Program Announcement
To DOE National Laboratories
LAB 10-06

Regional Models for Climate Change Integrated Assessment

SUMMARY:

The Office of Biological and Environmental Research (BER) of the Office of Science (SC), U.S. Department of Energy (DOE), hereby announces its interest in receiving peer-reviewable Field Work Proposals (FWPs) on the topic of Regional Models for Climate Change Integrated Assessment: Exploring Systems Interactions, Multiple Stressors, and Energy Systems Implications at the Mitigation-Adaptation Interface under the Integrated Assessment Research (IARP) Program.

The IARP, located within the Climate and Environmental Sciences Division (CESD) of BER, supports the DOE mission and the U.S. Global Change Research Program's interests to improve fundamental understanding of the interactions between human and natural systems in climate change, including the central role and implications for energy systems, and to develop the integrated science-based models and tools that inform national and regional decision-making on options for mitigation and adaptation. In the broadest sense, IARP is concerned with modeling, in collective frameworks, the end-to-end processes of climate change and the complex, non-linear interactions among major human and natural systems. Most major Integrated Assessment Models (IAMs) are global and national in scope with some regional processes represented in IAMs. For example, economics are often treated at broad regional scales and, increasingly, land use is displayed at increasingly finer scales within IAMs. Water and water resources are not often represented, or represented well, in IAMs. Because they are location and context specific, improving representations of climate change impacts and adaptations require significant advancements in IAM resolution and multi-scale modeling methodologies. It also requires modeling regional scale processes and process interactions, as well as collecting, aggregating, and managing new and potentially large data sets from other sources. (Note that physical experimentation and observational research are beyond the scope of this call and, more generally, beyond the scope of IARP.) Whether treated as resolution enhancements within the current set of IAMs or in a new class of complementary, regional scale IAMs that are linked to more aggregate, national and global IAMs, the goal of DOE's research in this area is to explore the multi-scale phenomenon. More specifically, the goal is to study the types of varied systems interactions that dominate in higher resolution spatial and temporal regimes, specifically, in regional scale IAMs. Accordingly, DOE is requesting proposals that will advance Regional Integrated Assessment Models (RIAMs). Proposals should seek to develop new insights on the mitigation-adaptation interface; the influence and interactions of multiple stressors on human and natural systems; energy systems impacts and vulnerabilities; and broadly, sustainability at regional scales under global change. Proposals should also explore issues of multi-scale, multi-model interactions, e.g., at the regional, national, and global scales. Note that for purposes of this announcement, regions should be viewed at spatial scales consistent with states, counties,

metropolitan areas, water basins, or stretches of coast line, as examples, but not clusters of nations. The latter is often a conventional use of the term "regions" within IAMs, one designating major economic regions.

High risk, high pay-off research that will advance regional Integrated Assessment (IA) modeling and multi-scale analyses is encouraged. Applicants should clearly describe how the proposed ideas have the potential to lead to breakthroughs or transformational approaches.

PREPROPOSALS: Preproposals are not required.

DATES:

Full proposals submitted in response to this Announcement must be received no later than **May 3, 2010**, 4:30 p.m., Eastern Time, to be accepted for merit review and to permit timely consideration for award in Fiscal Year 2010.

Please see the ADDRESSES section below for further instructions on the method of submission for the proposal.

ADDRESSES and SUBMISSON INSTRUCTIONS:

Have your Lab administrator submit the entire Lab proposal and FWP via Searchable FWP (https://www.osti.gov/fwp). If you have questions about who your Lab administrator is or how to use Searchable FWP, please contact the Searchable FWP Support Center.

Please submit, via Federal Express, a single PDF file of the entire Lab proposal and FWP on a CD along with two hard copies to the address below. This will assist in expediting the review process.

Please send the CD and 2 hard copies via Federal Express to:

Karen Carlson-Brown
Climate and Environmental Sciences Division, SC-23.1
Office of Biological and Environmental Research
Office of Science
19901 Germantown Road
Germantown, MD 20874-1290
ATTN: Program Announcement LAB 10-06

For further information contact:

Bob Vallario
Program Manager
Integrated Assessment Research Program
Climate and Environmental Sciences Division
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Email: Bob.Vallario@science.doe.gov

SUPPLEMENTARY INFORMATION:

The CESD has established the following Long Term Measure (LTM) for its climate science programs: *Deliver improved scientific data and models about the potential response of the Earth's climate and terrestrial biosphere to increased greenhouse gas levels for policy makers to determine safe levels of greenhouse gases in the atmosphere*. The IARP directly supports this LTM by developing the science-based models and tools to explore the interactions between human and natural systems in climate change, with an emphasis on the energy, technology, land use, and socioeconomic futures that can influence future climate, and the implications of those changes for human and natural systems, including feedbacks to the overall climate system. **Proposals submitted in response to this Announcement must explicitly state how the proposed research will support accomplishment of the BER CESD's LTM.** Additionally, the DOE's strategy for basic research in climate science is described in a recent strategic plan: http://www.sc.doe.gov/ober/Climate%20Strategic%20Plan.pdf. The Plan's focus area entitled Climate Change Modeling includes a specific section on IA research which describes the program's resources, goals and anticipated outcome for this program. Submitters are encouraged to review this document and to address the IARP's goals and outcomes when developing proposals.

The IA research provides scientific insights into climate change with multi-scale models of the combined human-climate system. To accelerate progress in the field and to address needs for understanding complex systems interactions that include impacts and adaptation, as well as the mitigation-adaptation interface, *DOE is requesting proposals for regional scale IAMs that include higher spatial and temporal resolution and improved process representations and data sets appropriate for such scale*. Highly competitive proposals will seek to address many if not all of the following issues:

- **Mitigation-Adaptation Interface.** Model development should emphasize understanding and representation of the mitigation and adaptation interface, reflecting important systems interactions and feedbacks at regional scales. In particular, models should reflect improved understanding and representations of the energy-water-land nexus, competition for natural resources, systems sustainability under global change, improved representations of biofuels; and other potential changes in land use as well as implications for carbon, nitrogen, water, and other cycles.
- **Energy Impacts, Vulnerabilities, and Adaptations.** Model development should incorporate more explicit representations of the effects of climate change on energy systems, including supply and transformations, distribution, and ultimately, consumption. Prolonged heat waves, floods, extreme storm events, coastal inundation, and changes in precipitation and availability of cooling water will all have significant implications for energy systems in the future, as well as how they may need to adapt to these changes. Not only will energy systems need to adapt but, importantly, energy systems will be the future "currency" for broader climate change adaptations, whether it be to move massive quantities of water to areas that are precipitation-starved, cool (or heat) populations in urban landscapes, power the removal of and coping with significant snow events, or protect infrastructure from the devastation of floods or other extreme weather events. Understanding all of these direct climate impacts and feedbacks to the energy system at relevant scales is an important goal of this solicitation.

- **Interaction of Complex, Climate Change Stressors.** The added dimensions of climate change impacts and adaptation add to the already complex task of modeling mitigation as part of a broader, highly complex system. A critical goal of future work in IA is to incorporate understanding and representations in models of the many impacts and adaptations to human and natural systems, thereby representing the full range of climate-induced stressors to such systems and their possible responses. Few of these systems are independent of one another. Thus, understanding these coupled processes is essential for gaining insights into the factors that may ultimately shape these systems and their future directions.
- **System and Process Scale-Dependencies.** Many processes and systems have unique scales and scale-dependencies. Applicants should consider the implications of process/system scale dependencies and the potential for nested scale approaches. For example, hydrology may best be examined at the water basin or watershed level whereas vulnerable urban/city energy infrastructure may best be examined at finer scales (or broader energy grid-level scales). Applicants should address the scales that are important for different systems, processes, and potential model applications and what methodologies can be deployed to address these differences.
- **Regional Scales and the Multi-Scale Issue.** What can be learned by exploring a bottom-up, regional scale IAM approach and how can it inform national and global scale IAMs, and vice-versa. Alternatively, what might be learned from a top down push for higher resolution, to the regional scale, within current IAMs? Are there different natural linkages and dependencies for climate model development? For example, can this research help to inform, from the perspective of one class of "user" and "supplier", directions in CESD climate modeling at regional and global scales. Are there compatibility issues for regional and global climate models and the scale requirements for RIAMs such that it might influence the development of new or different versions of models of intermediate complexity for the earth system processes typically found in IAMs? What are the implications of coupling elements of RIAMs with full Regional Climate Models (or Earth System Models) for deep dives into *regional* IA?
- **Uncertainty and Risk.** At a more general level, the issue of uncertainty and risk perspectives in IA has come to the fore. Specifically, proposals should address the implications for RIAMs and describe suitable methodologies for treating risk within such models. With an emphasis on impacts and adaptations, are there innovative ways to address alternative, non-monetary metrics for some critical systems?
- **Representative Regions.** Applicants should consider development and testing for suitable regions that have recognized common classes of climate change vulnerabilities. Model development focused on one or more representative regions would be beneficial for methodology development and testing, consistent with the goals of this announcement. For example, regions aligned by major urban/city landscapes, coastal vulnerabilities, farm belts, desert communities and other logical groupings would be helpful. In particular, highly vulnerable U.S. regions where existing studies and data are available would be appropriate for this phase of research. That being said and where possible, region selection and model development should seek to build from other investments and capabilities in DOE research. Applicants are also encouraged to consider coordinating their research with existing research sites or teams supported by other agencies. These sites or teams include, for example, those funded by the National Science

Foundation (NSF) in programs such as the Decision Making Under Uncertainty for Climate Change (DMUU) (http://dcdc.asu.edu/dcdcmain/index.php; http://www.cred.columbia.edu/; http://cdmc.epp.cmu.edu/) or the sites that are members of the Long Term Ecological Research (LTER) Network (http://www.lternet.edu/sites/). NSF will select new DMUU sites early in 2010 http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503374&org=NSF&sel_org=NSF&from=fund and was to add a number of urban LTER exploratory sites http://www.nsf.gov/pubs/2009/nsf09551/nsf09551.htm?org=NSF. The Regional Integrated Sciences and Assessments teams (http://www.climate.noaa.gov/cpo_pa/risa/) funded by the National Oceanic and Atmospheric Administration present additional possibilities for productive coordination of research.

The IARP is a basic research program and does not seek to apply the tools for the analysis of specific policy options. Rather, the Program aims to develop the scientific knowledge, data, and underlying models and tools that can be used by others to evaluate the implications of, for example, alternative energy policy options. This Announcement marks a shift in the IARP to advance, with greater focus and support, IA modeling of complex systems at regional scales. *Note that physical experimentation and observational research is beyond the scope of this Announcement.*

Additionally, scientific insights and capabilities should be phased to encourage early dissemination of research findings and interaction with other teams of scientists involved in IARP research, and more broadly, research within CESD. Such phasing should also consider windows of opportunities relative to ongoing, major, national and international scientific studies and assessments. That being said, research should not be driven by these considerations but applicants should seek to take advantage, build connections, and describe in their proposals where such opportunities exist.

The following four documents provide useful background material on the general field of IA and the IARP in particular. A major workshop report, "Science Challenges and Future Directions: Climate Change Integrated Assessment Research" can be found at: http://www.sc.doe.gov/ober/IA%20Workshop_06-25-09.pdf. This report, documenting a recent IARP-sponsored workshop, identifies the long-term research challenges in Integrated Assessment and a science vision for the field. Two Synthesis and Assessment Products of the U.S. Global Change Research Program were sponsored by DOE's IARP. The reports, "Scenarios of Greenhouse Gas Emissions and Atmospheric Concentrations" and "Global-Change Scenarios: Their Development and Use" can be found at: http://www.globalchange.gov/publications/reports/scientific-assessments/saps/sap2-1.

Finally, a third Synthesis and Assessment Product, found at http://www.climatescience.gov/Library/sap/sap4-5/default.php, identifies research needs to understand the effects of climate change on energy production and use in the U.S.

Data Sharing Policy: Research data obtained through public funding are a public trust. As such, these data must be publicly accessible. To be in compliance with the data policy of the U.S. Global Change Research Program of full and open access to global change research data,

proposals submitted in response to this Announcement must include a description of the researcher's data sharing plans if the proposed research involves the acquisition of data in the course of the research that would be of use to the climate change research and assessment communities. This includes data from extensive, long-term observations and experiments and from long-term model simulations of climate that would be costly to duplicate. The description must include plans for sharing the data that are to be acquired in the course of the proposed research, particularly how the acquired data will be preserved, documented, and quality assured, and where it will be archived for access by others. Data of potentially broad use in climate change research and assessments should be archived, when possible, in data repositories for subsequent dissemination. Examples of DOE-funded data repositories may be found at http://cdiac.ornl.gov/, http://www-pcmdi.llnl.gov/ipcc/about_ipcc.php. The repository where the researcher intends to archive the data should be notified in advance of the intention, contingent on a successful outcome of the proposal review. If data are to be archived at the researcher's home institution or in some other location, the proposal must describe how, where, and for how long the data will be documented and archived for access by others. Researchers are allowed an initial period of exclusive use of the acquired data to quality assure it and to publish papers based on the data, but they are strongly encouraged to make the data openly available as soon as possible after this period. DOE's Office of Biological and Environmental Research defines the exclusive use period to be one year after the end of the data acquisition period for the proposed performance period of the award but exceptions to extend this period may be justified for unique or extenuating circumstances.

PROGRAM FUNDING:

Contingent on the availability of FY 2010 appropriated funds, it is anticipated that approximately $700,000 will be available for awards in Fiscal Year 2010 with approximately $2,000,000 per year available in the outyears, contingent on the availability of funds and the progress of research and programmatic needs. It is anticipated that either one or two total awards will be made within these overall totals and applicants may request project support up to five years. Applicants may submit collaborative proposals for the total amount but are advised to provide an option, and corresponding insights regarding that option, at approximately half of total program funding. Multi-lab and/or multi-institutional proposals are encouraged. Funding for this research will come from the IARP. DOE is under no obligation to pay for any costs associated with preparation or submission of proposals. DOE reserves the right to fund, in whole or in part, any, all, or none of the proposals submitted.

ELIGIBILITY:

This is a **DOE Lab-Only Announcement**. FFRDCs from other agencies are not eligible to submit in response to this Announcement. Partnerships between DOE Labs and with university researchers are encouraged, as appropriate. Proposals with all collaborating parts should be submitted by the lead Lab. No individual submissions through grants.gov should be sent at this time.

SUBMISSION INFORMATION FOR FORMAL PROPOSALS:

The instructions and format described below must be followed. All submissions and inquiries about this Program Announcement must reference Program Announcement LAB 10-06.

The research project narrative must not exceed 20 pages exclusive of attachments. The proposals must include a one-page abstract of the proposed research. All collaborators should be listed with the abstract. Attachments should include curriculum vitae, a listing of all current and pending federal support and letters of intent when collaborations are part of the proposed research. Curriculum vitae should be limited to no more than two pages per individual. All proposals submitted in response to this Announcement must explicitly state how the proposed project will support accomplishment of the BER climate science activity LTM.

The following is a list of essential items that a proposal must contain:

1) **Field Work Proposal (FWP) Format** - Complete and signed by appropriate officials

2) **Proposal Cover Page**

3) **Table of Contents**

4) **Budget Page(s) (Form DOE F 4620.1)** - Complete a separate Budget Page for the entire multi-year period for each separate participating institution.

5) **Budget Description and Justification** - Separately for each collaborating institution if applicable.

6) **Other Project Information**

a) **A one-page abstract (on a page by itself)**. The abstract should include: name of the laboratory; name of the principal investigator and the principal investigator's email address and phone number; name of the co-principal investigator(s) (if any) and their email address(es) and phone number(s); an abstract of the project narrative.

b) **Project Narrative: (limit 20 pages)** A detailed description of the proposed project (research plan), including the justification and objectives of the project, its relationship to the Office of Science program and the researcher's plan for carrying it out. The narrative should be limited to 20 pages maximum (8.5x11-inch pages of single-spaced, standard 11-point type with 1-inch margins), exclusive of attachments such as figures or references. i) Introduction - Should contain enough background material, including review of the relevant literature, to demonstrate sufficient knowledge of the state of the science. ii) Research Plan - The major part of the narrative should be devoted to a description and justification of the proposed project, including details of the method 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. Include a plan that describes how the project results or resources will be disseminated in a timely manner and in an accessible and usable form to the broader scientific community. iii) Management Plan for multi-lab proposals - Should outline how the work will be

coordinated among the participating institutions, the overall chain of command, the communication plan, the leads for each area, the overall allocation of resources among the various partners, etc.

c) **Curriculum Vitae:** Detailed information about the background and experience of the principal investigator and co-principal investigator (if any). Biographical sketches are limited to two pages for the principal investigator, and two pages for the co-principal investigator (if any).

d) **Long Term Measure:** The proposal must explain how the proposed research will advance the BER climate science activity Long Term Measure detailed above.

e) **Facilities and Resources:** Include information on the experience of the proposer's organization, its facilities, and resources that would be relevant to successful operation of the project.

f) **Statement of all current and pending support** for the principal investigator and co-principal investigator (if any), including the time devoted to each project by the principal investigator and co-principal investigator (if any).

The instructions and format described should be followed. You must reference Program Announcement LAB 10-06 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

After an initial screening for eligibility and responsiveness to this Announcement, proposals will be subjected to a formal scientific merit review (peer review). The proposals will be evaluated against the following criteria, which are listed in descending order of importance:

1) Scientific and/or Technical Merit of the Project;
2) Appropriateness of the Proposed Method or Approach;
3) Competency of Researcher's Personnel and Adequacy of Proposed Resources; and
4) 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 agencies' programmatic needs. Note that

external peer reviewers are selected with regard to both their scientific expertise and the absence of conflict-of-interest issues. Both Federal and 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 412.1A) (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 - 20-page limit)
- Literature Cited
- Biographical Sketch(es)
- Description of Facilities and Resources
- Other Support of Investigator(s)
- Appendix (optional)

2.1 Submission Instructions

Have your LAB administrator submit the entire LAB proposal and FWP via Searchable FWP (https://www.osti.gov/fwp). If you have questions about who your LAB administrator is or how to use Searchable FWP, please contact the Searchable FWP Support Center.

Please submit, via Federal Express, a single PDF file of the entire LAB proposal and FWP on a CD along with two hard copies to the address below. This will assist in expediting the review process.

Please send the CD and 2 hard copies via Federal Express to:

Karen Carlson-Brown
Climate and Environmental Sciences Division, SC-23.1
Office of Biological and Environmental Research
Office of Science
19901 Germantown Road
Germantown, MD 20874-1290
ATTN: Program Announcement LAB 10-06

For further information contact:

Bob Vallario
Program Manager
Integrated Assessment Research Program
Climate and Environmental Sciences Division

Tel: (301) 903-5758
Email: Bob.Vallario@science.doe.gov

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 his or her proposal. 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 at least 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 412.1A) (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.

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/budgetform.pdf

3.5 Abstract

Summarize the proposal in one page. 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 lead DOE national Laboratory, 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 **20 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. It is important that the 20-page technical information section provide a complete description of the proposed work, because reviewers are not obliged to read the Appendices. Proposals exceeding these page limits may be rejected without review.

All proposals submitted in response to this LAB Announcement must explicitely state how the proposed project will support the accomplishment of the BER climate science Long Term Measure.

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. Each reference must include the names of all authors (in the same sequence in which they appear in the publication), the article and journal title, book title, volume number, page numbers, and year of publication. Include only bibliographic citations. Principal investigators should be especially careful to follow scholarly practices in providing citations for source materials relied upon when preparing any section of the proposal.

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 and must include:

Education and Training. Undergraduate, graduate and postdoctoral training, provide institution, major/area, degree and year.

Research and Professional Experience. Beginning with the current position list, in chronological order, professional/academic positions with a brief description.

Publications. Provide a list of up to 10 publications most closely related to the proposed project. For each publication, identify the names of all authors (in the same sequence in which they appear in the publication), the article title, book or journal title, volume number, page numbers, year of publication, and website address if available electronically. Patents, copyrights and software systems developed may be provided in addition to or substituted for publications.

Synergistic Activities. List no more than five professional and scholarly activities related to the effort proposed.

To assist in the identification of potential conflicts of interest or bias in the selection of reviewers, the following information must also 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. Finally, list any individuals who are not listed in the previous categories with whom you are discussing future collaborations. 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 $50,000 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.