established computer service rates should be included.

e. Subcontracts

Subcontracts should be listed so that they can be properly evaluated. There should be an anticipated cost and an explanation of that cost for each subcontract. The total amount of each subcontract should also appear as a budget item.

4.6 Indirect Costs

Explain the basis for each overhead and indirect cost. Include the current rates.