DEPARTMENT OF ENERGY
OFFICE OF SCIENCE
BIOLOGICAL AND ENVIRONMENTAL RESEARCH

ENVIRONMENTAL SYSTEM SCIENCE

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Submission Deadline for Letters of Intent:	**N/A**
Submission Deadline for Pre-Applications:	**December 5, 2019, at 5:00 pm Eastern Time**
Pre-Application Response Date:	**December 19, 2019, at 11:59 pm Eastern Time**
Submission Deadline for Applications:	**February 20, 2020, at 11:59 pm Eastern Time**

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UPDATES AND REMINDERS

RECOMMENDATION

The Department of Energy (DOE) Office of Science (SC) encourages you to register in all systems as soon as possible. You are also encouraged to submit pre-applications and applications well before the deadline.

AVOIDING ERRORS

The following advice is compiled from actual experiences of applicants for SC financial assistance awards.

- Please ensure that the research narrative is comprised of one and only one Portable Document Format (PDF) file, including all appendices, when it is attached to the SF-424 (R&R) form.
- When using the PAMS website at https://pamspublic.science.energy.gov, please avoid using the back-arrow button in your web browser to navigate.
- Please ensure that the application contains no personally identifiable information (PII).
- Please ensure that the budget is calculated using the applicable negotiated indirect cost and fringe benefit rates.

GRANTS.GOV WORKSPACE

Applications submitted through Grants.gov at https://www.Grants.gov must be submitted through a "Workspace" or the applicant's system-to-system service. Workspace permits members of a team to simultaneously work on their application in an online collaborative environment. Application forms may exist as both online webforms and downloadable forms. More information is available at https://www.Grants.gov/web/grants/applicants/workspace-overview.html.

DATA MANAGEMENT PLAN (DMP)

Applications submitted under this FOA are subject to the SC Statement on Digital Data Management, published at https://science.osti.gov/funding-opportunities/digital-data-management/. Compliance with this statement is detailed in Part IV, Section D of this FOA.

ACKNOWLEDGMENT OF FEDERAL SUPPORT

SC published guidance about how its support should be acknowledged at https://science.osti.gov/funding-opportunities/acknowledgements/.

Checklist for Avoiding Common Errors:

Item	**Issue**
Page Limits	Strictly followed throughout application, including particular attention to: - Research Narrative - Appendix 2 Narrative, if any - Biosketches - DMP(s) - Letter(s) of Support, if any
Protected Personally Identifiable Information	None present in the application
Research Narrative	Composed of one PDF file including all appendices
Project Summary / Abstract	Name(s) of applicant, PI(s), PI's institutional affiliation(s), Co-Investigator(s), Co-Investigator's institutional affiliation(s), including any unfunded collaborators
DOE Cover Page	Follow instructions closely, using the template listed in Section IV, B.
Budget	Use current negotiated indirect cost and fringe benefit rates
Budget Justification (attached to budget)	Justify all requested costs and ensure the amounts are identical to the budget form
Biographical Sketches	Follow page limits strictly and include all known Conflicts of Interest (COI's)
Current and Pending Support	Ensure completeness
Data Management Plans	- Include a DMP even if no experimental data is expected - Include the required links to ESS-DIVE in the DMP
Collaborations	- DOE Lab collaborations are limited to 10% of the total effort. Lab budgetary materials should not be included as a sub-award, but rather as an Appendix - Federal agency collaborations must submit a separate, identical application package with the budget/budget justification being the only difference - All other collaborators must be included as a subaward.

Section I – FUNDING OPPORTUNITY DESCRIPTION

GENERAL INQUIRIES ABOUT THIS FOA SHOULD BE DIRECTED TO:

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STATUTORY AUTHORITY

Public Law 95-91, U.S. Department of Energy Organization Act
Public Law 109-58, Energy Policy Act of 2005

APPLICABLE REGULATIONS

Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards, codified at 2 CFR 200
U.S. Department of Energy Financial Assistance Rules, codified at 2 CFR 910
U.S. Department of Energy, Office of Science Financial Assistance Program Rule, codified at 10 CFR 605

SUMMARY

The DOE SC program in Biological and Environmental Research (BER) hereby announces its interest in receiving applications for research in Environmental Systems Science (ESS), including Terrestrial Ecosystem Science (TES) and Subsurface Biogeochemical Research (SBR). The goal of the Environmental System Science (ESS) activity in BER is to advance a robust, predictive understanding of the set of interdependent physical, biogeochemical, ecological, hydrological, and geomorphological processes for use in Earth system, ecosystem and reactive transport models. Using an iterative approach to model-driven experimentation and observation, and interdisciplinary teams, ESS-supported scientists work to unravel the coupled physical, chemical and biological processes that control the structure and functioning of terrestrial ecosystems and integrated watersheds across critical spatial and temporal scales. This FOA will consider applications that focus on improving the understanding and representation of terrestrial and subsurface environments in ways that advance the sophistication and capabilities of local, regional, and larger scale models. Using new measurements, field experiments, more sophisticated modeling and/or synthesis studies, this FOA will encompass two topic areas: 1)

Terrestrial Ecology, specifically linking above and belowground processes, as well as methane biogeochemistry; and 2) Subsurface and Watershed Hydro-biogeochemistry, specifically studying the function and dynamics of hydro-biogeochemical processes within watersheds. All applications are required to clearly delineate an integrative, hypothesis-driven approach and describe the existing needs/gaps in state-of-the-art models. Applicants should provide details on how the results of the proposed research will be used to improve the predictability and sophistication of integrated watershed systems and/or terrestrial ecosystem models.

SUPPLEMENTARY INFORMATION

Program Objective

The ESS program resides in the BER Climate and Environmental Sciences Division (CESD) and is comprised of both the TES and SBR activities. The goal of ESS is to advance a robust, predictive understanding of the set of interdependent physical, biogeochemical, ecological, hydrological, and geomorphological processes for use in Earth System Models (ESMs) and local-scale models. ESS uses a systems approach to understand terrestrial surface and subsurface ecosystems over multiple scales that can be represented in models [e.g., single-process models, system models, and DOE's Energy Exascale Earth System Model (E3SM)]. Using an iterative approach to model-driven experimentation and observation, and interdisciplinary research teams, ESS supported scientists work to unravel the coupled physical, chemical and biological processes that control the structure and functioning of terrestrial ecosystems and integrated watersheds across critical spatial and temporal scales. This emphasis on the capture of advanced understanding in models has two goals. First, it seeks to improve the representation of these processes in coupled models, thereby increasing the sophistication of the projections from those models, and it exercises those models and compares the results against observations or other datasets to identify critical uncertainties that can inform future research directions.

This FOA will consider applications that focus on improving the understanding and representation of terrestrial and subsurface environments in ways that advance the sophistication and capabilities of local, regional, and larger scale models. Using new measurements from both field and laboratory experiments along with more sophisticated modeling and/or synthesis studies, this FOA will encompass two topic areas: 1) Terrestrial Ecology, specifically linking above- and belowground processes, as well as methane biogeochemistry; and 2) Integrated Watershed Hydro-biogeochemistry, specifically studying the function and dynamics of subsurface to surface hydro-biogeochemical processes within watersheds. All applications are required to clearly articulate an integrative, hypothesis-driven approach and describe the existing needs/gaps in state-of-the-art models. Applicants should provide details on how the results of the proposed research would be used to improve the predictability and sophistication of understanding integrated watershed systems and/or terrestrial ecosystem models.

In 2018, BER's CESD released its revised strategic plan that covers the period 2018-2023. This plan highlights five scientific grand challenges that outline science needs for basic research that address key uncertainties in the understanding of Earth system components, as well as complex uncertainties that arise from the interactions and interdependencies of these components in the coupled Earth system (https://science.osti.gov/-/media/ber/pdf/workshop-

reports/2018_CESD_Strategic_Plan.pdf). Applicants are encouraged to review this strategic plan to familiarize themselves with the identified science needs as they relate to the ESS program.

Program Approach

This FOA will consider applications that focus on improving the understanding and representation of terrestrial and subsurface environments in ways that advance the sophistication and capabilities of process, local, regional, and larger scale models. Research supported by this FOA must address the research scope and goals of either the TES or SBR activities:

Terrestrial Ecosystem Sciences (TES). As a part of the ESS program, the TES goal is to improve the representation of terrestrial ecosystem processes in ESMs, thereby improving the quality of complex Earth and environmental model projections. This contributes to the scientific foundation needed to inform DOE's and the nation's energy decisions. The TES research focuses on ecosystems and terrestrial processes that are globally important, climatically or environmentally sensitive, and comparatively understudied or underrepresented in Earth system models. TES uses a systems approach to characterize ecosystems over relevant temporal and spatial scales that can be represented in models (e.g., single process models, ecosystem models, and global models, such as the E3SM). The TES program carefully couples experimental and observational data on terrestrial ecosystem processes with models to identify key uncertainties in model projections. The program strategically focuses on collecting new data and knowledge to address these uncertainties thereby advancing the sophistication of the models and therefore the confidence in the projections through and iterative process. Research supported under TES must demonstrate an iterative dialog between the experimental and modeling research communities (also known as ModEx), such that a) experimental research objectives are cooperatively designed to address key model deficiencies and b) the modeling efforts are designed to inform the experimental/empirical research. By connecting the modeling and experimental components, this approach maximizes the return on scientific investments by reduced duplication of efforts, encouraging collaboration, and accelerating the adoption of scientific findings into improve predictive capabilities. Current information on TES can be found at https://tes.science.energy.gov/, and https://science.osti.gov/ber/Research/cesd/Terrestrial-Ecosystem-Science.

Subsurface Biogeochemical Research (SBR). As part of the ESS program, the SBR goal is to advance a robust predictive understanding of how watersheds function as integrated hydro-biogeochemical systems and how these systems respond to perturbations such as changes in water recharge, availability and quality, contaminant transformation and transport, nutrient loading and cycling, land use, and vegetative cover. Water resources critical for energy production and environmental sustainability are under pressure from growing water demand, contamination, drought, flooding, and saltwater intrusion. Sustainable management of watershed systems and their coupling with the built environment rely on understanding the hydrologic and biogeochemical processes that control watershed system dynamics and water availability and quality. SBR has five priority research objectives (https://doesbr.org/) that are being pursued through a variety of watershed testbeds within the contiguous United States. SBR-funded researchers are encouraged to use a systems approach to probe the structure, functioning and dynamics of integrated watersheds and to capture observations in mechanistic models representing both the complexities of the subsurface and interactions with surface water bodies

and vegetation. These mechanistic models use reactive transport and hydrology codes that incorporate metabolic models of microbial processes; molecular-scale understanding of geochemical stability, speciation, and biogeochemical reaction kinetics; and diagnostic signatures of the system response at varying spatial and temporal scales. To address the priority research objectives, SBR supports a portfolio of research activities at the DOE National Laboratories and other research institutions. The portfolio comprises six Science Focus Area (SFA) programs led by DOE National Laboratories (https://doesbr.org/research/sfa/). The SFA programs are long-term interdisciplinary research efforts, all of which are focused around field research sites that span a wide range of environments and hydrologic settings (currently, eastern and western river basins). The SFA watershed field sites or testbeds encompass many of the structural components of watersheds, including snow-dominated headwaters, 3rd and 8th order streams/rivers, wetlands, floodplains, and ponds. SBR is committed to designing and leveraging data and information from these distributed testbeds in ways that promote open scientific research (https://doesbr.org/documents/Open_Watersheds_By_Design_DRAFT.pdf). Several of the SFA testbeds also serve as modeling use cases for the Interoperable Design of Extreme-Scale Application Software (IDEAS)-Watersheds project (https://ideas-productivity.org/ideas-watersheds/), a community-wide effort that supports the integration of diverse hydro-biogeochemical datasets with multi-scale, multi-physics numerical models that are interoperable. SBR requires that codes developed are open source and made available to the scientific community. Current information on SBR is at https://doesbr.org/, and https://science.osti.gov/ber/Research/cesd/Subsurface-Biogeochemical-Research.

Application Types: Two types of research described below are solicited as part of this FOA. **Applicants must indicate which application type the proposed work addresses on the cover page of the application**:

1. Standard Application – These efforts may request support for up to three years, addressing a research project within scope of the objectives indicated in this FOA. Note that not all standard efforts require the maximum budget limited by this FOA, but should be commensurate with the scope of the proposed effort.
2. Exploratory Applications - These are smaller, more focused exploratory research efforts that would be perceived as "high-risk," i.e., that may have the potential for future high impact on ESS research. Applications for one or two year duration innovative exploratory research are encouraged where the proposed research is intended to fill critical knowledge gaps and can include the exploration of high-risk approaches. The probability of success and the risk-reward balance will be considered when making funding decisions.

Both types of applications will use the same submission process and are subject to the same review requirements. BER anticipates funding both categories of research efforts but the precise ratio of standard to exploratory applications to be funded will be determined based on the review and selection criteria of this FOA. Award information specific for each type of application and within each Topic Area (described below) is provided in Section II.

Science Research Areas

This FOA will support research within the ESS program under the topic areas described below.

Pre-applications and applications must clearly indicate the specific TES or SBR topic area, as well as the science research area that is being targeted. Pre-applications and/or applications that do not clearly identify a topic (Terrestrial Ecology or Subsurface and Watershed Hydro-biogeochemistry) and science research area (defined for each topic area), or indicate multiple areas may be declined without review.

Terrestrial Ecology Topic Area

For Terrestrial Ecology, this FOA will consider applications that include and couple where appropriate, measurements, experiments, modeling and/or synthesis, to provide improved quantitative and predictive understanding of terrestrial ecosystems spanning a continuum from the bedrock through vegetation/atmospheric interface. This FOA invites applications that seek to understand the terrestrial ecosystem feedbacks in response to environmental and Earth system changes and in ways that advance the parametrization of these processes in appropriate model frameworks. This understanding leads to improved model projections and contributes to the scientific foundation needed to inform DOE's energy decisions. Therefore, applicants must pose their research goals, objectives, and approach in the context of representing terrestrial ecosystem processes in system models. The emphasis on the applicability to models may be accomplished through either or both of the two following approaches: 1) through process research, which incorporates results via new parameterizations/modules into state-of-the-art process, ecosystem, environmental, or Earth system models; 2) by proposing direct improvements (through modification of existing parameterizations and/or algorithms) and related comparisons of synthesis activities that draw on existing observational/modeling data sets. Applicants are required to employ a model-inspired approach to pose research questions, which in turn provides a direct link or strategy to improving the model or process representation. At the Earth system scale, DOE has invested extensive efforts to develop the E3SM model and applicants are encouraged to link their activities to these efforts where appropriate. All applications (including synthesis activities) must clearly delineate an integrative, hypothesis-driven approach and clearly describe the existing needs and/or gaps in state-of-the-art models. Applicants should argue how the results of the proposed research, if successful, will improve our ability to understand and predict the role of the terrestrial ecosystems in a changing environment or Earth system.

While TES supports a broad spectrum of fundamental research with a view towards improved process representations and Earth system predictability, this FOA limits the scope of acceptable topics to the two science research areas described below. Applicants are strongly encouraged to propose research that is fully consistent with and within the scope of the following descriptions and science areas and goals:

- Science Research Area 1 – Interactions and Feedbacks between Above- and Belowground Processes: Improved understanding of the interactions and feedbacks among key above- and below-ground ecological and biogeochemical components/processes that span the functional soil-microbe-plant-atmosphere continuum, that in turn enables robust process level understanding and improved Earth system projections across scales.

  Terrestrial life on Earth depends on the dynamic interactions and interdependencies among various ecosystem components such as vegetation and soils. The interplay among aboveground vegetative processes (e.g., photosynthesis, growth, and respiration) and

belowground processes (e.g., carbon storage, water transport/availability and nutrient transformations) regulate the assimilation, stabilization and mineralization aspects of many critical biogeochemical cycles. An integrated systems approach that examines multi-scale processes across a soil-microbe-plant-atmosphere continuum is needed to better understand and project feedbacks of key processes at various temporal and spatial scales. This coupled-systems approach should enable better understanding of uncertainties associated with interdependent processes that influence or control hydro-biogeochemical pools and fluxes. This could include aboveground plant-mediated transformations such as priming and hydraulic redistribution, plant-microbe interactions such as mycorrhizal interactions, regulation of biogeochemical fluxes, and nutrient redistribution, and belowground drivers/regulators of photosynthesis and evapotranspiration, including water availability (including precipitation). Research under this topic should provide new insights on the conceptualization and mechanistic representation of coupled ecological and hydro-biogeochemical interactions and feedbacks between the above- and belowground system compartments/continuum in response to changing Earth and environmental systems. Particular interest will be on applications that examine coupled biogeochemical cycles, system thresholds, and/or factors that create and sustain biogeochemical "hot spots" and "hot moments" within scope described above. While applications are not required to target all components of the soil-microbe-plant-atmosphere continuum, applicants must clearly identify targeted aboveground and belowground processes and the specific interactions between these components and or processes. Applications that focus on coastal ecosystems, TES relevant ecosystems, and terrestrial-aquatic interfaces are encouraged.

Research that focuses on inorganic biogeochemical/ contaminant fate and transport, macro-organismal processes/involvement (e.g., insect, animal, humans, etc.), land-use management, agriculture, or geomorphology **will not be** considered for this FOA topic area.

- Science Research Area 2 – Ecological Controls and Feedbacks on the Methane Cycle: New or improved understanding of the ecological controls on methane fluxes, particularly those related to hot spot-hot moment phenomena that have the potential for direct feedbacks to the Earth system.

  Methane (CH_4) is a potent greenhouse gas and is ~28 times more effective at trapping outgoing infrared radiation than carbon dioxide (CO_2). Atmospheric CH_4 levels have reached their highest levels in more than a million years, with global emissions reaching more than 550 Tg per year. While CH_4 concentration leveled off in the mid-1990's to early 2000's, recent observations suggest significant growth and acceleration in levels since 2014. Unfortunately, the changes to and controls on the global CH_4 cycle are not well understood or represented in predictive models. The Second State of the Carbon Cycle (SOCCR-2, https://carbon2018.globalchange.gov/) highlights the persistent challenges in unravelling CH_4 dynamics across North America that arise from the need to fully quantify multiple sources and sinks, as well as a need for cross-disciplinary efforts to address these challenges and constrain the related uncertainties. Because CH_4 production and oxidation are sensitive to temperature and moisture, they exhibit

significant seasonal and interannual cycles, which are pronounced in high latitudes, temperate coastal and wetlands, and tropical systems. Research under this topic should provide new measurements and insights on the terrestrial ecological controls on CH_4 fluxes, which have the potential for direct feedbacks to the Earth system. Successful applications to this topic must include the collection of new CH_4 measurements in order to expand the limited, but growing CH_4 datasets for future synthesis, model development and analysis. Applications that examine factors that create, sustain and/or limit hot spot-hot moment phenomena for CH_4 fluxes are particularly encouraged. Additionally, applications are strongly encouraged to leverage the AmeriFlux network and its "Year of Methane" (https://ameriflux.lbl.gov/year-of-methane/year-of-methane/) where appropriate.

Applications that only focus on model development and analysis or atmospheric processes will not be considered for this FOA topic area. Research that focuses on ocean processes, land-management or agricultural practices, and macro-organismal processes/involvement (e.g., insect, animal, humans, etc.), **will not be** considered for this FOA topic area.

Applications to both of the Terrestrial Ecology science research areas 1 and 2 can be Exploratory or Standard. Additionally, applications that address either of these key science research areas are strongly encouraged to focus on high priority geographies relevant to the TES activity (see https://tes.science.energy.gov/) and/or other regions highlighted in the 2018 CESD Strategic Plan.

Subsurface and Watershed Hydro-biogeochemistry Topic Area

For Subsurface and Watershed Hydro-biogeochemistry, this FOA will consider applications that include and couple where appropriate, measurements, experiments, and modeling to provide improved quantitative and predictive understanding of the structure and hydro-biogeochemical function/dynamics of integrated watershed systems, including groundwater to surface water and the subsurface to soils and the rhizosphere. SBR-funded researchers are encouraged to use a systems approach to probe the structure, functioning and dynamics of integrated watersheds and to capture observations in mechanistic models representing both the complexities of the subsurface and interactions with surface water bodies and vegetation. For this topic area, applicants may propose experimental- and/or field-based research, or model development/enhancement research; however, there are some specific differences in what can be proposed for each of the science research areas, as detailed below. Pre-applications and final applications are expected to describe the scientific gaps requiring experimental- and/or field-based research, or model development/enhancement research, and clearly delineate an integrative, hypothesis-driven approach to address the science gaps. Proposed goals, objectives and research approaches should enable testing of the hypotheses. Applicants should also explain how the results of the proposed effort would lead to an improved understanding of the structure and/or hydro-biogeochemical functioning/dynamics of integrated watershed systems.

This Subsurface and Watershed Hydro-biogeochemistry topic area limits the scope of acceptable applications to the two science research areas, 3 and 4, described below. These science areas are aligned with several of the grand challenges identified in the 2018 CESD Strategic Plan. Applicants are strongly encouraged to propose research that is fully consistent with and within

the scope of the following descriptions of science areas and application types:

- Science Research Area 3 – Hydro-Biogeochemistry, Biogeochemistry and Geochemistry research to advance understanding of watershed function at existing watershed testbeds. For this science research area, SBR is seeking applications for research that complements and does not duplicate SBR's SFA research activities, and that explores new directions. **Applications to this science area are limited to Exploratory.**

  Research at the existing integrated watershed testbeds includes studies of the influence of groundwater-surface water interactions on nutrient cycling/loading (e.g., carbon and nitrogen), the role of critical biogeochemical elements in the functioning and dynamics of watershed systems (e.g., iron, sulfur and manganese), and the biogeochemical transformations of metal contaminants (e.g., mercury, uranium, and actinides). The spatial range of lab- and/or field-based research within the SFAs includes molecular, genomic, pore, and core scales, as well as field plot, borehole/subsurface, hillslope, hyporheic zone, stream bed, reach, floodplain, wetland, and watershed scales. Temporal scales range from nanoseconds for molecular-scale processes to months or longer for the larger scale studies. The Lawrence Berkeley National Laboratory (LBNL), Pacific Northwest National Laboratory (PNNL) and Oak Ridge National Laboratory (ORNL) SFAs are developing a variety of process, reactive transport and watershed models of their SFA testbeds. All the SFAs make use of a variety of unique analytical capabilities located at DOE User Facilities (see below), and many are making use of capabilities offered through the Worldwide Hydrobiogeochemistry Observation Network for Dynamic River Systems (WHONDRS) (https://whondrs.pnnl.gov/) effort.

  For this science research area, applications are solicited for both lab- and/or field-based research to address science gaps specific to any given watershed testbed. Examples of science gaps include:

  - Characterization of the spatial heterogeneity and co-variability of physical, chemical and biological properties of watersheds, from the subsurface through riverine/hyporheic zones and to terrestrial environments;
  - Characterization of stream and wetland biofilm community composition and links between community structure-function and key biogeochemical processes such as nutrient loading/cycling (C, N, and P); cycling of key elements (e.g., iron, sulfur, and manganese); metal contaminant transformations and transport (for Hg, Tc, U, and actinides as well as for As, Cr, Pb, and Zn); and colloid formation;
  - Elucidation of the molecular processes controlling complexation and redox chemistry between organic matter and nutrients, key elements, and metals/contaminants in dynamic/transient hydrologic and geochemical conditions; and
  - Methods for quantitative measurements of exchange fluxes (water, heat and solutes) between groundwater and surface water, and/or from permeable bedrock through the vegetative canopy at the local, reach, and watershed scales.

  In addition to lab- and field-based research, applications for model development or

enhancement are also encouraged. Applications focused on model development or enhancement for this science area must explain how the codes complement or can become interoperable with the codes that are being developed within the SFAs, and/or with those that are part of the IDEAS-Watersheds project, or with other DOE-relevant reactive transport/hydrology codes such as PFLOTRAN. Emphasis will be placed on reaction- and watershed-scale modeling applications, including catchment microbiology and watershed vegetation, and on river basin and regional-scale modeling applications focused on hydrologic processes and prediction, particularly for water/mass balances and evapotranspiration. These applications must discuss planned approaches for validating model outputs/results with field- or lab-based experimentation.

All applications to this science area must complement, but not duplicate, SFA research carried out by the National Laboratories.

The following **will not be** considered for this science research area: Research that focuses primarily on: a) genomic science; b) carbon cycling; c) geochemical or biogeochemical processes in the subsurface/soils, but that lacks a clear connection to understanding watershed function; d) non-SFA sites without sufficient explanation of how the research would be complementarity to, and not duplicative of, SFA research; e) non-metal contaminants; f) zooplankton, macroinvertebrates and higher multi-cellular organisms; g) remediation research; and h) biogeochemical processes occurring only in the water column.

- Science Research Area 4 – Hydro-biogeochemistry, Biogeochemistry and Geochemistry research to study the functioning of watershed structural components that are novel to the SBR program. For this science area, SBR is seeking applications that focus on headwater springs; gaining and/or losing streambeds other than those associated with the SFAs; and both tidal and freshwater mouths of watersheds. **Applications to this science area can be either an Exploratory or Standard.**

  The current SFA testbeds encompass many of the structural components of watersheds, including snow-dominated headwaters, 3rd and 8th order streams/rivers, wetlands, floodplains, and ponds; however, some important structural components of watersheds are not among the existing testbeds. Among the missing natural components are headwater springs, gaining and/or losing streambeds (other than those associated with the existing watershed testbeds), and both tidal and freshwater mouths of watersheds. To enable a more robust understanding of the hydro-biogeochemical functioning of integrated watershed systems from headwaters to the mouth, improved scientific understanding involving these missing structural components is needed. This science area seeks applications to investigate the hydro-biogeochemical functioning of these missing natural components of integrated watershed systems in the continental U.S. only. Applicants for this science research area should describe whether or not their proposed research has the potential to become, or will become, a part of the WHONDRS network.

  Example areas for lab- or field-based research:
  - Characterization of the spatial heterogeneity and co-variability of physical,

chemical and biological properties of headwater springs, gaining or losing streambeds, and both tidal and freshwater mouths of watersheds, from the subsurface through riverine/hyporheic zones and to terrestrial environments.

- Characterization of biofilm community composition and links between community structure-function and key biogeochemical processes such as nutrient loading/cycling (C, N, and P) and elemental (e.g., iron, sulfur, and manganese) cycling and transformations.
- Characterization of the factors contributing to the presence, persistence and intensity of "hot spot" and "hot moment" phenomena of biogeochemical activity in the subsurface, soils, aquatic sediments, and groundwater/surface water interaction zones.
- Studies of the impacts of perturbations (e.g., drought, flood, changes in nutrient inputs) on hydro-biogeochemistry and eco-hydrology at local, reach, and watershed scales.

In addition to lab- and field-based research, applications proposing model development or enhancement within this SBR science research area are encouraged. Applications are sought for process modeling, particularly for Reaction-scale, although Watershed-scale modeling research will also be considered. Applicants are encouraged to align code development/enhancement efforts with those of the IDEAS-Watersheds project and other DOE-supported codes such as PFLOTRAN. These applications must discuss planned approaches for validating model outputs/results with field- or lab-based experimentation.

The following **will not be** considered for this science area: Research that focuses primarily on: a) genomic science; b) carbon cycling; c) geochemical or biogeochemical processes in the subsurface/soils, but that lacks a clear connection to understanding watershed function; d) non-metal contaminants; e) zooplankton, harmful algal blooms, macroinvertebrates and higher multi-cellular organisms; f) human-influenced components of the integrated watershed system (e.g., impoundments/reservoirs, irrigated lands, constructed wetlands/streambeds); g) modeling studies at basin or regional scale; and h) biogeochemical processes occurring only in the water column.

OTHER REQUIREMENTS

These additional requirements apply to both the TES and SBR science areas.

Participation in ESS PI Meetings: To ensure that the program meets the broadest needs of the research community and the specific needs of the DOE CESD, a representative (preferably the lead PI) from successful applications are expected to attend the annual Environmental System Science Principal Investigator science team meeting. This two-day meeting is held in the Washington, DC area in the spring of each year. Travel funds should be budgeted to allow at least the lead PI to attend this meeting

Resubmissions: Applications that are based on previous applications that have been declined by this program are encouraged to address (within the Narrative Section) major issues and concerns raised by previous reviews and to describe how the application was improved and updated since

the original submission. Do not mark the application as "Revised" or a "Resubmission."

Multi-institution Teams and Collaborative Applications: Both single investigator and multi-investigator applications are encouraged. Multi-disciplinary and inter-institutional collaborations are also encouraged. Collaboration may include institutions such as universities, industry, non-profit organizations, Federal Agencies, and Federally Funded Research and Development Centers (FFRDCs), which include the DOE/NNSA National Laboratories[1].

DOE will consider funding multi-investigator teams or multi-institution teams under this FOA, where a team addresses a problem that cannot be addressed by a single investigator. Teaming partners must clearly designate a lead PI and institution, and must include a project management section in the lead PI's application narrative that clearly discusses plans for coordination/ communication, and indicates the roles, proposed activities and deliverables for each collaborator, especially those at another institution. Note that a well-thought-out research plan and its associated budget(s) should leave no confusion about which PI and institution will be the lead and which will do each of the planned parts of the research. Involvement of students and post-doctoral scientists is encouraged. The lead submission must include all budgetary information on the application cover page for all funded Co-PIs. Unfunded collaborators should also be included on the application cover page too. Applications that do not include these required elements may be declined without review.

DOE expects that any multi-institution team will have a clearly named lead PI with overall responsibility for the project and that the team will be strongly coordinated; thus, the intent is to fund a team as a single project, where possible. More information about and restrictions on multi-institutional teams/consortia can be found below and in Section III. Multi-institution teams led by eligible institutions should submit a single application (per team) from the lead institution that includes sub-contracts for any funded institutional collaborators to this FOA, unless the team contains collaborators from other Federal agencies. Because Federal agencies are funded via interagency agreements rather than grants, a multi-institutional team including one or more members from a Federal agency is the only scenario for which multiple collaborating applications as described below and in Section IV should be submitted.

If a multi-institution team includes one or more members from Federal agencies, then the lead non-Federal institution and the Federal agency or agencies must each submit collaborative applications. The application from the lead non-Federal institution should include in its budget the funding for any other non-federal members of the multi-institution team via subawards. Collaborative applications submitted from different institutions (**for this FOA, this only applies when at least one of the collaborating institutions is a non-DOE Federal Agency**) must

[1] The DOE/NNSA National Laboratories are all National Laboratories managed by DOE and/or the semi-autonomous NNSA. They are Ames Laboratory, Argonne National Laboratory, Brookhaven National Laboratory, Fermilab, Lawrence Berkeley National Laboratory, Idaho National Laboratory, Lawrence Livermore National Laboratory, Los Alamos National Laboratory, National Energy Technology Laboratory, National Renewable Energy Laboratory, Oak Ridge National Laboratory, Pacific Northwest National Laboratory, Princeton Plasma Physics Laboratory, Sandia National Laboratories, Savannah River National Laboratory, SLAC National Laboratory, and Thomas Jefferson National Accelerator Facility.

clearly indicate that they are part of a collaborative project/group, and each institution must submit an application through its own sponsored research office. Each application within the collaborative group, including the title, the narrative and all required appendices and attachments, must be identical with the following exceptions:

- Each application must contain a correct SF-424 (R&R) cover page for the submitting institution only.
- Each application must contain a unique budget corresponding to the expenditures for that application's submitting institution only.
- Each application must contain a unique budget justification corresponding to the expenditures for that application's submitting institution only.

Our intent is to create from the various applications associated with a collaborative group one document for merit review that consists of the common, identical application materials combined with a set of detailed budgets from the partner institutions. Thus, it is very important that every application in the collaborative group be identical (including the title) with the exception of the budget and budget justification pages.

Collaborations involving the DOE/NNSA National Laboratories are permitted; however, the efforts must reflect specific and unique capabilities/expertise at the collaborating National Laboratory. The National Laboratory component of these financial collaborations will be **limited to no more than 10% of total costs** and should show clear scientific leadership from the submitting institution and reflect an appropriate level of effort from the DOE National Laboratory (see table below). Funding for any given National Laboratory as part of the proposed effort will be provided via an FWP and not via the grant.

Reference Table for submission of applications involving collaborators:*

		Collaborating Institution		
		University/ Academic/ Other Non-Profit Institutions	**DOE National Lab**	**Federal Agency**
Lead Submitting Institution	**University/ Academic/ Other Non-Profit Institutions**	The lead university/institution submits one application with collaborating universities/institutions as sub awards. The non-lead university/ institution does not submit a separate application. The narrative cover page should include a summary table displaying the budget amounts requested for all project collaborators.	The lead university/institution includes DOE Lab budget sheets and justifications as an appendix to their application, but does not include the Lab in the lead university/institution budget sheets as a sub award. The lead university/institution has to include the expected funding level for the Lab in a table on the cover page. The DOE Lab does not submit an application.	The lead university/institution does not include the Federal Agency as a sub award. The Federal Agency must submit a separate, but identical application (with the only difference being their respective budget and justification). The narrative cover page should include a summary table displaying the budget amounts requested for all project collaborators. This is one of two ways a "collaborative application" can be submitted.

	Federal Agency	The Federal Agency submits one application with collaborating universities/institutions as sub awards. Universities/institutions collaborating with the Federal Agency do not submit a separate application. The narrative cover page should include a summary table displaying the budget amounts requested for all project collaborators.	The Federal Agency includes DOE Lab budget sheets and justifications as an appendix to their application, but does not include the Lab in the Federal Agency budget sheets as a sub award. The Federal Agency has to include the expected funding level for the Lab on a table in the cover page. The DOE Lab does not submit an application.	Each additional Federal Agency must submit a separate, but identical application (with the only difference being their respective budget and justification). The lead Federal Agency does not include the additional Federal Agency as a sub award. The narrative cover page should include a summary table displaying the budget amounts requested for all project collaborators. This is one of two ways a "collaborative application" can be submitted.
	DOE National Lab	A Lab cannot serve as a lead institution.	A Lab cannot serve as a lead institution.	A Lab cannot serve as a lead institution.

* Applicants with questions regarding collaborations and how to submit should contact the technical/scientific program contact for this FOA.

Instructions for preparing subaward budgets and applications involving collaborators from Federal agencies, along with submission information, are included in Section IV below. All applications involving unfunded collaborators must include letters of agreement from each unfunded collaborator who would participate in the proposed application. These letters should specify the contributions the unfunded collaborators intend to make if the application is accepted and funded. As outlined above, applications for multi-investigator projects at multiple institutions also must present a well-defined management structure and coordination/communication plan for integrating collaborating investigators. Applications that do not include these required elements may be declined without review.

Data Management and Data Sharing Policy: Research data obtained through public funding are a public trust. As such, these data must be publicly accessible. As noted in Section IV of this FOA, a Data Management Plan (DMP) is a required element for all applications. The DMP should include a clear description of the applicant's strategy for collecting, validating, curating, preserving, quality assuring, metadata tagging, and sharing of data acquired during the course of the funded research effort. This includes data from extensive, long-term observations and

experiments and from long-term Earth system model simulations and other simulations that would be costly to duplicate.

To assist funded researchers, CESD established the Environmental System Science – Data Infrastructure for a Virtual Ecosystems (ESS-DIVE) data archive at LBNL (https://ess-dive.lbl.gov/) with the goal of enabling the scientific community to archive environmental science data around consistent standards and protocols for long-term preservation. ESS-DIVE is available to ESS funded projects and allows data contributors to archive and share data, obtain digital object identifiers (DOIs) that can be used to cite and track usage of the data. Users of this data archive will be able to find and obtain data generated by ESS funded researchers that are organized for better interpretation, analysis, and integration. ESS-DIVE also provides connectivity to other community resources for example: the Earth System Grid Federation (https://esgf.llnl.gov/) and DataOne (https://www.dataone.org/).

At a minimum, successful applicants and collaborative teams are **required** to share their data, data products, and metadata from their funded project with ESS-DIVE. Details of what has been provided to ESS-DIVE, including names, descriptions, and URLs of data packages, must be provided in the project's annual progress report to DOE. Failure to provide evidence of data submission may jeopardize release of the continuation of financial support for the supported application.

If successful applicants store some or all of their data in an established, public, long-term archive other than ESS-DIVE (e.g., AmeriFlux Archive, NASA DAAC, NCBI, DOE user facilities), they are also required to, at a minimum, archive metadata describing the data with ESS-DIVE including links/DOI's to the archived data.

These archiving requirements are not intended to interfere with data management activities at the home institution(s) of the project PI(s). Applications that represent multiple PIs and or institutions, must describe data management strategy across the entire team and integration with the ESS-DIVE.

Individual PIs and teams are allowed an initial period of one year of exclusive use of the data from the date of acquisition to quality check the data and to publish papers based on the data, as outlined in the additional CESD requirements regarding digital data management (https://science.energy.gov/ber/funding-opportunities/digital-data-management/). The appropriate TES or SBR program manager must approve exceptions to this requirement, based upon a written request from the lead PI that fully explains the basis or extenuating circumstances for the request. Successful applicants are strongly encouraged to engage the ESS-DIVE team to develop a timeline for submitting the data and making the data openly available as soon as possible. Explicit data management and data sharing plans are required to be included as Appendix 6, and limited to 3 pages in length (i.e., they are not included in the narrative page length). Criteria for review of DMP's are provided to the reviewers, as described in Section V. Part A.2.

Software Productivity and Sustainability Improvement Plan (S-PSIP): Scientific software plays an increasingly important role in both accelerating scientific discovery and developing a

predictive understanding of complex systems. To support this role amidst the increasing complexity of system models and the disruptive changes in hardware and software, BER's SBR program encourages the use of "best practices" that support software development productivity and sustainability. For SBR-funded model development and enhancement projects, funded PIs are encouraged to follow best practices outlined in the materials posted on the Better Scientific Software site (https://bssw.io/). To increase the pace of scientific discovery and promote more efficient and effective use of government funding and resources, code development and enhancement efforts are expected to be open source and made available to the scientific community. Additionally, to assure that computational results are correct and accurate, SBR intends that model development/enhancement efforts be validated and verifiable.

Software Productivity and Sustainability Plans (S-PSIP) are planning and communication tools for capturing and conveying the practices, processes, policies and tools of a given software development/enhancement project. Applications to science areas 3 and 4 that have a model/software development or enhancement component are required to include an S-PSIP as Appendix 7. This appendix is limited to 4 pages and will not count towards the page limitation. Criteria for review of S-PSIPs will be provided to the reviewers, as described in Section V. Part A.2. See Section IV. Part D.2 for additional instructions on preparing S-PSIPs.

Flux Measurements and Sites: Applications that include the collection of flux measurements for carbon, water, and/or energy must contribute to the AmeriFlux Network (https://ameriflux.lbl.gov/) and must specify the nature and timing of data submission to AmeriFlux as part of the data management plan. The establishment of new flux measurement locations will be considered carefully against the value of existing sites. Potential applicants are encouraged to review scientific activity and data associated with the existing AmeriFlux locations and to consider opportunities for collaboration as alternatives to the establishment of new sites. For applications that seek to sustain existing AmeriFlux locations, priority will be placed on hypothesis-based research and sites that have a strong record of measurement performance and prompt delivery of data products to the AmeriFlux archive, with demonstrated use by the broader scientific community. There is an established archive for reporting AmeriFlux data (https://ameriflux.lbl.gov/data/how-to-uploaddownload-data/), and supported projects will be expected to comply rigorously with reporting guidelines and standards. Modeling, synthesis and integration activities should consider utilization of available AmeriFlux (https://ameriflux.lbl.gov/) and FACE (https://ess-dive.lbl.gov/) data products. Applications should identify any large computational requirements and their proposed plan for acquiring access to appropriate computational resources.

OTHER SUPPLEMENTARY INFORMATION

DOE Genomics Science Program: The DOE-BER Biological Systems Science Division (BSSD), Genomic Science Program (GSP) portfolio in environmental microbiology seeks to fund omics-driven basic research on the contributions of prokaryotic and eukaryotic microbes as well as microbiomes to nutrient cycling processes in terrestrial soil and sedimentary ecosystems. Previous research funded in this program has looked at systems biology studies on regulatory and metabolic networks of microbes, microbial consortia, and microbe-plant interactions involved in biogeochemical cycling of carbon and development and application of omics

approaches to investigate microbial community functional processes involved in carbon cycling in terrestrial ecosystems. The GSP approach to systems biology—coupling modeling and simulation with experiment and theory—aims to define the organizing principles that control the functional capabilities of organisms. More information including projects previously funded by the GSP can be found at https://genomicscience.energy.gov/carboncycle/index.shtml. Applications that leverage data, infrastructure, and other scientific investments supported by the DOE-BER BSSD and GSP, as described below, are welcome.

Availability of User Facilities and Other Specialized Resources: DOE has responsibility for User Facilities (https://science.osti.gov/User-Facilities) and programs that offer unique and complementary resources in support of research in environmental system science. Applicants are encouraged to consider using or collaborating with these experimental, observational and computational facilities/capabilities, which have existing and dedicated financial support, to leverage their capabilities, including archived samples and long-term data sets. Potential applicants are encouraged to consider use of these resources/user facilities in developing their applications. The applicant must certify via written documentation (e.g., letter of support) that user program coordinators, site/capability coordinators/managers, and/or advisory panels find the proposed research within their mission and would support the access or use if selected for an award. Some User Facilities have a separate proposal process, but applicants to this FOA should still provide a letter from that facility indicating the proposed interaction would be within scope of their capabilities pending successful selection through their respective process. This documentation should be in the form of a letter of agreement, signed by an individual with authority to commit the expertise/resources of the collaborating institution/project/program, and submitted with the application. Examples of available user facilities and other specialized resources include:

AmeriFlux Network	The AmeriFlux Network gathers and shares long-term carbon, water and energy flux measurements and site metadata collected by a cohort of sites that span a spectrum of climate and ecosystems across the Americas. The AmeriFlux Network ensures the availability of the continuous, long-term ecosystem measurements necessary to build effective models and multisite syntheses, while maximizing insight through robust, site-specific, independent research programs. Information on the availability of long-term flux data and contact information for the Network and individual AmeriFlux sites is available at: https://ameriflux.lbl.gov/.
Atmospheric Radiation Measurement (ARM) User Facility	The Atmospheric Radiation Measurement (ARM) User Facility (https://www.arm.gov) provides the research community with strategically located in situ and remote sensing observatories designed to improve the understanding and representation, in climate and Earth system models, of clouds and aerosols as well as their interactions and coupling with the Earth's surface. ARM operates three fixed sites: the Southern Great Plains (SGP) in Oklahoma; the North Slope of Alaska (NSA) in Barrow, AK; and the Eastern North Atlantic (ENA) in the Azores (https://www.arm.gov/capabilities/observatories). ARM also has three mobile facilities and an aerial facility (https://www.arm.gov/capabilities/observatories/aaf). All ARM data is

	available at no cost to scientific users through the ARM archive (https://www.arm.gov/data/). Deployment of the ARM Mobile Facility or ARM Aerial Facility to a specific location or large campaigns at fixed ARM sites is requested through an annual ARM facility user proposal process, with pre-applications typically due in February. Smaller campaigns (such as deployment of user-owned instruments to ARM facilities or requests for intensive or special operation of existing ARM instruments) are requested through an ARM facility user proposal process (https://www.arm.gov/research/campaigns) and reviewed quarterly.
Center for Accelerator Mass Spectrometry (CAMS)	The Center for Accelerator Mass Spectrometry (CAMS) at Lawrence Livermore National Laboratory provides AMS capabilities on a cost-recovery basis to the scientific community. CAMS provides technical and analytical support for 14C applications in several existing research projects in carbon cycle science. Radiocarbon measurements can be used to determine the 'age' and rate of change of carbon stocks or as a biogeochemical tracer to elucidate processes and pathways for carbon cycling studies. Additionally, CAMS offers routine sample processing and AMS measurement capabilities for 7Be, 10Be, 26Al, and 36Cl. These isotopes are commonly applied to date the exposure and burial of Earth-surface materials, quantify erosion rates, and trace numerous soil production and landscape evolution processes. More information on the applicability of CAMS capability to environmental systems science is available at https://cams.llnl.gov/cams-competencies/terrestrial-carbon-cycle and https://cams.llnl.gov/cams-competencies/earth-system-processes.
Environmental Molecular Sciences Laboratory (EMSL)	The Environmental Molecular Sciences Laboratory (EMSL) User Facility (https://www.emsl.pnl.gov/) located at the Pacific Northwest National Laboratory, advances discovery and mechanistic understanding of molecular to meso-scale biological, chemical and physical processes and interactions within terrestrial, watershed, and subsurface ecosystems to enable predictive understanding. EMSL provides users access to premier instruments for experimental research, high performance computing (HPC), and a variety of software codes for a range of modeling and simulation studies across molecular to watershed/ecosystem scales as well as assistance with experimental design and analysis. Users can investigate dynamic interactions among plants, microbes and soil minerals, gain process-level understanding of hydro-biogeochemical processes at terrestrial-aquatic interfaces, and investigate processes and feedbacks that govern nutrient flux and transformation, vegetation dynamics, land-atmosphere exchange, and contaminant fate and transport. Experimental capabilities available include: premier chemical imaging/electron microscopy, high-resolution mass spectrometry and NMR spectroscopy for transcriptomics/metabolomics/proteomics, isotopic and spectroscopic analyses of biological and geologic surfaces and structures, and optimized software and associated hardware for molecular geochemistry, reactive transport, and multi-scale modeling, among many others. These and other experimental and computational capabilities are available at no charge

	through a user proposal process (https://www.emsl.pnl.gov/emslweb/proposal-opportunities). Applicants are also encouraged to explore the Facilities Integrating Collaborations for User Science (FICUS) initiative between JGI and EMSL (https://www.emsl.pnl.gov/emslweb/facilities-integrating-collaborations-user-science-ficus), through which capabilities at both user facilities can be accessed with one proposal.
Energy Exascale Earth System Model (E3SM)	DOE's Energy Exascale Earth System Model (E3SM) is a coupled global model, designed to run on DOE High Performance Computers and to address energy-related science questions, including water availability, carbon and nutrient cycles, and sea-level changes. E3SM's land model (ELM) foci include hydrology, water management, soil nutrients, dynamic vegetation (using the FATES model), crops and agricultural practice, land-use and land-cover, and disturbance effects. Version 1 of the model has been released (including codes, output and analysis codes), and the development codes are open-access. Training materials for new users are under development. To learn more about E3SM, see https://E3SM.org.
Environmental Systems Science – Data Infrastructure for a Virtual Ecosystem (ESS-DIVE)	ESS-DIVE is a data repository for Earth and environmental science data that is funded by the Data Management program within CESD. Maintained and managed at LBNL, ESS-DIVE archives and publicly shares data obtained from observational, experimental, and modeling research that are funded by the SBR and TES programs. ESS-DIVE allows data contributors to obtain digital object identifiers (DOIs) that can be used to cite and track usage of the data. For more information, see: https://ess-dive.lbl.gov/.
Fine-Root Ecology Database (FRED)	The Fine-Root Ecology Database (FRED) gathers observations of root traits from across the globe into a common framework, freely available to empiricists and modelers alike. FRED facilitates the quantification of fine-root trait variation within and among species and across environments, as well as the improved representation and parameterization of fine-root processes in terrestrial biosphere models. A new version of FRED is now available. FRED 2.0 houses 50% more root trait observations, particularly in the categories of root anatomy, architecture, chemistry, and morphology; ancillary data on associated site, vegetation, edaphic, and climatic conditions from across the globe have also increased concurrently. FRED 2.0 has more than 105,000 observations of more than 300 root traits, with data collected from more than 1200 data sources. More information can be found at: https://roots.ornl.gov.
High Performance Computing Centers	DOE supports high performance computing centers, which provide compute cycles and data storage through a proposal process to the scientific user community. These resources include the Molecular Science Computing (MSC) capability at EMSL (https://www.emsl.pnl.gov/emslweb/capabilities/computing/), the National Energy Research Scientific Computing Center (NERSC) at the Lawrence Berkeley National Laboratory (https://www.nersc.gov), and the National Center for Computational Sciences (NCCS) at the Oak Ridge National Laboratory (https://www.nccs.gov).

IDEAS-Watersheds	The Interoperable Design of Extreme-Scale Application Software (IDEAS) – Watersheds project is accelerating watershed science through the development and support of a sustainable community-driven software ecosystem of interoperable components and libraries. This flexible modeling capacity is an important part of the growing SBR community cyberinfrastructure that supports the integration of diverse and complex environmental datasets with multi-scale, multi-physics models. The IDEAS-Watersheds project aims to develop a sustainable software ecosystem of numerical codes to address a variety of hydro-biogeochemistry questions across a range of temporal and spatial scales. Planning, development and performance enhancements to codes within the IDEAS-Watersheds project are guided through materials posted on the Better Scientific Software site (https://bssw.io/).Through use cases that are aligned with the SFAs, the IDEAS-Watersheds project is leveraging advances in software development methodologies and design, establishing multi-scale workflows, and exploring the bridging of fine-scale mechanistic models to watersheds and river basin/regional-scale models and analyses. For more information, see: https://ideas-productivity.org/ideas-watersheds/.
International Land Model Benchmarking	The International Land Model Benchmarking (ILAMB) project is a model-data intercomparison and integration project designed to improve the performance of land models and, in parallel, improve the design of new measurement campaigns to reduce uncertainties associated with key land surface processes. ILAMB provides new analysis approaches, benchmarking tools that facilitate evaluation of land models and is expected to be a primary analysis tool for CMIP6. More information can be found at https://www.ilamb.org/.
Joint Genome Institute	The Joint Genome Institute (JGI) User Facility, located at the Integrative Genomics Building on the Berkeley lab campus in California provides the scientific community access to high-throughput sequencing and analysis, DNA synthesis and metabolomics capabilities, for microbial, plant, microbial community, and other (non-pathogen) targets. The JGI provides the national and international scientific community access to massive-scale DNA sequencing to underpin modern systems biology research and provide fundamental data on key genes that may link to biological functions, including microbial metabolic pathways and enzymes that are used to generate fuel molecules, affect plant biomass formation, degrade contaminants, or capture CO2 to support further discovery in DOE mission areas (https://www.jgi.doe.gov). These resources are available at no charge through a user proposal process (see https://proposals.jgi.doe.gov/). Applicants are also encouraged to explore the Facilities Integrating Collaborations for User Science (FICUS) initiative between JGI and EMSL, through which capabilities at these (and potentially other) User Facilities can be combined (https://jgi.doe.gov/user-program-info/community-science-program/how-to-propose-a-csp-project/emsl). Through these programs, the Department of Energy aims to advance genome science-based innovative research exploiting a range of capabilities.

KBase	The U.S Department of Energy Systems Biology Knowledgebase (KBase) (https://www.kbase.us/) is an open-source software and data platform designed to meet the grand challenge of systems biology—predicting and designing biological function from the biomolecular (small scale) to the ecological (large scale). KBase is available for anyone to use, and enables researchers to collaboratively generate, test, compare, and share hypotheses about biological functions; perform large-scale analyses on scalable computing infrastructure; and combine experimental evidence and conclusions that lead to accurate models of plant and microbial physiology and community dynamics. The KBase platform has (1) extensible analytical capabilities (2) a web-browser-based user interface that supports building, sharing, and publishing reproducible and well annotated analyses with integrated data; (3) access to extensive computational resources; and (4) a software development kit allowing the community to add functionality to the system. Science done within KBase is featured peer-reviewed publications (https://kbase.us/publications) and the KBase Narratives associated with these experiments are available to be copied, re-run and extended by all.
LeafWeb	LeafWeb is an automated online tool for leaf photosynthesis and fluorescence analyses. It applies the principle of SErvices in Exchange for Data Sharing (SEEDS). By using LeafWeb, users agree to share their data with the broad scientific community with proper credits and acknowledgement of data contribution. LeafWeb accepts the submission of standard leaf gas exchange and Pulse Amplitude Modulated (PAM) fluorometry measurements. After passing initial format and quality checks, the data are then analyzed with standard mechanistic models to estimate key biochemical and physiological photosynthetic parameters that are used in plant science research and carbon cycle models. The obtained parameters are then reported back to the user. For more information, visit https://www.leafweb.org/.
Mercury Aqueous Speciation Database (AQUA-MER)	A database and toolkit for researchers working on environmental mercury geochemistry. AQUA-MER is useful for researchers who want to investigate mercury *speciation* in defined environments i.e., to which chemical elements and functional groups mercury will bind and in what proportions, given an input of concentrations of chemicals. See: https://aquamer.ornl.gov/.
Neutron Beam Facilities	DOE provides the scientific community access to high flux neutron sources that are capable of providing structural and chemical information often unavailable using other technologies. DOE has two such facilities at the Oak Ridge National Laboratory, the Spallation Neutron Source (SNS; https://neutrons.ornl.gov/sns/) and the High Flux Isotope Reactor (HFIR; https://neutrons.ornl.gov/hfir/). Use of the neutron sources is available at no charge through a user proposal process.
Next Generation Ecosystem Experiment –	DOE supports process studies and modeling to assess carbon cycle dynamics in high-latitude terrestrial ecosystems. The NGEE Arctic project focuses on permafrost ecology in a warming Arctic, and how associated changes in biogeochemical processes, disturbance ecology, and vegetation dynamics

Arctic (NGEE-Arctic)	will affect feedbacks to the climate system. Fundamental knowledge gained in these investigations will improve representation of ecosystem dynamics, subsurface biogeochemistry, and atmosphere processes in regional and global models, and improve predictions of climate change in tundra ecosystems. Field sites for the NGEE Arctic project exist at locations in Alaska. More information on the study and information for contacting NGEE Arctic project staff to discuss collaborative research are described on the project web site (https://ngee.ornl.gov/).
Next Generation Ecosystem Experiment – Tropics (NGEE-Tropics)	The Next Generation Ecosystem Experiment - Tropics (NGEE-Tropics) supports modeling and process-based studies for tropical forest ecosystems. Research is focused in three primary research focus areas: tree ecophysiological responses to drought and elevated temperature stress; forest community assembly across moisture, nutrient and disturbance gradients; and forest-atmosphere water, carbon, and energy fluxes at landscape to regional scales. Scientific advances in these areas result in improved Earth system model (ESM) representation of vegetation dynamics, coupled biogeochemical cycles, and feedbacks to Earth's climate system. NGEE-Tropics field sites are located in Puerto Rico, Panama, the Brazilian Amazon, and additional pantropically distributed sites. Additional information on NGEE-Tropics activities, the collaborative team, and institutional partners can be found on the project's website: (https://ngee-tropics.lbl.gov/)
Spruce and Peatland Responses Under Changing Environments (SPRUCE)	DOE supports an experiment to assess the response of northern boreal and peatland ecosystems to increases in temperature and elevated atmospheric CO_2 concentrations. The SPRUCE experiment is being operated for a planned decade of operation (2016-2025) at the Marcell Experimental Forest in northern Minnesota. More information on the study, a listing of currently funded collaborators, and the method for contacting SPRUCE project staff is described on the project web site (https://mnspruce.ornl.gov/). Interested collaborators must discuss potential research interests with project participants to avoid duplication of effort and to ensure available space within the SPRUCE footprint. SPRUCE is already hosting an abundance of funded cooperative research efforts focused on peat matrix processes (e.g., microbial community responses including metagenomic analyses, methane biogeochemistry and process, etc.), and may not be able to accommodate other research in this area at this time. The SPRUCE project is looking for new collaborators using state of the art approaches for assessing cold hardiness characteristics of vegetation to supplement an already extensive network of participants.
Synchrotron Light Sources	DOE provides the scientific community access to synchrotron light sources that are capable of providing structural and chemical information often unavailable with conventional sources of x- rays. Use of each synchrotron light source is available at no charge through its user proposal process. Information about each DOE synchrotron user facility can be found at: Argonne National Laboratory (https://www.aps.anl.gov/); Brookhaven National Laboratory (https://www.bnl.gov/ps/); Lawrence Berkeley National

	Laboratory (https://www.als.lbl.gov/); and Stanford Synchrotron Radiation Laboratory (https://www-ssrl.slac.stanford.edu/index.html). For more information about the BER-supported biology beamline resources at the synchrotron and neutron facilities, visit: https://www.berstructuralbioportal.org/.
Worldwide Hydro-biogeochemical Observation Network for Dynamic River Systems (WHONDRS)	A global consortium of researchers and other interested parties striving to elucidate transferrable principles of coupled hydrologic, biogeochemical, and microbial function within dynamic river corridors. In collaboration with the community, WHONDRS coordinates global-scale river corridor campaigns that embody open science. Field campaigns involve the use of unique *in situ* sensor capabilities, are carried out by the community, and are designed to generate data relevant to integrated hydro-biogeochemical models. Current sensors focus on hydrologic fluxes through riverbed sediments. The costs of sampling supplies, sensors, shipping, analysis, and data management are covered by WHONDRS and through collaborations with BER user facilities, including EMSL and JGI. WHONDRS data include ultra-high resolution carbon chemistry, small metabolite concentrations, microbial community potential and expressed functions, respiration rates, aqueous chemistry, sediment texture and mineralogy, surface water hydrology, water isotopes, and many others. Data are all georeferenced such that they can be further augmented and contextualized with public geospatial data. High dimensionality and consistency of the collective data lends itself to the application of machine learning as well as integration with mechanistic numerical models to enable distributed modeling efforts. For more information, see: https://whondrs.pnnl.gov/.

SC is dedicated to promoting the values of openness in Federally-supported scientific research, including, but not limited to, ensuring that research may be reproduced and that the results of Federally-supported research are made available to other researchers. These objectives may be met through any number of mechanisms including, but not limited to, data access plans, data sharing agreements, the use of archives and repositories, and the use of various licensing schemes. The use of the phrase “open-source” does not refer to any particular licensing arrangement, but is to be understood as encompassing any arrangement that furthers the objective of openness.

Section II – AWARD INFORMATION

A. TYPE OF AWARD INSTRUMENT

DOE anticipates awarding grants to University/Academic/ Other Non-Profit Institutions and interagency agreements to other Federal agencies.

DOE will consider funding multi-institution collaborations under this FOA.

B. ESTIMATED FUNDING

Research Grant Awards and Interagency Agreements are expected to be made for a period of one to three years at a funding level appropriate for the proposed scope, with out-year support contingent on the availability of funds and satisfactory progress. Total funding up to $10,000,000 is expected to be available to support this FOA subject to appropriation of funds by the Congress. DOE is under no obligation to pay for any costs associated with the preparation or submission of an application. DOE reserves the right to fund, in whole or in part, any, all, or none of the applications submitted in response to this FOA.

The award ceiling listed in Section C applies to the total budget, regardless of whether the application is from a single institution or from a multi-institutional team. If a non-DOE Federal Agency is part of a multi-institutional team, then collaborative applications must be submitted and the total budget of the collaborative applications cannot be more than the award ceiling listed in Section C. Additionally, any DOE/NNSA National Laboratory component of these financial collaborations will be limited to no more than 10% of total costs and should show clear scientific leadership from the submitting institution and reflect an appropriate level of effort from the DOE/NNSA National Laboratory.

C. MAXIMUM AND MINIMUM AWARD SIZE

The award size will depend on the number of meritorious applications and the availability of appropriated funds.

Ceiling

$1,000,000 for “standard” 3-year projects for the Terrestrial Ecosystem Science topic area, and $600,000 for “standard” 3-year projects for the Subsurface Biogeochemical Research topic area; and $300,000 total for 1- to 2-year exploratory (“high risk”) projects for both topic areas.

Floor

$100,000

D. EXPECTED NUMBER OF AWARDS

Approximately 5 to 18 awards are expected.

The exact number of awards will depend on the number of meritorious applications and the availability of appropriated funds.

E. ANTICIPATED AWARD SIZE

The award size will depend on the number of meritorious applications and the availability of appropriated funds.

F. PERIOD OF PERFORMANCE

Research Grant and Interagency Agreement Awards are expected to be made for a period of one to three years as befitting the project.

Out-year funding will depend upon suitable progress and the availability of appropriated funds.

G. TYPE OF APPLICATION

DOE will accept only new applications under this FOA.

H. VALUE/FUNDING FOR DOE/NNSA NATIONAL LABORATORY CONTRACTORS AND NON-DOE/NNSA FFRDC CONTRACTORS

For grant awards, the value of, and funding for, a DOE/National Nuclear Security Administration (NNSA) National Laboratory contractor, a non-DOE/NNSA Federally Funded Research And Development Center (FFRDC) contractor, or another Federal agency's portion of the work will not be included in the award to the successful applicant. DOE will fund a DOE/NNSA National Laboratory contractor through the DOE field work authorization system or other appropriate process and will fund non-DOE/NNSA FFRDC contractors and other Federal agencies through an interagency agreement in accordance with the Economy Act, 31 USC 1535, or other statutory authority.

I. RESPONSIBILITY

The successful prime applicant/awardee (lead organization) will be the responsible authority regarding the settlement and satisfaction of all contractual and administrative issues, including but not limited to, disputes and claims arising out of any agreement between the applicant and any team member, and/or subawardee.

If an sub-award is made to a DOE/NNSA National Laboratory, all Disputes and Claims will be resolved in accordance with the terms and conditions of the DOE/NNSA National Laboratory's management and operating (M&O) contract, as applicable, in consultation between DOE and the prime awardee.

If an award is made to another Federal agency or its FFRDC contractor, all Disputes and Claims will be resolved in accordance with the terms and conditions of the interagency agreement in consultation between DOE and the prime awardee.

Section III – ELIGIBILITY INFORMATION

A. ELIGIBLE APPLICANTS

All types of applicants are eligible to apply as prime recipients, except Federally Funded Research and Development Center (FFRDC) Contractors, and nonprofit organizations described in section 501(c)(4) of the Internal Revenue Code of 1986 that engaged in lobbying activities after December 31, 1995.
Applications involving the effort of multiple institutions are permitted, subject to the following requirements.

- An application must be submitted by a lead institution that includes proposed subawards to any other institution, except other Federal agencies. (Other Federal agencies must submit their own application.)
- DOE/NNSA National Laboratories, are not eligible to apply as lead institutions but may be proposed as team members.
- The involvement of all DOE/NNSA National Laboratories is limited to no more than 10% of the total costs requested in an application. Applications involving DOE/NNSA National Laboratories must demonstrate clear scientific leadership from the submitting institution
- A multi-institutional application must clearly designate a lead PI and institution, and must include a project management section in the lead PI's application that clearly describes the roles, proposed activities and deliverables for each collaborator, especially those at another institution.
- The lead institution must submit budgetary information for each of the funded Co-PIs on a supplement to the application cover page, as explained in Section IV. Part C.2.
- All applications involving unfunded collaborators must include letters of agreement. These letters should specify the contributions the collaborators intend to make if the application is accepted and funded.
- Applications for multi-investigator projects at multiple institutions also must present a well-defined management structure and coordination/communication plan for integrating collaborating investigators.
- Applications that do not include any of the elements listed here may be declined without review.

The table below summarizes how Federally-affiliated organizations may participate with non-Federal organizations in applying to this FOA.

	Non-Federal Entity	DOE National Labs	Other Federal Agencies (USDA, NIST)	Other Agency FFRDCs (Lincoln Lab, JPL)
Prime applicant (aka Lead)	Yes	No	Yes	No
Subawardee or Team Member	Yes	Yes, but limited to 10% of the total budget	Yes, but will need to submit a collaborative application	Yes

Applicants that are not domestic organizations should be advised that:

- Individual applicants are unlikely to possess the skills, abilities, and resources to successfully accomplish the objectives of this FOA. Individual applicants are encouraged to address this concern in their applications and to demonstrate how they will accomplish the objectives of this FOA.
- Non-domestic applicants are advised that successful applications from non-domestic applicants include a detailed demonstration of how the applicant possesses skills, resources, and abilities that do not exist among potential domestic applicants.

DOE/NNSA National Laboratory Contractors

DOE/NNSA National Laboratory Contractor applicants are not eligible for a prime award under this FOA, but may be proposed as a team member on another entity's application if their cognizant DOE/NNSA Contracting Officer provides written authorization. This authorization should be submitted with the application as part of the Budget Justification for DOE/NNSA National Laboratory Contractor File. [This is not required for the National Energy Technology Laboratory because it is a Government Owned/Government Operated (GOGO).] **Please note that failure to provide this authorization may result in rejection of an application prior to merit review.** If a DOE/NNSA National Laboratory Contractor is selected for award, or proposed as a team member, the proposed work will be authorized under the DOE field work authorization system or other appropriate process and performed under the laboratory Contractor's M&O contract, as applicable. The following wording is acceptable for the authorization:

"Authorization is granted for the _____ Laboratory to participate in the proposed project. The work proposed for the laboratory is consistent with or complementary to the missions of the laboratory and will not adversely impact execution of the DOE/NNSA assigned programs at the laboratory."

Note that while DOE/NNSA National Laboratories are eligible to participate as a collaborator, they are limited to no more than 10% of the total proposed budget.

Non-DOE/NNSA Federal Agencies and their FFRDC Contractors

Federal Agencies are eligible for a prime award under this FOA, and may be proposed as a team member on another entity's application. Non-DOE/NNSA Federal agency FFRDC contractors are not eligible for a prime award under this FOA, but may be proposed as a team member on another entity's application subject to the following guidelines:

The prime applicant must obtain written authorization for non-DOE/NNSA FFRDC participation. The cognizant Contracting Officer for the Federal agency sponsoring the FFRDC contractor must authorize in writing the participation of the FFRDC contractor on the proposed project and this authorization should be submitted with the application. The written authorization must also contain a determination that the use of a FFRDC contractor is consistent with the contractor's authority under its award and does not place the FFRDC contractor in direct

competition with the private sector, in accordance with FAR Part 17.5. **Please note that failure to provide this authorization may result in rejection of an application prior to merit review.** The following wording is acceptable for the authorization:

> "Authorization is granted for the _____ Laboratory to participate in the proposed project. The work proposed for the laboratory is consistent with or complementary to the missions of the laboratory and will not adversely impact execution of the (insert agency) assigned programs at the laboratory. This laboratory is authorized to perform the work proposed in the application submitted under DOE Funding Opportunity Announcement DE-FOA-XXXXXXX by the following statutory authority (insert statute name, citation, and section)."

B. COST SHARING

Cost sharing is not required.

C. ELIGIBLE INDIVIDUALS

Individuals with the skills, knowledge, and resources necessary to carry out the proposed research as a Principal Investigator (PI) are invited to work with their organizations to develop an application for assistance. Individuals from underrepresented groups as well as individuals with disabilities are always encouraged to apply for assistance.

D. LIMITATIONS ON SUBMISSIONS

Applicant institutions are limited to no more than *one* pre-application and application for each PI at the applicant institution (as lead PI). DOE will consider the latest received submissions to be the institution's intended submissions.

- Pre-applications in excess of the limited number of submissions may be discouraged.
- Applications in excess of the limited number of submissions may be declined without review.

DOE/NNSA NATIONAL LABORATORY EFFORT

The scope of work to be performed by DOE/NNSA National Laboratories may not be more significant than the scope of work to be performed by the applicant.

The DOE/NNSA National Laboratory effort, in aggregate, shall not exceed 10 percent of the total estimated cost of the project, including the applicant's and the DOE/NNSA National Laboratories' portions of the effort.

Section IV – APPLICATION AND SUBMISSION INFORMATION

A. ADDRESS TO REQUEST APPLICATION PACKAGE

Application forms and instructions are available at Grants.gov. To access these materials, go to https://www.Grants.gov, select "Apply for Grants", and then select "Download Application Package." Enter the CFDA number (81.049) and/or the FOA number DE-FOA-0002184 shown on the cover of this FOA and then follow the prompts to download the application package.

Applications submitted through www.FedConnect.net will not be accepted.

B. LETTER OF INTENT AND PRE-APPLICATION

1. Letter of Intent

Not applicable.

2. Pre-application

PRE-APPLICATION DUE DATE

December 5, 2019, at 5:00 pm Eastern Time

ENCOURAGE/DISCOURAGE DATE

December 19, 2019, at 5:00 pm Eastern Time

A pre-application is required and must be submitted by December 5, 2019, at 5:00 pm Eastern Time.

Pre-applications will be reviewed for responsiveness of the proposed work to the research topics identified in this FOA. DOE will send a response by email to each applicant encouraging or discouraging the submission of an application by December 19 2019, at 5:00 pm Eastern Time. Applicants who have not received a response regarding the status of their pre-application by this date are responsible for contacting the program to confirm this status.

Applications that have not been encouraged by DOE may be declined without merit review. The pre-application attachment must include, at the top of the first page, the following information:

Title of Pre-Application:
Principal Investigator: (Name, Job Title)
Institution:
PI Postal Address:
PI Phone Number:
PI Email Address:
FOA Number: DE-FOA-0002184

Proposal type: (Standard or Exploratory)
Proposed topic and science area of this FOA to which the application is responding:*
Project keywords: (up to five keywords describing the proposed research):

PI Name	Institution	Anticipated Year 1 Budget	Anticipated Year 2 Budget	Anticipated Year 3 Budget	Anticipated Total Budget
Collaborator**					
Collaborator					
Collaborator					

(* Note you must identify which topic area and science area [as identified in Section I of this FOA] the application is targeting ;** Please include all funded and unfunded collaborators)

The pre-application title page must include a list of the names, institutional affiliations and anticipated (non-binding) budgets of all participating investigators, including collaborators (funded and unfunded) and consultants on the proposed project.

Pre-application narrative should include the following four sections: Objectives/Goals, Background, Methods/Approach, and Program/FOA/Topic Relevance.

1. Objectives/Goals – Description of the research objectives and goals along with a proposed testable hypothesis(es).
2. Background/Justification – A description of the background related to the proposed research topic and justification for the scientific need.
3. Methods/Approach – A high-level description of the proposed technical and methodological approaches to address test the proposed hypothesis.
4. Program, FOA, and Topic Relevance – A description of how the proposed research addressed the scientific research needs highlighted by this FOA's topic areas, as well as the program strategic needs (e.g., program reports, CESD strategic plan, SFA's etc.)

Pre-applications should be clear and concise and adhere to this format. The pre-application may not exceed two pages, with a minimum text font size of 11 point and margins no smaller than one inch on all sides. The pre-application package should include the cover page and 2-page narrative. Figures, if included, must fit within the two-page limit and be clearly legible. References (if necessary) are not included within the two-page limit. Pre-applications that exceed the two-page limit may not be reviewed. **It is the responsibility of the applicant to include sufficient information in the pre-application to enable evaluation of responsiveness to the terms of this announcement.**

PRE-APPLICATION REVIEW

Those pre-applications that are encouraged will be used to help SC begin planning for the application peer review process. SC's intent in discouraging submission of certain applications is to save the time and effort of applicants in preparing and submitting applications not responsive to this FOA.

The PI will be automatically notified when the pre-application is encouraged or discouraged. The DOE SC Portfolio Analysis and Management System (PAMS) will send an email to the PI from PAMS.Autoreply@science.doe.gov, and the status of the pre-application will be updated at the PAMS website https://pamspublic.science.energy.gov/. Notifications are sent as soon as the decisions to encourage or discourage are finalized.

PRE-APPLICATION SUBMISSION

It is important that the pre-application be a single file with extension .pdf, .docx, or .doc. The filename must not exceed 50 characters. The pre-application must be submitted electronically through the DOE SC Portfolio Analysis and Management System (PAMS) website https://pamspublic.science.energy.gov/. The PI and anyone submitting on behalf of the PI must register for an account in PAMS before it will be possible to submit a pre-application. All PIs and those submitting pre-applications on behalf of PIs are encouraged to establish PAMS accounts as soon as possible to avoid submission delays.

You may use the Internet Explorer, Firefox, Google Chrome, or Safari browsers to access PAMS.

Please see Section IV, Part I, 4 DOE SC Portfolio Analysis and Management System (PAMS), below, for instructions about how to register in PAMS.

Submit Your Pre-Application:

- Create your pre-application (called a preproposal in PAMS) outside the system and save it as a file with extension .docx, .doc, or .pdf. Make a note of the location of the file on your computer so you can browse for it later from within PAMS.
- Log into PAMS and click the Proposals tab. Click the "View / Respond to Funding Opportunity Announcements" link and find the current announcement in the list. Click the "Actions/Views" link in the Options column next to this announcement to obtain a dropdown menu. Select "Submit Preproposal" from the dropdown.
- On the Submit Preproposal page, select the institution from which you are submitting this preproposal from the Institution dropdown. If you are associated with only one institution in the system, there will only be one institution in the dropdown.
- Note that you must select one and only one PI per preproposal; to do so, click the "Select PI" button on the far right side of the screen. Find the appropriate PI from the list of all registered users from your institution returned by PAMS. (Hint: You may have to sort, filter, or search through the list if it has multiple pages.) Click the "Actions" link in the Options column next to the appropriate PI to obtain a dropdown menu. From the dropdown, choose "Select PI."
- If the PI for whom you are submitting does not appear on the list, it means he or she has not yet registered in PAMS. For your convenience, you may have PAMS send an email invitation to the PI to register in PAMS. To do so, click the "Invite PI" link at the top left of the "Select PI" screen. You can enter an optional personal message to the PI in the "Comments" box, and it will be included in the email sent by PAMS to the PI. You must wait until the PI registers before you can submit the preproposal. Save the preproposal for later work by clicking the "Save" button at the bottom of the screen. It will be stored in "My Preproposals" for later editing.

- Enter a title for your preproposal.
- Select the appropriate technical contact from the Program Manager dropdown.
- To upload the preproposal file into PAMS, click the "Attach File" button at the far right side of the screen. Click the "Browse" (or "Choose File" depending on your browser) button to search for your file. You may enter an optional description of the file you are attaching. Click the "Upload" button to upload the file.
- At the bottom of the screen, click the "Submit to DOE" button to save and submit the preproposal to DOE.
- Upon submission, the PI will receive an email from the PAMS system <PAMS.Autoreply@science.doe.gov> acknowledging receipt of the preproposal.

You are encouraged to register for an account in PAMS at least a week in advance of the preproposal submission deadline so that there will be no delays with your submission.

> **WARNING**: The PAMS website at https://pamspublic.science.energy.gov will permit you to edit a previously submitted pre-application in the time between your submission and the deadline. If you choose to edit, doing so will remove your previously submitted version from consideration. If you are still editing at the time of the deadline, you will not have a valid submission. Please pay attention to the deadline.

For help with PAMS, click the "External User Guide" link on the PAMS website, https://pamspublic.science.energy.gov/. You may also contact the PAMS Help Desk, which can be reached Monday through Friday, 9 AM – 5:30 PM Eastern Time. Telephone: (855) 818-1846 (toll free) or (301) 903-9610, email: sc.pams-helpdesk@science.doe.gov. All submission and inquiries about this FOA should reference DE-FOA-0002184.

Pre-applications submitted outside PAMS will not be considered. Pre-applications may not be submitted through Grants.gov or FedConnect.

C. GRANTS.GOV APPLICATION SUBMISSION AND RECEIPT PROCEDURES

This section provides the application submission and receipt instructions for applications to SC. Please read the following instructions carefully and completely.

1. Electronic Delivery

SC is participating in the Grants.gov initiative to provide the grant community with a single site to find and apply for grant funding opportunities. SC requires applicants to submit their applications online through Grants.gov.

2. How to Register to Apply through Grants.gov

a. Instructions: Read the instructions below about registering to apply for SC funds. Applicants should read the registration instructions carefully and prepare the information requested before beginning the registration process. Reviewing and assembling the required information before

beginning the registration process will alleviate last-minute searches for required information.

Organizations must have a Data Universal Numbering System (DUNS) Number, active System for Award Management (SAM) registration, and Grants.gov account to apply for grants. If individual applicants are eligible to apply for this FOA, then you may begin with step 3, Create a Grants.gov Account, listed below.

Creating a Grants.gov account can be completed online in minutes, but DUNS and SAM registrations may take several weeks. Therefore, an organization's registration should be done in sufficient time to ensure it does not impact the entity's ability to meet required application submission deadlines.

Complete organization instructions can be found on Grants.gov here: https://www.Grants.gov/web/grants/applicants/organization-registration.html

1) *Obtain a DUNS Number*: All entities applying for funding, including renewal funding, must have a DUNS Number from Dun & Bradstreet (D&B). Applicants must enter the DUNS Number in the data entry field labeled "Organizational DUNS" on the SF-424 form. For more detailed instructions for obtaining a DUNS Number, refer to: https://www.Grants.gov/web/grants/applicants/organization-registration/step-1-obtain-duns-number.html

2) *Register with SAM*: All organizations applying online through Grants.gov must register with SAM at https://www.sam.gov. Failure to register with SAM will prevent your organization from applying through Grants.gov. SAM registration must be renewed annually. For more detailed instructions for registering with SAM, refer to: https://www.Grants.gov/web/grants/applicants/organization-registration/step-2-register-with-sam.html

3) *Create a Grants.gov Account*: The next step is to register an account with Grants.gov. Follow the on-screen instructions or refer to the detailed instructions here: https://www.Grants.gov/web/grants/applicants/registration.html

4) *Add a Profile to a Grants.gov Account*: A profile in Grants.gov corresponds to a single applicant organization the user represents (i.e., an applicant) or an individual applicant. If you work for or consult with multiple organizations and have a profile for each, you may log in to one Grants.gov account to access all of your grant applications. To add an organizational profile to your Grants.gov account, enter the DUNS Number for the organization in the DUNS field while adding a profile. For more detailed instructions about creating a profile on Grants.gov, refer to: https://www.Grants.gov/web/grants/applicants/registration/add-profile.html

5) *EBiz POC Authorized Profile Roles*: After you register with Grants.gov and create an Organization Applicant Profile, the organization applicant's request for Grants.gov roles and access is sent to the EBiz POC. The EBiz POC will then log in to Grants.gov and authorize the appropriate roles, which may include the AOR role, thereby giving you

permission to complete and submit applications on behalf of the organization. You will be able to submit your application online any time after you have been assigned the AOR role. For more detailed instructions about creating a profile on Grants.gov, refer to: https://www.Grants.gov/web/grants/applicants/registration/authorize-roles.html

6) *Track Role Status*: To track your role request, refer to: https://www.Grants.gov/web/grants/applicants/registration/track-role-status.html

b. *Electronic Signature*: When applications are submitted through Grants.gov, the name of the organization applicant with the AOR role that submitted the application is inserted into the signature line of the application, serving as the electronic signature. The EBiz POC **must** authorize people who are able to make legally binding commitments on behalf of the organization as a user with the AOR role; **this step is often missed and it is crucial for valid and timely submissions.**

3. How to Submit an Application to SC via Grants.gov

Grants.gov applicants can apply online using Workspace. Workspace is a shared, online environment where members of a grant team may simultaneously access and edit different webforms within an application. For each FOA, you can create individual instances of a workspace.

Below is an overview of applying on Grants.gov. For access to complete instructions on how to apply for opportunities, refer to:
https://www.Grants.gov/web/grants/applicants/apply-for-grants.html

1) Create a Workspace: Creating a workspace allows you to complete it online and route it through your organization for review before submitting.

2) Complete a Workspace: Add participants to the workspace, complete all the required forms, and check for errors before submission.

a. Adobe Reader: If you decide not to apply by filling out webforms you can download individual PDF forms in Workspace so that they will appear similar to other Standard forms. The individual PDF forms can be downloaded and saved to your local device storage, network drive(s), or external drives, then accessed through Adobe Reader.

NOTE: Visit the Adobe Software Compatibility page on Grants.gov to download the appropriate version of the software at:
https://www.Grants.gov/web/grants/applicants/adobe-software-compatibility.html

b. Mandatory Fields in Forms: In the forms, you will note fields marked with an asterisk and a different background color. These fields are mandatory fields that must be completed to successfully submit your application.

c. Complete SF-424 Fields First: The forms are designed to fill in common required

fields across other forms, such as the applicant name, address, and DUNS number. To trigger this feature, an applicant must complete the SF-424 information first. Once it is completed, the information will transfer to the other forms.

3) Submit a Workspace: An application may be submitted through workspace by clicking the Sign and Submit button on the Manage Workspace page, under the Forms tab. Grants.gov recommends submitting your application package *at least 24-48 hours prior to the close date* to provide you with time to correct any potential technical issues that may disrupt the application submission.

4) Track a Workspace: After successfully submitting a workspace package, a Grants.gov Tracking Number (GRANTXXXXXXXX) is automatically assigned to the package. The number will be listed on the Confirmation page that is generated after submission.

For additional training resources, including video tutorials, refer to:
https://www.Grants.gov/web/grants/applicants/applicant-training.html

Applicant Support: Grants.gov provides applicants 24/7 support via the toll-free number 1-800-518-4726 and email at support@Grants.gov. For questions related to the specific grant opportunity, contact the number listed in the application package of the grant you are applying for.

If you are experiencing difficulties with your submission, it is best to call the Grants.gov Support Center and get a ticket number. The Support Center ticket number will assist SC with tracking your issue and understanding background information on the issue.

4. Timely Receipt Requirements and Proof of Timely Submission

Proof of timely submission is automatically recorded by Grants.gov. An electronic date/time stamp is generated within the system when the application is successfully received by Grants.gov. The applicant AOR will receive an acknowledgement of receipt and a tracking number (GRANTXXXXXXXX) from Grants.gov with the successful transmission of their application. Applicant AORs will also receive the official date/time stamp and Grants.gov Tracking number in an email serving as proof of their timely submission.

When SC successfully retrieves the application from Grants.gov, and acknowledges the download of submissions, Grants.gov will provide an electronic acknowledgment of receipt of the application to the email address of the applicant with the AOR role. Again, proof of timely submission shall be the official date and time that Grants.gov receives your application. Applications received by Grants.gov after the established due date for the program will be considered late and may not be considered for funding by SC.

Applicants using slow internet, such as dial-up connections, should be aware that transmission can take some time before Grants.gov receives your application. Again, Grants.gov will provide either an error or a successfully received transmission in the form of an email sent to the applicant with the AOR role. The Grants.gov Support Center reports that some applicants end the

transmission because they think that nothing is occurring during the transmission process. Please be patient and give the system time to process the application.

D. CONTENT AND APPLICATION FORMS

APPLICATION PREPARATION

You must submit the application through Grants.gov at https://www.Grants.gov/, using either the online webforms or downloaded forms. (Additional instructions are provided in Section IV, Part C of this FOA.)

You are required to use the compatible version of Adobe Reader software to complete a Grants.gov Adobe application package. To ensure you have the Grants.gov compatible version of Adobe Reader, visit the software compatability page at https://www.Grants.gov/web/grants/applicants/adobe-software-compatibility.html.

You must complete the mandatory forms and any applicable optional forms (e.g., Disclosure of Lobbying Activities (SF-LLL)) in accordance with the instructions on the forms and the additional instructions below.

Files that are attached to the forms must be PDF files unless otherwise specified in this FOA. Attached PDF files must be plain files consisting of text, numbers, and images without editable fields, signatures, passwords, redactions, or other advanced features available in some PDF-compatible software. Do not use PDF portfolios or binders.

Please note the following restrictions that apply to the names of all files attached to your application:

- Please limit file names to 50 or fewer characters
- Do not attach any documents with the same name. All attachments must have a unique name.
- Please use only the following characters when naming your attachments: A-Z, a-z, 0-9, underscore, hyphen, space, period, parenthesis, curly braces, square brackets, ampersand, tilde, exclamation point, comma, semi colon, apostrophe, at sign, number sign, dollar sign, percent sign, plus sign, and equal sign. Attachments that do not follow this rule may cause the entire application to be rejected or cause issues during processing.

LETTERS

Letters of support for collaborators and/or resources should be included in the application but do not count toward the page limit. General letters of support for the project should not be included.

RESUBMISSION OF APPLICATIONS

Applications submitted under this FOA may be withdrawn from consideration by using the PAMS website at https://pamspublic.science.energy.gov. Applications may be withdrawn at any time between when the applicant submits the application and when DOE makes the application available to merit reviewers. Such withdrawals take effect immediately and cannot be reversed.

Please exercise due caution. After the application is made available to merit reviewers, the applicant may contact the DOE program office identified in this FOA to request that it be withdrawn.

After an application is withdrawn, it may be resubmitted, if this FOA is still open for the submission of applications. Such resubmissions will only count as one submission if this FOA restricts the number of applications from an applicant.

Note that there may be a delay between the application's submission in Grants.gov and when it is available to be withdrawn in PAMS. SC will usually consider the last submission, according to its Grants.gov timestamp, to be the intended version. Please consult with your program manager to resolve any confusion about which version of an application should be considered.

Improper Contents of Applications

Applications submitted under this FOA will be stored in controlled-access systems, but they may be made publicly available if an award is made. As such, it is critical that applicants follow these guidelines:

- Do not include information subject to any legal restriction on its open distribution, whether classified, export control, or unclassified controlled nuclear information.
- Do not include sensitive and protected personally identifiable information, including social security numbers, birthdates, citizenship, marital status, or home addresses. Pay particular attention to the content of biographical sketches and curriculum vitae.
- Do not include letters of support from Federal officials.
- Do not include letters of support on Federal letterhead. Letters that are not letters of support (such as letters confirming access to sites, facilities, equipment, or data; or letters from cognizant contracting officers) may be on Federal letterhead.
- Clearly mark all proprietary or trade-secret information.

Change of Awardee Institution

If an awardee chooses to relinquish an award made under this FOA to permit the transfer of the award to a new institution, the new institution must submit an application under the then-available SC "annual" or "open" FOA.

1. SF-424 (R&R)

Complete this form first to populate data in other forms. Complete all the required fields in accordance with the pop-up instructions on the form. The list of certifications and assurances referenced in Field 17 is available on the DOE Financial Assistance Forms Page at https://energy.gov/management/office-management/operational-management/financial-assistance/financial-assistance-forms under Certifications and Assurances.

Applicants that have updated or started their registrations in https://www.SAM.gov on or after February 2, 2019, will also be bound by their representations and certifications in SAM.gov.

DUNS AND EIN NUMBERS (FIELDS 5 AND 6)

The DUNS and Employer Identification Number (EIN) fields on the SF-424 (R&R) form are used in PAMS to confirm the identity of the individual or organization submitting an application.

- Enter each number as a nine-digit number.
- Do not use hyphens or dashes.
- SC does not use the twelve-digit EIN format required by some other agencies.
- SC does not use the DUNS+4 format.

TYPE OF APPLICATION (FIELD 8)

Only new applications will be accepted. A **new** application is one in which DOE support for the proposed research is being requested for the first time.

SC does not make use of the Resubmission or Continuation options.

Please answer "yes" to the question "Is this application being submitted to other agencies?" if substantially similar, identical, or closely related research objectives are being submitted to another Federal agency. Indicate the agency or agencies to which the similar objectives have been submitted.

2. Research and Related Other Project Information

Complete questions in fields 1 through 6 of the SF-424 Research and Related Other Project Information form.

Note regarding question 4.a. and 4.b.:

If any environmental impact, positive or negative, is anticipated, indicate "yes" in response to question 4.a., "potential impact – positive or negative - on the environment." Disclosure of the impact should be provided in response to question 4.b. First indicate whether the impact is positive or negative and then identify the area of concern (e.g., air, water, exposure to radiation, etc.). Should the applicant have any uncertainty, they should check "yes."

DOE understands the phrase in field 4.a., "potential impact … negative" to apply if the work described in the application could potentially have any of the impacts listed in (1) through (5) of 10 CFR 1021, Appendix B, Conditions that Are Integral Elements of the Classes of Action in Appendix B. (https://www.ecfr.gov)

Additionally, for actions which could have any other adverse impacts to the environment or have any possibility for adverse impacts to human health (e.g., use of human subjects, Biosafety Level 3-4 laboratory construction/operation, manufacture or use of certain nanoscale materials which are known to impact human health, or any activities involving transuranic or high level radioactive waste, or use of or exposure to any radioactive materials beyond de minimis

levels), applicants should indicate a "negative" impact on the environment.

Lastly, 1) if there would be extraordinary circumstances (i.e., scientific or public controversy) related to the significance of environmental effects (10 CFR 1021.410 (b)(2)), 2) if the work is connected to other actions with potentially significant impacts (10 CFR 1021.410 (b)(3), or 3) if the work is related to other nearby actions with the potential for cumulatively significant impacts (10 CFR 1021.410 (b)(3)), applicants should indicate a "negative" impact on the environment.

The bulk of your application will consist of files attached to the Research and Related Other Project Information form. The files must comply with the following instructions:

PROJECT SUMMARY/ABSTRACT (FIELD 7 ON THE FORM)

The project summary/abstract is a summary of the proposed activity suitable for distribution to the public and sufficient to permit potential reviewers to identify conflicts of interest. It must be a self-contained document. Provide the name of the applicant, the project title, the PI and the PI's institutional affiliation, any coinvestigators and their institutional affiliations, the objectives of the project, a description of the project, including methods to be employed, and the potential impact of the project (i.e., benefits, outcomes. A sample is provided below:

A Really Great Idea

A. Smith, Lead Institution (Principal Investigator)
A. Brown, Institution 2 (Co-Investigator)
A. Jones, Institution 3 (Co-Investigator)

Text of abstract

The project summary must not exceed 1 page when printed using standard 8.5" by 11" paper with 1" margins (top, bottom, left and right) with font not smaller than 11 point. To attach a Project Summary/Abstract, click "Add Attachment."

If an application is recommended for award, the project summary will be used in preparing a public abstract about the award. Award abstracts and titles form a Government document that describes the project and justifies the expenditure of Federal funds in light of the DOE and SC mission statements at https://energy.gov/mission and https://science.osti.gov/about/.

- Do not include any proprietary or sensitive business information.
- DOE may use the abstract may to prepare public reports about supported research.

DOE COVER PAGE
(PART OF PROJECT NARRATIVE ATTACHED TO FIELD 8 ON THE FORM)

The application narrative must begin with a cover page that will not count toward the project narrative page limitation. The cover page must follow the template below and include the following items:

Title of Application:
Principal Investigator: (Name, Job Title)
Institution:
PI Postal Address:
PI Phone Number:
PI Email Address:
FOA Number: DE-FOA-0002184
DOE/SC Program Office: Biological and Environmental Research
DOE /SC Program Office Technical Contact: Dr. Daniel Stover
PAMS Pre-Application Tracking Number:
Proposal type: (Standard or Exploratory)
Proposed topic and science area of this FOA to which the application is responding:*
Project keywords: (up to five keywords describing the proposed research):

PI Name	Institution	Year 1 Budget	Year 2 Budget	Year 3 Budget	Total Budget
Lead PI					
Co-PI/Collaborator**					
Co-PI/Collaborator**					
Co-PI/Collaborator**					
Unfunded Collaborator**					
Total Budget					

(* Note you must identify which topic area and science area (as identified in Section I of this FOA) the application is targeting ; **Note that you must include all collaborators (funded and unfunded), including federal agencies, sub awardees and DOE National Labs with their respective budgets even if they will be funded separately.)

Important Instructions to the Sponsored Research Office of Submitting Institutions: SC requires that you create one single PDF file that contains the DOE Cover Page, project narrative, biographical sketch, current and pending support, bibliography and references cited, facilities and other resources, equipment, data management plan, and other attachments. This single PDF file must be attached in Field 8 on the Grants.gov form. Do not attach any of the items listed in this paragraph separately in any other field in Grants.gov. If you do, these additional attachments will not become part of the application in PAMS.

COVER PAGE SUPPLEMENT FOR COLLABORATIONS
(PART OF PROJECT NARRATIVE ATTACHED TO FIELD 8 ON THE FORM)

Collaborative applications submitted from different institutions (**for this FOA, this only applies when at least one of the collaborating institutions is a non-DOE Federal Agency**) must clearly indicate they are part of a collaborative project/group. Every partner institution must submit an application through its own sponsored research office. Each collaborative group can have only one lead institution. Each application within the collaborative group, including the narrative and all required appendices and attachments, must be identical with the following exceptions:

- Each application must contain a correct SF-424 (R&R) cover page for the submitting institution only.
- Each application must contain a unique budget corresponding to the expenditures for that application's submitting institution only.
- Each application must contain a unique budget justification corresponding to the expenditures for that application's submitting institution only.

Each application belonging to a collaborative group must have the same title in Block 11 of the SF 424 (R&R) form.

SC will use the multiple applications associated with a collaborative group to create one consolidated document for merit review that consists of the common, identical application materials combined with a set of detailed budgets from the partner institutions. It is very important that every application in the collaborative group be identical (including the title) with the exception of the budget and budget justification pages.

PROJECT NARRATIVE (FIELD 8 ON THE FORM)

The project narrative **must not exceed 15 pages** of technical information, including charts, graphs, maps, photographs, and other pictorial presentations, when printed using standard 8.5" by 11" paper with 1 inch margins (top, bottom, left, and right). The font must not be smaller than 11 point. Merit reviewers will only consider the number of pages specified in the first sentence of this paragraph. This page limit does not apply to the Cover Page, Budget Page(s), Budget Justification, biographical material, publications and references, and appendices, each of which may have its own page limit. Please note that smaller efforts (e.g., exploratory applications) should be concise and may not require the maximum page length for the narrative as it should be commensurate with the size/scope of the proposed effort and budget.

Do not include any Internet addresses (URLs) that provide supplementary or additional information that constitutes a part of the application. Merit reviewers are not required to access Internet sites; however, Internet publications in a list of references will be treated identically to print publications. See Section VIII, Part D for instructions on how to mark proprietary application information. To attach a Project Narrative, click "Add Attachment."

Project Objectives: This section should provide a clear, concise statement of the specific objectives/aims of the proposed project, as well as including a testable hypothesis

Background/Introduction: Explanation of the importance and relevance of the proposed work as well as a review of the relevant literature.

Proposed Research and Methods: Identify the hypotheses to be tested and details of the methods to be used including the integration of experiments with theoretical and computational research efforts.

Timetable of Activities: Timeline for all major activities including milestones and deliverables.

Team and Project Management Plan: This section should provide a clear strategy for coordinating and operating the collective team and resources to meet the proposed research goals (including communication plans among team members at other institutions, data sharing, coordination of personnel, etc.)

The Project Narrative comprises the research plan for the project. 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 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. There should be no ambiguity about which personnel will perform particular parts of the project, and the time at which these activities will take place.

For Collaborative Proposals Only: In the situation a proposal has a Federal agency as a collaborator, each collaborating institution must submit an identical common narrative. Collaborative proposals will necessarily be longer than single-institution proposals. The common narrative must identify which tasks and activities will be performed by which of the collaborating institutions in every budget period of the proposed project. The budget and the budget justification—which are unique to each collaborating institution—may refer to parts of the common narrative to further identify each collaborating institution's activities in the joint project. There should be no ambiguity about each institution's role and participation in the collaborative group.

SC will use the multiple applications associated with a collaborative group to create one consolidated document for merit review that consists of the common, identical application materials combined with a set of detailed budgets from the partner institutions. It is very important that every application in the collaborative group be identical (including the title) with the exception of the budget and budget justification pages.

Do not attach any of the requested appendices described below as files for fields 9, 10, 11, and 12 in Grants.gov. Follow the below instructions to include the information as appendices in the single, bundled project narrative file.

APPENDIX 1: BIOGRAPHICAL SKETCH

Provide a biographical sketch for the PI and each senior/key person listed in Section A on the R&R Budget form.

As part of the sketch, provide information that can be used by reviewers to evaluate the PI's potential for leadership within the scientific community. Examples of information of interest are invited and/or public lectures, awards received, scientific program committees, conference or workshop organization, professional society activities, special international or industrial partnerships, reviewing or editorship activities, or other scientific leadership experiences.

- Provide the biographical sketch information as an appendix to your project narrative.
- Do not attach a separate file.
- The biographical sketch appendix will not count in the project narrative page limitation.
- The biographical information (curriculum vitae) for each person must not exceed 2 pages when printed on 8.5" by 11" paper with 1 inch margins (top, bottom, left, and right) with font not smaller than 11 point and must include:

SC does not require a particular format for a biosketch. Applicants may use a format developed for other agencies or generated by any software package, including SciENcv, a cooperative venture maintained at https://www.ncbi.nlm.nih.gov/sciencv/. The biographical information (curriculum vitae) must include the following items within its page limit:

- **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. An abbreviated style such as the Physical Review Letters (PRL) convention for citations (list only the first author) may be used for publications with more than 10 authors.
- **Synergistic Activities**: List no more than 5 professional and scholarly activities related to the effort proposed.

In addition, the biographical sketch must include information to permit DOE to identify individuals who are conflicted with or potentially biased (favorably or unfavorably) against the investigator. Include a section entitled "**Identification of Potential Conflicts of Interest or Bias in Selection of Reviewers**" that will not count in a page limit. Provide the following information

in this section:

- **Collaborators and Co-editors**: List in alphabetical order all persons, including their current organizational affiliation, who are, or who have been, collaborators or co-authors with you on a research project, book or book article, report, abstract, or paper during the 48 months preceding the submission of this application. For publications or collaborations with more than 10 authors or participants, only list those individuals in the core group with whom the PI interacted on a regular basis while the research was being done. Also, list any individuals who are currently, or have been, co-editors with you on a special issue of a journal, compendium, or conference proceedings during the 24 months preceding the submission of this application. If there are no collaborators or co-editors to report, state "None."
- **Graduate and Postdoctoral Advisors and Advisees**: List the names and current organizational affiliations of your graduate advisor(s) and principal postdoctoral sponsor(s). Also, list the names and current organizational affiliations of your graduate students and postdoctoral associates.

Personally Identifiable Information: Do not include sensitive and protected personally identifiable information including social security numbers, birthdates, citizenship, marital status, or home addresses. Do not include information that a merit reviewer should not make use of.

APPENDIX 2: CURRENT AND PENDING SUPPORT

Provide a list of all current and pending support (both Federal and non-Federal) for the PI and senior/key persons, including subawardees, for ongoing projects and pending applications. List all sponsored activities or awards requiring a measurable commitment of effort, whether paid or unpaid. SC does not require a particular format for current and pending support. Applicants may use a format developed for other agencies or generated by any software package, including SciENcv, a cooperative venture maintained at https://www.ncbi.nlm.nih.gov/sciencv/.
For every activity, list the following items:

- The sponsor of the activity or the source of funding
- The award or other identifying number
- The title of the award or activity
- The total cost or value of the award or activity, including direct and indirect costs. For pending proposals, provide the total amount of requested funding.
- The award period (start date – end date).
- The person-months of effort per year being dedicated to the award or activity
- Briefly describe the research being performed and explicitly identify any overlaps or synergies with the proposed research.

Provide the Current and Pending Support as an appendix to your project narrative. Concurrent submission of an application to other organizations for simultaneous consideration will not prejudice its review.

- Do not attach a separate file.
- This appendix will not count in the project narrative page limitation.

APPENDIX 3: BIBLIOGRAPHY & REFERENCES CITED

Provide a bibliography of any references cited in the Project 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. For research areas where there are routinely more than ten coauthors of archival publications, you may use an abbreviated style such as the Physical Review Letters (PRL) convention for citations (listing only the first author). For example, your paper may be listed as, "A Really Important New Result," A. Aardvark et. al. (MONGO Collaboration), PRL 999. Include only bibliographic citations. Applicants should be especially careful to follow scholarly practices in providing citations for source materials relied upon when preparing any section of the application. Provide the Bibliography and References Cited information as an appendix to your project narrative.

- Do not attach a separate file.
- This appendix will not count in the project narrative page limitation.

APPENDIX 4: FACILITIES & OTHER RESOURCES

This information is used to assess the capability of the organizational resources, including subawardee resources, available to perform the effort proposed. Identify the facilities to be used (Laboratory, Animal, Computer, Office, Clinical and Other). If appropriate, indicate their capacities, pertinent capabilities, relative proximity, and extent of availability to the project. Describe only those resources that are directly applicable to the proposed work. Describe other resources available to the project (e.g., machine shop, electronic shop) and the extent to which they would be available to the project. For proposed investigations requiring access to experimental user facilities maintained by institutions other than the applicant, please provide a document from the facility manager confirming that the researchers will have access to the facility. Please provide the Facility and Other Resource information as an appendix to your project narrative.

- Do not attach a separate file.
- This appendix will not count in the project narrative page limitation.

APPENDIX 5: EQUIPMENT

List major items of equipment already available for this project and, if appropriate identify location and pertinent capabilities. Provide the Equipment information as an appendix to your project narrative.

- Do not attach a separate file.
- This appendix will not count in the project narrative page limitation.

APPENDIX 6: DATA MANAGEMENT PLAN

Provide a Data Management Plan (DMP) that addresses the following requirements:

1. DMPs should describe whether and how data generated in the course of the proposed research will be shared and preserved, including submission to ESS-DIVE; https://ess-dive.lbl.gov/. If the plan is not to share and/or preserve certain data, then the plan must

explain the basis of the decision (for example, cost/benefit considerations, other parameters of feasibility, scientific appropriateness, or limitations discussed in #4). Applicants should familiarize themselves with the ESS-DIVE terms of use (https://ess-dive.lbl.gov/about/terms/). At a minimum, DMPs must describe how data sharing and preservation will enable validation of results, or how results could be validated if data are not shared or preserved.

2. DMPs should provide a plan for making all research data displayed in publications resulting from the proposed research open, machine-readable, and digitally accessible to the public at the time of publication. This includes data that are displayed in charts, figures, images, etc. In addition, the underlying digital research data used to generate the displayed data should be made as accessible as possible to the public in accordance with the principles stated in the Office of Science Statement on Digital Data Management (https://science.osti.gov/funding-opportunities/digital-data-management. This requirement could be met by including the data as supplementary information to the published article, or through other means. The published article should indicate how these data can be accessed.
3. DMPs should consult and reference available information about data management resources to be used in the course of the proposed research. In particular, DMPs that explicitly or implicitly commit data management resources at a facility beyond what is conventionally made available to approved users should be accompanied by written approval from that facility. In determining the resources available for data management at Office of Science User Facilities, researchers should consult the published description of data management resources and practices at that facility and reference it in the DMP. Information about other Office of Science facilities can be found at https://science.osti.gov/user-facilities/.
4. DMPs must protect confidentiality, personal privacy, Personally Identifiable Information, and U.S. national, homeland, and economic security; recognize proprietary interests, business confidential information, and intellectual property rights; avoid significant negative impact on innovation, and U.S. competitiveness; and otherwise be consistent with all applicable laws, and regulations. There is no requirement to share proprietary data.

DMPs will be reviewed as part of the overall SC research proposal merit review process. Applicants are encouraged to consult the SC website for further information and suggestions for how to structure a DMP (https://science.osti.gov/funding-opportunities/digital-data-management) as well as BER's additional requirements and guidance for digital data management ((https://science.osti.gov/ber/Funding-Opportunities/Digital-Data-Management).

Research data obtained through research supported by the FOA must also submit data to the BER supported Environmental System Science – Data Infrastructure for Virtual Ecosystems (ESS-DIVE).

- This appendix should not exceed 3 pages including charts, graphs, maps, photographs, and other pictorial presentations, when printed using standard 8.5" by 11" paper with 1 inch margins (top, bottom, left, and right).
- Do not attach a separate file.
- This appendix will not count in the project narrative page limitation.

APPENDIX 7: SOFTWARE PRODUCTIVITY AND SUSTAINABILITY PLANS (FOR SBR APPLICATIONS ONLY)

Applications to science areas 3 and 4 only and that have a model/software development or enhancement component are required to prepare a Software Productivity and Sustainability Improvement Plan (S-PSIP) and to include it in this appendix. This appendix is limited to 4 pages and will not count towards the page limitation. The S-PSIP should address the following:

1. Describe the process for making the software available to the broader community:
    a. Will the software be made available open source and what sort of license will be sought (how will collaborators and users access software products)?
    b. What is the general timetable for availability and open release of the software?
    c. Through what mechanisms will the software be made available?
2. Describe the overall software development/enhancement process to be used by the project, emphasizing elements that are most important for productivity and sustainability. Details should include descriptions of:
    a. How software requirements are determined and transformed into implemented code, tested, and deployed (the software lifecycle),
    b. How integration of new and revised capabilities into the existing software will preserve existing capabilities (regression testing), and
    c. How users will learn about using the code in their scientific efforts (documentation and training).
3. Describe the associated software tools and processes:
    a. Source management tools and processes (how source code will be developed and managed),
    b. Issue tracking tools and processes (how feature requests and software faults or "bugs" will be recorded and managed), and
    c. Regression testing tools and processes (how regression tests will be invoked).
4. Describe training:
    a. How new software developers will be trained, and
    b. How the value of the work of departing developers will be retained.
5. Describe improvement strategies:
    a. How software productivity and sustainability will be improved over the life of the proposed research projects, and
    b. How improvement efforts will be rewarded.

Software-PSIPs will be reviewed as part of the overall SC research proposal merit review process.

APPENDIX 8: DOE NATIONAL LABORATORY COLLABORATIONS

If your project includes a collaboration with a DOE National Laboratory, please use this appendix for their budget and budget justification forms.

APPENDIX 9: OTHER ATTACHMENT

If you need to elaborate on your responses to questions 1-6 on the "Other Project Information" document, please provide the Other Attachment information as an appendix to your project narrative. Information not easily accessible to a reviewer may be included in this appendix, but do not use this appendix to circumvent the page limitations of the application. Reviewers are not required to consider information in this appendix.

- Do not attach a separate file.
- This appendix will not count in the project narrative page limitation.

REMINDERS REGARDING ALL APPENDICES:

- **Follow the above instructions to include the information as appendices to the project narrative file.**
- **These appendices will not count toward the project narrative's page limitation.**
- **Do not attach any files to fields 9, 10, 11, or 12.**

3. Research And Related Budget

Complete the Research and Related Budget form in accordance with the instructions on the form (Activate Help Mode to see instructions) and the following instructions. You must complete a separate budget for each year of support requested. The form will generate a cumulative budget for the total project period. You must complete all the mandatory information on the form before the NEXT PERIOD button is activated. You may request funds under any of the categories listed as long as the item and amount are necessary to perform the proposed work, meet all the criteria for allowability under the applicable Federal cost principles, and are not prohibited by the funding restrictions in this FOA (See Section IV, Part H).

The following advice will improve the accuracy of your budget request:

- Funds requested for personnel (senior, key, and other) must be justified as the product of their effort on the project and their institutional base salary.
- Funds requested for fringe benefits must be calculated as the product of the requested salary and, if present, the negotiated fringe benefit rate contained in an institution's negotiated indirect cost rate agreement.
- Funds requested for indirect costs must be calculated using the correct indirect cost base and the negotiated indirect cost rate.
- You are encouraged to include the rate agreement used in preparing a budget as a part of the budget justification.

If you are proposing indirect costs and do not already have an Indirect Cost Rate Agreement with your Cognizant Federal Agency or documentation of rates accepted for estimating purposes by DOE or another Federal agency, it is recommended that you begin preparing an Indirect Cost Rate Proposal to be submitted, upon request, to the DOE contract specialist/grants management specialist who will evaluate your application if you are selected for award.

For your convenience in preparing an Indirect Cost Rate proposal, a link to applicant resources, including indirect rate model templates, has been provided below: https://science.osti.gov/sbir/applicant-resources/grant-application/.

Budget Fields

Section A Senior/Key Person	For each Senior/Key Person, enter the requested information. List personnel, base salary, the number of months that person will be allocated to the project, requested salary, fringe benefits, and the total funds requested for each person. The requested salary must be the product of the base salary and the effort. Include a written narrative in the budget justification that justifies the need for requested personnel.
Section B Other Personnel	List personnel, the number of months that person will be allocated to the project, requested salary fringe benefits, and the total funds requested for each person. Include a written narrative in the budget justification that fully justifies the need for requested personnel.
Section C Equipment	For the purpose of this budget, equipment is designated as an item of property that has an acquisition cost of $5,000 or more and an expected service life of more than one year. (Note that this designation applies for proposal budgeting only and differs from the DOE definition of capital equipment.) List **each** item of equipment separately and justify each in the budget justification section. Do not aggregate items of equipment. Allowable items ordinarily will be limited to research equipment and apparatus not already available for the conduct of the work. General-purpose office equipment is not eligible for support unless primarily or exclusively used in the actual conduct of scientific research.
Section D Travel	For purposes of this section only, travel to Canada or to Mexico is considered domestic travel. In the budget justification, list each trip's destination, dates, estimated costs including transportation and subsistence, number of staff traveling, the purpose of the travel, and how it relates to the project. Indicate the basis for the cost estimate (quotes from vendors or suppliers, past experience of similar items, or some other basis). 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. Domestic travel is to be justified separately from foreign travel.
Section E Participant/Trainee Support Costs	If applicable, submit training support costs. Educational projects that intend to support trainees (precollege, college, graduate and post graduate) must list each trainee cost that includes stipend levels and amounts, cost of tuition for each trainee, cost of any travel (provide the same information as needed under the regular travel category), and costs for any related training expenses. Participant costs are those costs associated with conferences, workshops, symposia or institutes and

	breakout items should indicate the number of participants, cost for each participant, purpose of the conference, dates and places of meetings and any related administrative expenses. Indicate the basis for the cost estimate (quotes from vendors or suppliers, past experience of similar items, or some other basis).
Section F Other Direct Costs	• **Materials and Supplies:** Enter total funds requested for materials and supplies in the appropriate fields. In the budget justification, indicate general categories such as glassware, and chemicals, including an amount for each category (items not identified under "Equipment"). Categories less than $1,000 are not required to be itemized. Indicate the basis for the cost estimate (quotes from vendors or suppliers, past experience of similar items, or some other basis). • **Publication Costs:** Enter the total publication funds requested. The proposal budget may request funds for the costs of documenting, preparing, publishing or otherwise making available to others the findings and products of the work conducted under the award. In the budget justification, include supporting information. Indicate the basis for the cost estimate (quotes from vendors or suppliers, past experience of similar items, or some other basis). • **Consultant Services:** Enter total funds requested for all consultant services. In the budget justification, identify each consultant, the services he/she will perform, total number of days, travel costs, and total estimated costs. Indicate the basis for the cost estimate (quotes from vendors or suppliers, past experience of similar items, or some other basis). • **ADP/Computer Services:** Enter total funds requested for ADP/Computer Services. The cost of computer services, including computer-based retrieval of scientific, technical and education information may be requested. In the budget justification, include the established computer service rates at the proposing organization if aspplicable. Indicate the basis for the cost estimate (quotes from vendors or suppliers, past experience of similar items, or some other basis). • **Subawards/Consortium/Contractual Costs:** Enter total costs for all subawards/consortium organizations and other contractual costs proposed for the project. In the budget justification, justify the details. • **Equipment or Facility Rental/User Fees:** Enter total funds requested for Equipment or Facility Rental/User Fees. In the budget justification, identify each rental/user fee and justify. Indicate the basis for the cost estimate (quotes from vendors or suppliers, past experience of similar items, or some other basis). • **Alterations and Renovations:** Enter total funds requested for

	Alterations and Renovations. In the budget justification, itemize by category and justify the costs of alterations and renovations, including repairs, painting, removal or installation of partitions, shielding, or air conditioning. Where applicable, provide the square footage and costs. • **Other:** Add text to describe any other Direct Costs not requested above. Enter costs associated with "Other" item(s). Use the budget justification to further itemize and justify.
Section G Direct Costs	This represents Total Direct Costs (Sections A through F)
Section H Other Indirect Costs	Enter the Indirect Cost information for each field. Only four general categories of indirect costs are allowed/requested on this form, so please consolidate if needed. Include the cognizant Federal agency and contact information if using a negotiated rate agreement.
Section I Total Direct and Indirect Costs	This is the total of Sections G and H

BUDGET JUSTIFICATION (FIELD L ON THE FORM)

Provide a justification that explains all costs proposed in the budget. The following items of advice are offered to assist you in developing a justification.

- Organize the justification by listing items in the same order as presented on the budget.
- Ensure that the narrative matches the budget in dollar amounts and language.
- Explain the line items. If costs are estimated, provide a basis for the estimate. Explain if costs are based on prior experience of similar activities. If a cost is based on the product of two numbers (such as a number of items at a per-item price), ensure that your math is correct.
- If including an inflationary factor for future budget periods, explain the basis for the inflation.

Provide any other information you wish to submit to justify your budget request. Including items in the budget justification is not considered a form of cost-sharing: Provide the details of all personnel (key or other) who will be working on the award, regardless of their source(s) of compensation. Explain their source(s) of compensation if it is not from this award. Include the indirect cost rate agreement as a part of the budget justification. **Attach a single budget justification file for the entire project period in field L.** The file automatically carries over to each budget year.

4. R&R Subaward Budget Attachment(s) Form

Budgets for Subawardees: You must provide a separate R&R budget and budget justification for each subawardee. Download the R&R Budget Attachment from the R&R SUBAWARD BUDGET ATTACHMENT(S) FORM and either e-mail it to each subawardee that is required to submit a separate budget or use the collaborative features of Workspace. After the subawardee

has either e-mailed its completed budget back to you or completed it within Workspace, attach it to one of the blocks provided on the form. Use up to 10 letters of the subawardee's name (plus.pdf) as the file name (e.g., ucla.pdf or energyres.pdf). Filenames must not exceed 50 characters.

If the project involves more subawardees than there are places in the SUBAWARD BUDGET ATTACHMENT(S) FORM, the additional subaward budgets may be saved as PDF files and appended to the Budget Justification attached to Field L.

Applicants should consult their local information technology ("IT") support resources for any necessary assistance in converting the forms downloaded from Grants.gov into plain PDF files that can be combined into one non-Portfolio PDF file (the Budget Justification).

Ensure that any files received from subawardees are the PDF files extracted from the SUBAWARD BUDGET ATTACHMENT(S) FORM. Errors will be created if a subawardee sends a prime applicant a budget form that was not extracted from the application package.

Note: If an application proposes subawards to a DOE National Laboratory, a Federal agency, or another Federal agency's FFRDC, the value of such proposed subawards will be deducted from any resulting award: Those classes of organizations must be paid directly by SC. However, the details of such proposed budgets are an essential for understanding and analyzing the proposed research.

5. Project/Performance Site Location(s)

Indicate the primary site where the work will be performed. If a portion of the project will be performed at any other site(s), identify the site location(s) in the blocks provided.

Note that the Project/Performance Site Congressional District is entered in the format of the 2 digit state code followed by a dash and a 3 digit Congressional district code, for example VA-001. Hover over this field for additional instructions.

Use the Next Site button to expand the form to add additional Project/Performance Site Locations.

6. Disclosure of Lobbying Activities (SF-LLL)

If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the grant/cooperative agreement, you must complete and submit Standard Form - LLL, "Disclosure Form to Report Lobbying."

7. Summary of Required Forms/Files

Your application must include the following items:

Name of Document	Format	Attach to
SF 424 (R&R)	Form	N/A
RESEARCH AND RELATED Other Project Information	Form	N/A
Project Summary/Abstract	PDF	Field 7
Project Narrative, including required appendices	PDF	Field 8
RESEARCH & RELATED BUDGET	Form	N/A
Budget Justification	PDF	Field L
R&R SUBAWARD BUDGET ATTACHMENT(S) FORM (if applicable)	Form	N/A
Subawardee Budget Justification (if applicable)	PDF	Field L of each subaward budget
PROJECT/PERFORMANCE SITE LOCATION(S)	Form	N/A
SF-LLL Disclosure of Lobbying Activities, if applicable	Form	N/A

E. SUBMISSIONS FROM SUCCESSFUL APPLICANTS

If selected for award, DOE reserves the right to request additional or clarifying information for any reason deemed necessary, including, but not limited to:

- Indirect cost information
- Other budget information
- Name and phone number of the Designated Responsible Employee for complying with national policies prohibiting discrimination (See 10 CFR 1040.5)
- Representation of Limited Rights Data and Restricted Software, if applicable
- Commitment Letter from Third Parties Contributing to Cost Sharing, if applicable
- Environmental Information

Applicants that are not institutions of higher education, that request indirect costs, and that do not already have an Indirect Cost Rate Agreement with their Cognizant Federal Agency or documentation of rates accepted for estimating purposes by DOE or another Federal agency, are advised to begin preparing an Indirect Cost Rate Proposal for submission, upon request, to the DOE contract specialist/grants management specialist who will evaluate your application if you are selected for award.

F. SUBMISSION DATES AND TIMES

1. Letter of Intent Due Date

N/A

2. Pre-application Due Date

December 5, 2019, at 5:00 pm Eastern Time

You are encouraged to submit your pre-application well before the deadline. Pre-applications may be submitted at any time between the publication of this FOA and the stated deadline.

3. Application Due Date

February 20, 2020, at 11:59 pm Eastern Time

You are encouraged to transmit your application well before the deadline. Applications may be submitted at any time between the publication of this FOA and the stated deadline.

4. Late Submissions

Delays in submitting letters of intent, pre-applications, and applications may be unavoidable. DOE has accepted late submissions when applicants have been unable to make timely submissions because of widespread technological disruptions or significant natural disasters. DOE has made accommodations for incapacitating or life-threatening illnesses and for deaths of immediate family members. Other circumstances may or may not justify late submissions. Unacceptable justifications include the following:

- Failure to begin submission process early enough.
- Failure to provide sufficient time to complete the process.
- Failure to understand the submission process.
- Failure to understand the deadlines for submissions.
- Failure to satisfy prerequisite registrations.
- Unavailability of administrative personnel.
- An upper respiratory infection (a “cold”) the week of the deadline.

You are responsible for beginning the submission process in sufficient time to accommodate reasonably foreseeable incidents, contingencies, and disruptions.

Applicants must contact the Program Office/Manager listed in this FOA to discuss the option of a late submission. Contacting the Program Office/Manager after the deadline may reduce the likelihood that a request will be granted.

DOE notes that not all requests for late submission will be approved.

G. INTERGOVERNMENTAL REVIEW

This program is not subject to Executive Order 12372 Intergovernmental Review of Federal Programs.

H. FUNDING RESTRICTIONS

Funding for all awards and future budget periods are contingent upon the availability of funds appropriated by Congress for the purpose of this program and the availability of future-year budget authority.

Cost Principles: Costs must be allowable, allocable and reasonable in accordance with the applicable Federal cost principles referenced in 2 CFR 200 as modified by 2 CFR 910 (DOE Financial Assistance Regulation).

Pre-award Costs: Recipients may charge to an award resulting from this FOA pre-award costs that were incurred within the ninety (90) calendar day period immediately preceding the effective date of the award, if the costs are allowable in accordance with the applicable Federal cost principles referenced in 2 CFR 200 as modified by 2 CFR 910 (DOE Financial Assistance Regulation). Recipients must obtain the prior approval of the contracting officer for any pre-award costs that are for periods greater than this 90 day calendar period.

Pre-award costs are incurred at the applicant's risk. DOE is under no obligation to reimburse such costs if for any reason the applicant does not receive an award or if the award is made for a lesser amount than the applicant expected.

I. OTHER SUBMISSION AND REGISTRATION REQUIREMENTS

1. Systems to Register In

Applicants must complete a series of registrations and enrollments to submit applications in response to this FOA. Applicants not currently registered with SAM and Grants.gov should allow **at least 4 weeks** to complete these requirements.

You should start the process as soon as possible.

You may not be able to use your preferred Internet browser: Each system has its own requirements.

Applicants must obtain a DUNS number at https://fedgov.dnb.com/webform.

Applicants must register with SAM at https://www.sam.gov/. If you had an active registration in the Central Contractor Registry (CCR), you should have an active registration in SAM. More information about SAM registration for applicants is found at https://www.sam.gov/SAM/transcript/Quick_Guide_for_Grants_Registrations.pdf. SAM maintains a complete user guide at https://www.sam.gov/SAM/transcript/SAM_Non_Federal_User_Guide.pdf.

Applicants must provide a Taxpayer Identification Number (TIN) to complete their registration in www.SAM.gov. An applicant's TIN is an EIN assigned by the Internal Revenue Service (IRS). In limited circumstances, a Social Security Number (SSN) assigned by the Social Security

Administration (SSA) may be used as a TIN. You may obtain an EIN from the IRS at https://www.irs.gov/businesses/small-businesses-self-employed/apply-for-an-employer-identification-number-ein-online.

> DOE discourages the use of a SSN as a TIN. You are encouraged to obtain a TIN from the IRS using the website listed above.

Applicants must register with FedConnect at www.FedConnect.net. The full, binding version of assistance agreements will be posted to FedConnect.

Recipients must register with the Federal Funding Accountability and Transparency Act Subaward Reporting System at https://www.fsrs.gov. This registration must be completed before an award may be made: you are advised to register while preparing your application.

2. Registering in Grants.gov

Applicants must register with Grants.gov, following the instructions at https://www.Grants.gov/web/grants/applicants/registration.html.

3. Where to Submit an Application

You must submit the application through Grants.gov at www.Grants.gov, using either the online webforms or downloaded forms. (Additional instructions are provided in Section IV, Part A of this FOA.)

Submit electronic applications through the "Apply for Grants" function at www.Grants.gov. If you have problems completing the registration process or submitting your application, call Grants.gov at 1-800-518-4726 or send an email to support@Grants.gov.

Please ensure that you have read the applicable instructions, guides, help notices, frequently asked questions, and other forms of technical support on Grants.gov.

4. DOE SC Portfolio Analysis and Management System (PAMS)

After you submit your application through Grants.gov, the application will automatically transfer into the Portfolio Analysis and Management System (PAMS) for processing by the DOE SC. Many functions for grants and cooperative agreements can be done in PAMS, which is available at https://pamspublic.science.energy.gov.

You will want to "register to" your application: a process of linking yourself to the application after it has been submitted through Grants.gov and processed by DOE.

You must register in PAMS to submit a pre-application or a letter of intent.

You may use the Internet Explorer, Firefox, Google Chrome, or Safari browsers to access PAMS.

Notifications sent from the PAMS system will come from the PAMS email address <PAMS.Autoreply@science.doe.gov>. Please make sure your email server/software allows delivery of emails from the PAMS email address to yours.

Registering to PAMS is a two-step process; once you create an individual account, you must associate yourself with ("register to") your institution. Detailed steps are listed below.

1. CREATE PAMS ACCOUNT:

To register, click the "Create New PAMS Account" link on the website https://pamspublic.science.energy.gov/.

- Click the "No, I have never had an account" link and then the "Create Account" button.
- You will be prompted to enter your name and email address, create a username and password, and select a security question and answer. Once you have done this, click the "Save and Continue" button.
- On the next page, enter the required information (at least one phone number and your mailing address) and any optional information you wish to provide (e.g., FAX number, website, mailstop code, additional email addresses or phone numbers, Division/Department). Click the "Create Account" button.
- Read the user agreement and click the "Accept" button to indicate that you understand your responsibilities and agree to comply with the rules of behavior for PAMS.
- PAMS will take you to the "Having Trouble Logging In?" page. (If you have been an SC merit reviewer or if you have previously submitted an application, you may already be linked to an institution in PAMS. If this happens, you will be taken to the PAMS home page.)

2. REGISTER TO YOUR INSTITUTION:

- Click the link labeled "Option 2: I know my institution and I am here to register to the institution." (Note: If you previously created a PAMS account but did not register to an institution at that time, you must click the Institutions tab and click the "Register to Institution" link.)
- PAMS will take you to the "Register to Institution" page.
- Type a word or phrase from your institution name in the field labeled, "Institution Name like," choose the radio button next to the item that best describes your role in the system, and click the "Search" button. A "like" search in PAMS returns results that contain the word or phrase you enter; you do not need to enter the exact name of the institution, but you should enter a word or phrase contained within the institution name. (If your institution has a frequently used acronym, such as ANL for Argonne National Laboratory or UCLA for the Regents of the University of California, Los Angeles, you may find it easiest to search for the acronym under "Institution Name like." Many institutions with acronyms are listed in PAMS with their acronyms in parentheses after their names.)
- Find your institution in the list that is returned by the search and click the "Actions" link in the Options column next to the institution name to obtain a dropdown list. Select "Add me to this institution" from the dropdown. PAMS will take you to the "Institutions – List" page.

- If you do not see your institution in the initial search results, you can search again by clicking the "Cancel" button, clicking the Option 2 link, and repeating the search.
- If, after searching, you think your institution is not currently in the database, click the "Cannot Find My Institution" button and enter the requested institution information into PAMS. Click the "Create Institution" button. PAMS will add the institution to the system, associate your profile with the new institution, and return you to the "Institutions – List" page when you are finished.

For help with PAMS, click the "External User Guide" link on the PAMS website, https://pamspublic.science.energy.gov/. You may also contact the PAMS Help Desk, which can be reached Monday through Friday, 9AM – 5:30 PM Eastern Time. Telephone: (855) 818-1846 (toll free) or (301) 903-9610, email: sc.pams-helpdesk@science.doe.gov. All submission and inquiries about this FOA should reference DE-FOA-0002184.

5. Viewing Submitted Applications

Each Grants.gov application submitted to the DOE SC automatically transfers into PAMS and is subsequently assigned to a program manager. At the time of program manager assignment, the three people listed on the SF-424 (R&R) cover page will receive an email with the subject line, "Receipt of Proposal 0000xxxxxx by the DOE Office of Science." These three people are the PI (Block 14), Authorized Representative (Block 19), and Point of Contact (Block 5). In PAMS notation, applications are known as proposals, the PI is known as the PI, the Authorized Representative is known as the Sponsored Research Officer/Business Officer/Administrative Officer (SRO/BO/AO), and the Point of Contact is known as the POC.

There will be a period of time between the application's receipt at Grants.gov and its assignment to a DOE SC program manager. Program managers are typically assigned two weeks after applications are due at Grants.gov: please refrain from attempting to view the proposal in PAMS until you receive an email providing the assignment of a program manager.

Once the email is sent, the PI, SRO/BO/PO, and POC will each be able to view the submitted proposal in PAMS. Viewing the proposal is optional.

You may use the Internet Explorer, Firefox, Google Chrome, or Safari browsers to access PAMS.

Following are two sets of instructions for viewing the submitted proposal, one for individuals who already have PAMS accounts and one for those who do not.

If you already have a PAMS account, follow these instructions:
1. Log in to PAMS at https://pamspublic.science.energy.gov/.
2. Click the "Proposals" tab and click "Access Previously Submitted Grants.gov Proposal."
3. Enter the following information:
    - Proposal ID: Enter the ten-digit PAMS proposal ID, including the leading zeros (e.g., 00002xxxxx). Do not use the Grants.gov proposal number. Use the PAMS number previously sent to you in the email with subject line, "Receipt of Proposal …".

- Email (as entered in Grants.gov application): Enter your email address as it appears on the SF424(R&R) Cover Page.
- Choose Role: Select the radio button in front of the role corresponding to the SF-424 (R&R) cover page. If your name appears in block 19 of the SF-424 (R&R) cover page as the authorizing representative, select "SRO/BO/AO (Sponsored Research Officer/Business Officer/Administrative Officer)." If your name appears in block 14 of the SF424 R&R cover page as the PI, select "Principal Investigator (PI)." If your name appears in block 5 of the SF424 R&R as the point of contact, select "Other (POC)."

4. Click the "Save and Continue" button. You will be taken to your "My Proposals" page. The Grants.gov proposal will now appear in your list of proposals. Click the "Actions/Views" link in the options column next to this proposal to obtain a dropdown list. Select "Proposal" from the dropdown to see the proposal. Note that the steps above will work only for proposals submitted to the DOE SC since May 2012.

If you do not already have a PAMS account, follow these instructions:

1. To register, click the "Create New PAMS Account" link on the website https://pamspublic.science.energy.gov/.
2. Click the "No, I have never had an account" link and then the "Create Account" button.
3. You will be prompted to enter your name and email address, create a username and password, and select a security question and answer. Once you have done this, click the "Save and Continue" button.
4. On the next page, enter the required information (at least one phone number and your mailing address) and any optional information you wish to provide (e.g., FAX number, website, mailstop code, additional email addresses or phone numbers, Division/Department). Click the "Create Account" button.
5. Read the user agreement and click the "Accept" button to indicate that you understand your responsibilities and agree to comply with the rules of behavior for PAMS.
6. You will be taken to the Register to Institution page. Select the link labeled, "Option 1: My institution has submitted a proposal in Grants.gov. I am here to register as an SRO, PI, or POC (Sponsored Research Officer, Principal Investigator, or Point of Contact)."
7. Enter the following information:
   - Proposal ID: Enter the ten-digit PAMS proposal ID, including the leading zeros (e.g., 00002xxxxx). Do not use the Grants.gov proposal number. Use the PAMS number previously sent to you in the email with subject line, "Receipt of Proposal …".
   - Email (as entered in Grants.gov proposal): Enter your email address as it appears on the SF424(R&R) Cover Page.
   - Choose Role: Select the radio button in front of the role corresponding to the SF-424 (R&R) cover page. If your name appears in block 19 of the SF-424 (R&R) cover page as the authorizing representative, select "SRO/BO/AO (Sponsored Research Officer/Business Officer/Administrative Officer)." If your name appears in block 14 of the SF424 R&R cover page as the PI, select "Principal Investigator (PI)." If your name appears in block 5 of the SF424 R&R as the point of contact, select "Other (POC)."
8. Click the "Save and Continue" button. You will be taken to your "My Proposals" page. The Grants.gov proposal will now appear in your list of proposals. Click the "Actions/Views" link in the options column next to this proposal to obtain a dropdown list. Select "Proposal" from the dropdown to see the proposal.

If you were listed as the PI on a prior submission but you have not previously created an account, you may already be listed in PAMS. If this is the case, you will be taken to the PAMS home page after agreeing to the Rules of Behavior. If that happens, follow the instructions listed above under "If you already have a PAMS account…" to access your Grants.gov proposal.

The steps above will work only for proposals submitted to the DOE SC since May 2012.

For help with PAMS, click the "External User Guide" link on the PAMS website, https://pamspublic.science.energy.gov/. You may also contact the PAMS Help Desk, which can be reached Monday through Friday, 9 AM – 5:30 PM Eastern Time. Telephone: (855) 818-1846 (toll free) or (301) 903-9610, Email: sc.pams-helpdesk@science.doe.gov. All submissions and inquiries about this FOA should reference DE-FOA-0002184.

Section V - APPLICATION REVIEW INFORMATION

A. CRITERIA

1. Initial Review Criteria

Prior to a comprehensive merit evaluation, DOE will perform an initial review in accordance with 10 CFR 605.10(b) to determine that (1) the applicant is eligible for the award; (2) the information required by the FOA has been submitted; (3) all mandatory requirements are satisfied; (4) the proposed project is responsive to the objectives of the FOA, and (5) the proposed project is not duplicative of programmatic work. Applications that fail to pass the initial review will not be forwarded for merit review and will be eliminated from further consideration.

2. Merit Review Criteria

Applications will be subjected to scientific merit review (peer review) and will be evaluated against the following criteria as found in 10 CFR 605.10(d), the Office of Science Financial Assistance Program Rule.

- Scientific and/or Technical Merit of the Project;
- Appropriateness of the Proposed Method or Approach;
- Competency of Applicant's Personnel and Adequacy of Proposed Resources;
- Reasonableness and Appropriateness of the Proposed Budget; and
- Data and Team Management.

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 an application constitutes agreement that this is acceptable to the investigator(s) and the submitting institution.

The descriptions below are provided to the merit reviewers to elaborate the criteria established by regulation:

SCIENTIFIC AND/OR TECHNICAL MERIT OF THE PROPOSED RESEARCH

- What is the scientific innovation of proposed research?
- Does the proposed work include a testable hypothesis?
- What is the likelihood of achieving valuable results?
- How might the results of the proposed work impact the direction, progress, and thinking in relevant scientific fields of research?
- How does the proposed work compare with other efforts in its field, both in terms of scientific and/or technical merit and originality?

APPROPRIATENESS OF THE PROPOSED METHOD OR APPROACH

- How logical and feasible are the research approaches?
- Does the proposed research employ innovative concepts or methods?
- Are the conceptual framework, methods, and analyses well justified, adequately developed, and likely to lead to meeting the objectives, hypotheses and scientifically valid conclusions
- Does the applicant recognize significant potential problems and consider alternative strategies?
- For Terrestrial Ecology (TES) topic areas, does the PI pose their research applications in the context of representing terrestrial ecosystem processes in Earth system model? This is not necessarily guidance to include a modeler in every application, but rather to pose the questions in the context of identified (or unrecognized) needs for Earth system models and to propose mechanisms whereby the results of the proposed research would be transitioned to the modeling community.
- For Subsurface and Watershed Hydro-biogeochemistry (SBR) topic areas that propose model/software development/enhancement, consider how well the S-PSIP (Appendix 7) describes a plan for releasing the code open source and making the software available to the broader community, whether the applicant plans to incorporate best practices for development/enhancement, how the source code will be managed and issues tracked, whether there are mechanisms for recognizing the value of the individual developing/enhancing the code, and whether there is long-term plan for sustaining and continuing to improve the developed code.

COMPETENCY OF APPLICANT'S PERSONNEL AND ADEQUACY OF PROPOSED RESOURCES

- What is the past performance and potential of the Principal Investigator (PI)/team?
- How well qualified is the research team to carry out the proposed research?
- Are the research environment and facilities adequate for performing the research?
- Does the proposed work take advantage of unique facilities and capabilities?

REASONABLENESS AND APPROPRIATENESS OF THE PROPOSED BUDGET

- Are the proposed budget and staffing levels adequate to carry out the proposed research?
- Is the budget reasonable and appropriate for the scope?
- Are investments in new or enhanced research sites justified? Note the solicitation's guidance that: "Authors are encouraged to consider utilization of, or collaboration with sites that have existing support (e.g., former DOE sites or existing AmeriFlux projects) thereby leveraging existing investments, archived samples and long-term data sets."

DATA AND TEAM MANAGEMENT

- Does the application present a team management plan, particularly for applications involving collaborating investigators from different institutions? Does this plan provide adequate details on the project's management structure and mechanisms for integrating the research

carried out between/among the collaborating investigators to produce the proposed results, and means of communication to help ensure the team will produce the proposed results?

- Is there a Data Management Plan (DMP)? Does the proposed DMP describe whether and how data generated in the course of the proposed research will be shared and preserved, and does it describe how data sharing and preservation will enable validation of results, or how results could be validated if data are not shared or preserved?
- Does the plan clearly outline how the acquired data (experimental, model code, and/or model output) will be successfully shared with the community and the timeline for that sharing? Does the plan include sharing data with the DOE funded Environmental System Science – Data Infrastructure for Virtual Ecosystems (ESS-DIVE) data repository? Does the plan agree to the ESS-DIVE terms of use?
- Does the proposed DMP describe the plan for making all research data displayed in publications resulting from the proposed research open, machine-readable, and digitally accessible to the public at the time of publication?
- Does the proposed DMP consult and reference available information about data management resources to be used in the course of the proposed research?
- Does the proposed DMP protect confidentiality, personal privacy, personally identifiable information (PII), and U.S. national, homeland, and economic security; recognize proprietary interests, business confidential information, and intellectual property rights; avoid significant negative impact on innovation, and U.S. competitiveness; and otherwise be consistent with all applicable laws, regulations, and DOE orders and policies?

B. REVIEW AND SELECTION PROCESS

1. Merit Review

Applications that pass the initial review will be subjected to a formal merit review and will be evaluated based on the criteria codified at 10 CFR 605.10(d) in accordance with the guidance provided in the "Office of Science Merit Review System for Financial Assistance," which is available at: https://science.osti.gov/grants/policy-and-guidance/merit-review-system/.

2. Program Policy Factors

The Selection Official may consider any of the following program policy factors in making the selection, listed in no order of significance:

- Availability of funds
- Relevance of the proposed activity to SC priorities and CESD Strategic Plans
- Ensuring an appropriate balance of activities within SC programs
- Performance under current awards
- Use of DOE user facilities and resources, when applicable
- Commitment to sharing the results of research with the scientific community

3. Selection

The Selection Official will consider the findings of the merit review and may consider any of the Program Policy Factors described above.

4. Review of Risk

Pursuant to 2 CFR 200.205, DOE will conduct an additional review of the risk posed by applications submitted under this FOA. Such review of risk will include:

- Technical merit of the application,
- Reports and findings from audits performed under 2 CFR 200 or OMB Circular A-133, and
- Systems maintained under 2 CFR 180.

DOE may make use of other publicly available information and the history of an applicant's performance under DOE or other Federal agency awards.

Applicants with no prior performance of DOE awards may be asked to provide information about their financial stability and or their ability to comply with the management standards of 2 CFR 200.

REPORTING OF MATTERS RELATED TO RECIPIENT INTEGRITY AND PERFORMANCE (DECEMBER 2015)

DOE, prior to making a Federal award with a total amount of Federal share greater than the simplified acquisition threshold, is required to review and consider any information about the applicant that is in the designated integrity and performance system accessible through SAM (currently FAPIIS) (see 41 USC 2313).

The applicant, at its option, may review information in the designated integrity and performance systems accessible through SAM and comment on any information about itself that a Federal awarding agency previously entered and is currently in the designated integrity and performance system accessible through SAM.

DOE will consider any written comments by the applicant, in addition to the other information in the designated integrity and performance system, in making a judgment about the applicant's integrity, business ethics, and record of performance under Federal awards when completing the review of risk posed by applicants as described in 2 CFR 200.205 Federal awarding agency review of risk posed by applicants.

5. Discussions and Award

The Government may enter into discussions with a selected applicant for any reason deemed necessary, including but not limited to the following: (1) the budget is not appropriate or reasonable for the requirement; (2) only a portion of the application is selected for award; (3) the Government needs additional information to determine that the recipient is capable of complying with the requirements in 2 CFR 200 as modified by 2 CFR 910 (DOE Financial Assistance

Regulation); and/or (4) special terms and conditions are required. Failure to resolve satisfactorily the issues identified by the Government will preclude award to the applicant.

C. ANTICIPATED NOTICE OF SELECTION AND AWARD DATES

It is anticipated that the award selection will be completed by August 1, 2020. It is expected that awards will be made in Fiscal Year 2020.

Section VI - AWARD ADMINISTRATION INFORMATION

A. AWARD NOTICES

1. Notice of Selection

Selected Applicants Notification: DOE will notify applicants selected for award. This notice of selection is not an authorization to begin performance. (See Section IV, Part H with respect to the allowability of pre-award costs.)

Non-selected Notification: Organizations whose applications have not been selected will be advised as promptly as possible. This notice will explain why the application was not selected.

2. Notice of Award

An Assistance Agreement issued by the contracting officer is the authorizing award document. It normally includes, either as an attachment or by reference, the following items: (1) Special Terms and Conditions; (2) Applicable program regulations, if any; (3) Application as approved by DOE; (4) 2 CFR 200 as modified by 2 CFR 910 (DOE Financial Assistance Regulation); (5) National Policy Assurances To Be Incorporated As Award Terms; (6) Budget Summary; (7) Intellectual Property Provisions; and (8) Federal Assistance Reporting Checklist, which identifies the reporting requirements.

Research awards made under this FOA will be subject to the government-wide Research Terms and Conditions published at https://www.nsf.gov/pubs/policydocs/rtc/rtcoverlay_march17.pdf and the DOE Agency Specific Standard Research Terms and Conditions published at https://www.nsf.gov/pubs/policydocs/rtc/agencyspecifics/doe_417.pdf. These Terms and Conditions will be incorporated in the award by reference.

B. ADMINISTRATIVE AND NATIONAL POLICY REQUIREMENTS

1. Administrative Requirements

The administrative requirements for DOE grants and cooperative agreements are contained in 2 CFR 200 as modified by 2 CFR 910 (DOE Financial Assistance Regulation).

NONDISCLOSURE AND CONFIDENTIALITY AGREEMENTS REPRESENTATIONS (JUNE 2015)

In submitting an application in response to this FOA the Applicant represents that:
(1) It **does not and will not** require its employees or contractors to sign internal nondisclosure or confidentiality agreements or statements prohibiting or otherwise restricting its employees or contactors from lawfully reporting waste, fraud, or abuse to a designated investigative or law enforcement representative of a Federal department or agency authorized to receive such information.
(2) It **does not and will not** use any Federal funds to implement or enforce any nondisclosure and/or confidentiality policy, form, or agreement it uses unless it contains the following

provisions:

a. *‘‘These provisions are consistent with and do not supersede, conflict with, or otherwise alter the employee obligations, rights, or liabilities created by existing statute or Executive order relating to (1) classified information, (2) communications to Congress, (3) the reporting to an Inspector General of a violation of any law, rule, or regulation, or mismanagement, a gross waste of funds, an abuse of authority, or a substantial and specific danger to public health or safety, or (4) any other whistleblower protection. The definitions, requirements, obligations, rights, sanctions, and liabilities created by controlling Executive orders and statutory provisions are incorporated into this agreement and are controlling.’’*

b. The limitation above shall not contravene requirements applicable to Standard Form 312, Form 4414, or any other form issued by a Federal department or agency governing the nondisclosure of classified information.

c. Notwithstanding provision listed in paragraph (a), a nondisclosure or confidentiality policy form or agreement that is to be executed by a person connected with the conduct of an intelligence or intelligence-related activity, other than an employee or officer of the United States Government, may contain provisions appropriate to the particular activity for which such document is to be used. Such form or agreement shall, at a minimum, require that the person will not disclose any classified information received in the course of such activity unless specifically authorized to do so by the United States Government. Such nondisclosure or confidentiality forms shall also make it clear that they do not bar disclosures to Congress, or to an authorized official of an executive agency or the Department of Justice, that are essential to reporting a substantial violation of law.

REGISTRATION REQUIREMENTS

Additional administrative requirements for DOE grants and cooperative agreements are contained in 2 CFR 25 (See: www.eCFR.gov). Prime awardees must keep their data in SAM current at www.SAM.gov. SAM is the government-wide system that replaced the Central Contractor Registry (CCR). If you had an active registration in the CCR, you have an active registration in SAM. Subawardees at all tiers must obtain DUNS numbers and provide the DUNS to the prime awardee before the subaward can be issued.

SUBAWARD AND EXECUTIVE REPORTING

Additional administrative requirements necessary for DOE grants and cooperative agreements to comply with the Federal Funding and Transparency Act of 2006 (FFATA) are contained in 2 CFR 170. (See: www.eCFR.gov). Prime awardees must register with the new FSRS database and report the required data on their first tier subawardees. Prime awardees must report the executive compensation for their own executives as part of their registration profile in SAM.

PROHIBITION ON LOBBYING ACTIVITY

By accepting funds under this award, you agree that none of the funds obligated on the award shall be expended, directly or indirectly, to influence congressional action on any legislation or appropriation matters pending before Congress, other than to communicate to Members of

Congress as described in 18 USC 1913. This restriction is in addition to those prescribed elsewhere in statute and regulation.

2. Terms and Conditions

The DOE Special Terms and Conditions for Use in Most Grants and Cooperative Agreements are located at https://energy.gov/management/office-management/operational-management/financial-assistance/financial-assistance-forms under Award Terms.

The standard DOE financial assistance intellectual property provisions applicable to various types of recipients are located at:
https://energy.gov/gc/standard-intellectual-property-ip-provisions-financial-assistance-awards

3. National Policy Assurances

The National Policy Assurances To Be Incorporated As Award Terms are located at https://energy.gov/management/office-management/operational-management/financial-assistance/financial-assistance-forms under Award Terms.

4. Statement of Substantial Involvement

Not applicable.

5. Additional Conditions

CONFERENCE SPENDING (FEBRUARY 2015)

The recipient shall not expend any funds on a conference not directly and programmatically related to the purpose for which the grant or cooperative agreement was awarded that would defray the cost to the United States Government of a conference held by any Executive branch department, agency, board, commission, or office for which the cost to the United States Government would otherwise exceed $20,000, thereby circumventing the required notification by the head of any such Executive Branch department, agency, board, commission, or office to the Inspector General (or senior ethics official for any entity without an Inspector General), of the date, location, and number of employees attending such conference.

CORPORATE FELONY CONVICTION AND FEDERAL TAX LIABILITY REPRESENTATIONS (MARCH 2014)

In submitting an application in response to this FOA the Applicant represents that:

- It is **not** a corporation that has been convicted of a felony criminal violation under any Federal law within the preceding 24 months,
- It is **not** a corporation that has any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability.

For purposes of these representations the following definitions apply:

- A Corporation includes any entity that has filed articles of incorporation in any of the 50 states, the District of Columbia, or the various territories of the United States [but not foreign corporations]. It includes both for-profit and non-profit organizations.

PUBLICATIONS

The recipient is expected to publish or otherwise make publicly available the results of the work conducted under any award resulting from this FOA. Publications and other methods of public communication describing any work based on or developed under an award resulting from this FOA must contain an acknowledgment of SC support. The format for such acknowledgments is provided at https://science.osti.gov/funding-opportunities/acknowledgements/. The author's copy of any peer-reviewed manuscript accepted for funding must be announced to DOE's Office of Scientific and Technical Information (OSTI) and made publicly available in accordance with the instructions contained in the Reporting Requirements Checklist incorporated in all Assistance Agreements.

C. REPORTING

Reporting requirements are identified on the Federal Assistance Reporting Checklist, DOE F 4600.2, attached to the award agreement. The checklist is available at https://energy.gov/management/office-management/operational-management/financial-assistance/financial-assistance-forms under Award Forms.

Section VII - QUESTIONS/AGENCY CONTACTS

A. QUESTIONS

Questions relating to the Grants.gov registration process, system requirements, how an application form works, or the submittal process must be directed to Grants.gov at 1-800-518-4726 or support@Grants.gov. DOE cannot answer these questions. Please only contact the Grants.gov help desk for questions related to Grants.gov.

For help with PAMS, click the "External User Guide" link on the PAMS website, https://pamspublic.science.energy.gov/. You may also contact the PAMS Help Desk, which can be reached Monday through Friday, 9AM – 5:30 PM Eastern Time. Telephone: (855) 818-1846 (toll free) or (301) 903-9610, Email: sc.pams-helpdesk@science.doe.gov. All submission and inquiries about this FOA should reference DE-FOA-0002184. Please contact the PAMS help desk for technological issues with the PAMS system.

Questions regarding the specific program areas and technical requirements may be directed to the technical contacts listed for each program within the FOA or below. Please contact the program staff with all questions not directly related to the Grants.gov or PAMS systems.

B. AGENCY CONTACTS

Grants.gov Customer Support	800-518-4726 (toll-free) support@Grants.gov
PAMS Customer Support	855-818-1846 (toll-free) 301-903-9610 sc.pams-helpdesk@science.doe.gov
Program Manager Scientific Contact	Terrestrial Ecosystem Science Dr. Daniel Stover (301) 903-0289 Email: Daniel.Stover@science.doe.gov Subsurface Biogeochemical Research Mr. Paul Bayer (301) 903-5324 Email: Paul.Bayer@science.doe.gov Dr. Amy Swain (301) 903-1828 Email: Amy.Swain@science.doe.gov

Section VIII - OTHER INFORMATION

A. MODIFICATIONS

Notices of any modifications to this FOA will be posted on Grants.gov and the FedConnect portal. You can receive an email when a modification or an FOA message is posted by registering with FedConnect as an interested party for this FOA. It is recommended that you register as soon after release of the FOA as possible to ensure you receive timely notice of any modifications or other FOAs. More information is available at www.FedConnect.net.

B. GOVERNMENT RIGHT TO REJECT OR NEGOTIATE

DOE reserves the right, without qualification, to reject any or all applications received in response to this FOA and to select any application, in whole or in part, as a basis for negotiation and/or award.

C. COMMITMENT OF PUBLIC FUNDS

(a) A DOE financial assistance award is valid only if it is in writing and is signed, either in writing or electronically, by a DOE Contracting Officer.

(b) Recipients are free to accept or reject the award. A request to draw down DOE funds constitutes the Recipient's acceptance of the terms and conditions of this Award.

D. PROPRIETARY APPLICATION INFORMATION

Patentable ideas, trade secrets, proprietary or confidential commercial or financial information, disclosure of which may harm the applicant, should be included in an application only when such information is necessary to convey an understanding of the proposed project. The use and disclosure of such data may be restricted, provided the applicant includes the following legend on the first page of any document included in the application that contains such proprietary information and specifies the pages of the document which are to be restricted:

"The data contained in pages _____ of this document have been submitted in confidence and contain trade secrets or proprietary information, and such data shall be used or disclosed only for evaluation purposes, provided that if this applicant receives an award as a result of or in connection with the submission of this application, DOE shall have the right to use or disclose the data herein to the extent provided in the award. This restriction does not limit the government's right to use or disclose data obtained without restriction from any source, including the applicant."

To protect such data, each line or paragraph on the pages containing such data must be specifically identified and marked with a legend similar to the following:

"The following contains proprietary information that (name of applicant) requests not be released to persons outside the Government, except for purposes of review and evaluation."

E. EVALUATION AND ADMINISTRATION BY NON-FEDERAL PERSONNEL

In conducting the merit review evaluation, the Government may seek the advice of qualified non-Federal personnel as reviewers. The Government may also use non-Federal personnel to conduct routine, nondiscretionary administrative activities. The applicant, by submitting its application, consents to the use of non-Federal reviewers/administrators. Non-Federal reviewers must sign a conflict of interest agreement and a certificate of confidentiality prior to reviewing an application. Non-Federal personnel conducting administrative activities must sign a non-disclosure agreement.

F. INTELLECTUAL PROPERTY DEVELOPED UNDER THIS PROGRAM

Patent Rights: The government will have certain statutory rights in an invention that is conceived or first actually reduced to practice under a DOE award. 42 USC 5908 provides that title to such inventions vests in the United States, except where 35 USC 202 provides otherwise for nonprofit organizations or small business firms. However, the Secretary of Energy may waive all or any part of the rights of the United States subject to certain conditions. (See "Notice of Right to Request Patent Waiver" in paragraph G below.)

Rights in Technical Data: Normally, the government has unlimited rights in technical data created under a DOE agreement. Delivery or third party licensing of proprietary software or data developed solely at private expense will not normally be required except as specifically negotiated in a particular agreement to satisfy DOE's own needs or to insure the commercialization of technology developed under a DOE agreement.

G. NOTICE OF RIGHT TO REQUEST PATENT WAIVER

Applicants may request a waiver of all or any part of the rights of the United States in inventions conceived or first actually reduced to practice in performance of an agreement as a result of this FOA, in advance of or within 30 days after the effective date of the award. Even if such advance waiver is not requested or the request is denied, the recipient will have a continuing right under the award to request a waiver of the rights of the United States in identified inventions, i.e., individual inventions conceived or first actually reduced to practice in performance of the award. Any patent waiver that may be granted is subject to certain terms and conditions in 10 CFR 784. For more information, see https://energy.gov/gc/services/technology-transfer-and-procurement/office-assistant-general-counsel-technology-transf-1

Domestic small businesses and domestic nonprofit organizations will receive the patent rights clause at 37 CFR 401.14, i.e., the implementation of the Bayh-Dole Act. This clause permits domestic small business and domestic nonprofit organizations to retain title to subject inventions. Therefore, small businesses and nonprofit organizations do not need to request a waiver.

H. NOTICE REGARDING ELIGIBLE/INELIGIBLE ACTIVITIES

Eligible activities under this program include those which describe and promote the understanding of scientific and technical aspects of specific energy technologies, but not those which encourage or support political activities such as the collection and dissemination of information related to potential, planned or pending legislation.

I. AVAILABILITY OF FUNDS

Funds are not presently available for this award. The Government's obligation under this award is contingent upon the availability of appropriated funds from which payment for award purposes can be made. No legal liability on the part of the Government for any payment may arise until funds are made available to the contracting officer for this award and until the awardee receives notice of such availability, to be confirmed in writing by the contracting officer.

J. ENVIRONMENTAL, SAFETY AND HEALTH (ES&H) PERFORMANCE OFWORK AT DOE FACILITIES

With respect to the performance of any portion of the work under this award which is performed at a DOE-owned or controlled site, the recipient agrees to comply with all state and Federal ES&H regulations, and with all other ES&H requirements of the operator of such site.

Prior to the performance on any work at a DOE-Owned or controlled site, the recipient shall contact the site facility manager for information on DOE and site specific ES&H requirements.

The recipient shall apply this provision to all subawardees at any tier.

K. FEDERAL, STATE, AND LOCAL REQUIREMENTS

With respect to the performance of any portion of the work under this award, the recipient agrees to comply with all applicable local, state, and Federal ES&H regulations. The recipient shall apply this provision to all sub awardees at any tier.

L. NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) COMPLIANCE

If question 4.a. on the "Research and Related Other Project Information" document indicates "potential impact on the environment", or if DOE's own review indicates it, DOE may ask the applicant to provide additional information on those impacts in order to prepare an environmental critique/synopsis per 10 CFR 1021.216. Note that this pre-award environmental critique/synopsis process would be separate from the preparation of a NEPA document such as an environmental impact statement (EIS) or an environmental assessment (EA). If DOE determines the latter documentation is necessary, this process would need to be completed, funded by and with the participation of the awardee, prior to them taking any action on the proposed project that could have adverse environmental effects or that could limit the choice of reasonable alternatives. Note that in most cases, even when additional information is requested, preparation of such NEPA documents is rarely necessary, but DOE has the expectation that the

Applicant will disclose the potential, which would serve to initiate dialog with DOE if necessary. The inability to satisfy the NEPA requirements after an award would result in cancellation of the award.

Section IX - APPENDICES/REFERENCE MATERIAL

Glossary of Useful Grants and Cooperative Agreement terms

Acquisition cost	*Acquisition cost* means the cost of the asset including the cost to ready the asset for its intended use. Acquisition cost for equipment, for example, means the net invoice price of the equipment, including the cost of any modifications, attachments, accessories, or auxiliary apparatus necessary to make it usable for the purpose for which it is acquired. Acquisition costs for software includes those development costs capitalized in accordance with generally accepted accounting principles (GAAP). Ancillary charges, such as taxes, duty, protective in transit insurance, freight, and installation may be included in or excluded from the acquisition cost in accordance with the non-Federal entity's regular accounting practices.
Administrative requirements	*Administrative requirement*s means the general business management practices that are common to the administration of all grants, such as financial accountability, reporting, equipment management, and retention of records.
Advance payment	*Advance payment* means a payment that a Federal awarding agency or pass-through entity makes by any appropriate payment mechanism, including a predetermined payment schedule, before the non-Federal entity disburses the funds for program purposes.
Allocation	*Allocation* means the process of assigning a cost, or a group of costs, to one or more cost objective(s), in reasonable proportion to the benefit provided or other equitable relationship. The process may entail assigning a cost(s) directly to a final cost objective or through one or more intermediate cost objectives.
Allocability	*Allocability* means the principle which requires that an expense or service charged must directly benefit and be necessary for the performance of the project; when multiple projects are benefited reasonable proportions must be able to be assigned.
Allowable cost	*Allowable cost* means a cost incurred by a recipient that is: (1) reasonable for the performance of the award; (2) allocable; (3) in conformance with any limitations or exclusions set forth in the Federal cost principles applicable to the organization incurring the cost or in the award documents as to the type or amount of cost; (4) consistent with regulations, policies, and procedures of the recipient that are applied uniformly to both federally supported and other activities of the organization; (5) accorded consistent treatment as a direct or indirect cost; (6) determined in accordance with generally accepted accounting principles; and (7) not included as a cost in any other federally supported award (unless specifically authorized by statute).
Application	*Application* means a request for financial support of a project or activity submitted to DOE on specified forms and in accordance with DOE instructions. Also known as a proposal
Appropriation Act	*Appropriation act* means the statute that provides the authority for Federal agencies to incur obligations to and make payments out of the U.S. treasury for specified purposes.
Approved budget	*Approved budget* means the financial expenditure plan for the grant-supported project or activity, including revisions approved by DOE and permissible revisions made by the grantee. The approved budget consists of Federal (grant) funds and, if required by the terms and conditions of the award, non-Federal participation in the form of matching or cost sharing. The approved budget specified in the award documents may be shown in detailed budget categories or as total costs without a categorical breakout. Expenditures charged to an approved budget that consists of both Federal and non-Federal shares are

	deemed to be borne by the grantee in the same proportion as the percentage of Federal/non-Federal participation in the overall budget.
Assurance	*Assurance* means a certification by an applicant, normally included with the application or State plan, indicating that the entity is in compliance with, or that it will abide by, a particular requirement if awarded a Federal grant.
Authorized organizational representative	*Authorized organizational representative* means the individual, named by the applicant organization, who is authorized to act for the applicant and to assume the obligations imposed by the Federal laws, regulations, requirements, and conditions that apply to grant applications or grant awards.
Award	*Award* means the provision of funds by DOE, based on an approved application and budget or progress report, to an organizational entity or an individual to carry out a project or activity.
Award documents	*Award documents* means the entirety of the documents describing the legal relationship between DOE and an awardee or recipient. The award documents include an Assistance Agreement and other documents which may be incorporated by reference or as attachments to the Assistance Agreement. The award documents are the official, legally binding document, signed (or the electronic equivalent of signature) by a contracting officer that: • notifies the recipient of the award of a grant; • contains or references all the terms and conditions of the grant and Federal funding limits and obligations; and, • provides the documentary basis for recording the obligation of Federal funds in the DOE accounting system.
Bayh-Dole Act	*Bayh-Doyle Act* means a law which encourages universities and researchers to develop their inventions into marketable products; formal citation is Section 6 of the Patent and Trademark Amendment of 1980, Pub. L 96-517
Budget	*Budget* means the financial plan for the project or program that the Federal awarding agency or pass-through entity approves during the Federal award process or in subsequent amendments to the Federal award. It may include the Federal and non-Federal share or only the Federal share, as determined by the Federal awarding agency or pass-through entity.
Budget period	*Budget period* means the intervals of time (usually 12 months each) into which a project period is divided for budgetary and funding purposes.
Business officer	*Business officer* means the financial official of the grantee who has primary fiscal responsibility for the grant. Also known as authorized organizational representative.
Capital assets	*Capital assets* means tangible or intangible assets used in operations having a useful life of more than one year which are capitalized in accordance with GAAP. Capital assets include: (a) Land, buildings (facilities), equipment, and intellectual property (including software) whether acquired by purchase, construction, manufacture, lease-purchase, exchange, or through capital leases; and (b) Additions, improvements, modifications, replacements, rearrangements, reinstallations, renovations or alterations to capital assets that materially increase their value or useful life (not ordinary repairs and maintenance)
Carryover	*Carryover* means unobligated Federal funds remaining at the end of any budget period that, with the approval of the contracting officer or under an automatic authority, may be carried forward to another budget period to cover allowable costs of that budget period (whether as an offset or additional authorization). Obligated, but unliquidated, funds are not considered carryover.
Change in scope	*Change in scope* means an activity whereby the objectives or specific aims identified in the approved grant application are significantly changed by the grantee after award. Contracting officer prior approval is required for a change in scope to be allowable under an award.

Closeout	*Closeout* means the process by which a Federal awarding agency determines that all applicable administrative actions and all required work under an award have been completed by the grantee and the Federal awarding agency.
Competitive segment	*Competitive segment* means the initial project period recommended for support or each extension of a project period resulting from a renewal award.
Conference (domestic or international)	*Conference (domestic or international)* means a symposium, seminar, workshop, or any other organized and formal meeting, whether conducted face-to-face or via the Internet, where individuals assemble (or meet virtually) to exchange information and views or explore or clarify a defined subject, problem, or area of knowledge, whether or not a published report results from such meeting.
Consortium or sub-award agreement	*Consortium or sub-award agreement* means a formalized agreement whereby a research project is carried out by the grantee and one or more other organizations that are separate legal entities. Under the agreement, the grantee must perform a substantive role in the conduct of the planned research and not merely serve as a conduit of funds to another party or parties. These agreements typically involve a specific level of effort from the consortium organization's PD/PI and a categorical breakdown of costs, such as personnel, supplies, and other allowable expenses, including F&A costs. The relationship between the recipient and the collaborating organizations is considered a sub-award relationship.
Consultant	*Consultant* means an individual who provides professional advice or services for a fee, but normally not as an employee of the engaging party. In unusual situations, an individual may be both a consultant and an employee of the same party, receiving compensation for some services as a consultant and for other work as a salaried employee. To prevent apparent or actual conflicts of interest, grantees and consultants must establish written guidelines indicating the conditions of payment of consulting fees. Consultants also include firms that provide professional advice or services.
Continuation application/award	*Continuation application/award* means a financial assistance request (in the form of an application or progress report) or resulting award for a subsequent budget period within a previously approved project period for which a recipient does not have to compete with other applicants.
Contract	*Contract* means a legal instrument by which a non-Federal entity purchases property or services needed to carry out the project or program under a Federal award. The term as used in this part does not include a legal instrument, even if the non-Federal entity considers it a contract, when the substance of the transaction meets the definition of a Federal award or sub-award (see 2 CFR 200.92 Sub-award).
Contractor	*Contractor* means an entity that receives a contract as defined in 2 CFR 200.22 Contract.
Contract (or Grants Management) officer	*Contract (or Grants Management) officer* means a DOE official responsible for the business management aspects of grants and cooperative agreements, including review, negotiation, award, and administration, and for the interpretation of grants administration policies and provisions. COs and GMOs are delegated the authority to obligate DOE to the expenditure of funds and permit changes to approved projects on behalf of DOE.
Contract (or Grants Management) specialist	*Contract (or Grants Management) specialist* means a DOE staff member who works with a contract or grants management officer and is assigned the day-to-day management of a portfolio of grants and/or cooperative agreements. These activities include, but are not limited to, evaluating grant applications for administrative content and compliance with statutes, regulations, and guidelines; negotiating grants; providing consultation and technical assistance to grantees; and administering grants after award.
Cooperative agreement	*Cooperative agreement* means a type of financial assistance used when there

	will be substantial Federal scientific or programmatic involvement. Substantial involvement means that, after award, scientific or program staff will assist, guide, coordinate, or participate in project activities.
Cost principles	*Cost principles* means the government-wide principles, issued by OMB (or, in the case of commercial organizations, the Federal Acquisition Regulation [48 CFR 21], or, in the case of hospitals, 45 CFR 74, Appendix E, "Principles For Determining Costs Applicable to Research and Development Under Grants and Contracts with Hospitals"), on allowability and unallowability of costs under federally sponsored agreements. As of December 26, 2014, the cost principles were consolidated in 2 CFR 200.
Cost sharing or matching	*Cost sharing or matching* means the portion of project costs not paid by Federal funds (unless otherwise authorized by Federal statute). See also 2 CFR 200.306 Cost sharing or matching.
Deadline	*Deadline* means the published date and/or time that a grant application is to be either postmarked/mailed or electronically submitted to the funding agency.
Debarment and suspension	*Debarment and suspension* means the actions taken by a debarring official in accordance with OMB guidance at 2 CFR 180, "Non-procurement Debarment and Suspension," to exclude a person or organization from participating in grants and other non-procurement awards government-wide. If debarred or suspended, the person or organization may not receive financial assistance (under a grant, cooperative agreement, or sub-award, or contract under a grant) for a specified period of time. Debarments and suspensions carried out pursuant to 2 CFR 376 are distinct from post-award suspension action by an awarding agency.
Direct costs	*Direct costs* means costs that can be identified specifically with a particular sponsored project, an instructional activity, or any other institutional activity, or that can be directly assigned to such activities relatively easily with a high degree of accuracy.
Disallowed costs	*Disallowed costs* means those charges to a Federal award that the Federal awarding agency or pass-through entity determines to be unallowable, in accordance with the applicable Federal statutes, regulations, or the terms and conditions of the Federal award.
Domestic organization	*Domestic organization* means a public (including a State or other governmental agency) or private non-profit or for-profit organization that is located in the United States or its territories, is subject to U.S. laws, and assumes legal and financial accountability for awarded funds and for the performance of the grant-supported activities.
DUNS number	*DUNS number* means a nine-digit number established and assigned by Dun and Bradstreet to uniquely identify a business entity.
Effort	*Effort* means the amount of time, usually expressed as a percentage of the total, which a faculty member or other employee spends on a sponsored project. No one is allowed to spend more than 100% total commitment on all academic activities, including grant-sponsored research, university-sponsored research, teaching, administration, advising and other contracted duties. Effort is indicated on the budget in units of person-months.
Equipment	*Equipment* means tangible personal property (including information technology systems) having a useful life of more than one year and a per-unit acquisition cost which equals or exceeds the lesser of the capitalization level established by the non-Federal entity for financial statement purposes, or $5,000. See also 2 CFR 200.12 Capital assets, 200.20 Computing devices, 200.48 General purpose equipment, 200.58 Information technology systems, 200.89 Special purpose equipment, and 200.94 Supplies.
Expanded authorities	*Expanded authorities* means authorization to grantees under certain research grant mechanisms which waives the requirement for prior agency approval for specified actions related to awards. Example: 90-day pre-award spending

	authority, no cost extensions for up to one additional year, and automatic carryover of unobligated funds from one budget period to the next. The expanded authorities are now contained in the standard terms and conditions for most research grants.
Expiration date	*Expiration date* means generally, the date signifying the end of the current project period, after which the grantee is not authorized to obligate grant funds.
Facilities and administrative costs	*Facilities and administrative costs* means costs that are incurred by a grantee for common or joint objectives and that, therefore, cannot be identified specifically with a particular project or program. These costs also are known as indirect costs.
Federal financial report	*Federal financial report* means submitted on Standard Form (SF) 425, to indicate the status of awarded funds for the period covered. Frequency of reporting is specified in the Reporting Checklist provided as part of the award documents. Replaces the SF-269 Financial Status Report (FSR)
Financial assistance	*Financial assistance* means transfer by DOE of money or property to an eligible entity to support or stimulate a public purpose authorized by statute.
Financial status report	*Financial status report* means see Federal Financial Report.
Foreign travel	*Foreign travel* is meant to include travel outside of the United States and its territories and possessions (Guam, American Samoa, Puerto Rico, the Virgin Islands, and the Canal Zone) and Canada. A trip is considered foreign travel for all legs of the itinerary if the traveler does not return to his or her post prior to departure for a foreign destination. Costs for foreign travel may be restricted by the language of a Funding Opportunity Announcement.
Funding opportunity announcement (FOA)	*Funding opportunity announcement (FOA)* means A publicly available document by which a Federal Agency makes known its intentions to award discretionary grants or cooperative agreements, usually as a result of competition for funds. Funding opportunity announcements may be known as program announcements, requests for applications, notices of funding availability, solicitations, or other names depending on the Agency and type of program. Funding opportunity announcements can be found at www.Grants.gov. An FOA may also be known as a solicitation.
Grant agreement	*Grant agreement* means a legal instrument of financial assistance between a Federal awarding agency or pass-through entity and a non-Federal entity that, consistent with 31 USC 6302, 6304: (a) Is used to enter into a relationship the principal purpose of which is to transfer anything of value from the Federal awarding agency or pass-through entity to the non-Federal entity to carry out a public purpose authorized by a law of the United States (see 31 USC 6101(3)); and not to acquire property or services for the Federal awarding agency or pass-through entity's direct benefit or use; (b) Is distinguished from a cooperative agreement in that it does not provide for substantial involvement between the Federal awarding agency or pass-through entity and the non-Federal entity in carrying out the activity contemplated by the Federal award. (c) Does not include an agreement that provides only: (1) Direct United States Government cash assistance to an individual; (2) A subsidy; (3) A loan; (4) A loan guarantee; or (5) Insurance.
Grant-supported project or activity	*Grant-supported project or activity* means those activities specified or described in a grant application or in a subsequent submission that are approved by DOE for funding, regardless of whether Federal funding constitutes all or only a portion of the financial support necessary to carry them out.

Grantee	*Grantee* means the organization or individual awarded a grant or cooperative agreement by DOE that is responsible and accountable for the use of the funds provided and for the performance of the grant-supported project or activity. The grantee is the entire legal entity even if a particular component is designated in award documents. The grantee is legally responsible and accountable to DOE for the performance and financial aspects of the grant-supported project or activity. Also known as awardee or recipient.
Grants.gov	*Grants.gov* (https://www.Grants.gov/) has been designated by the Office of Management and Budget as the single access point for all grant programs offered by 26 Federal grant-making agencies. It provides a single interface for agencies to announce their grant opportunities and for all applicants to find and apply for those opportunities.
Indirect costs (facilities & administrative)	*Indirect (F&A) costs* means those costs incurred for a common or joint purpose benefitting more than one cost objective, and not readily assignable to the cost objectives specifically benefitted, without effort disproportionate to the results achieved. To facilitate equitable distribution of indirect expenses to the cost objectives served, it may be necessary to establish a number of pools of indirect (F&A) costs. Indirect (F&A) cost pools must be distributed to benefitted cost objectives on bases that will produce an equitable result in consideration of relative benefits derived.
Institutional base salary	*Institutional base salary* means the annual compensation paid by an organization for an employee's appointment, whether that individual's time is spent on research, teaching, patient care, or other activities. Base salary excludes any income that an individual may be permitted to earn outside of duties for the applicant/grantee organization. Base salary may not be increased as a result of replacing organizational salary funds with grant funds.
Matching or cost sharing	*Matching or cost sharing* means the value of third-party in-kind contributions and the portion of the costs of a federally assisted project or program not borne by the Federal government. Matching or cost sharing may be required by statute or program regulation. Costs used to satisfy matching or cost-sharing requirements are subject to the same policies governing allowability as other costs under the approved budget.
Merit (or peer) review	*Merit (or peer) review* means the process that involves the consistent application of standards and procedures that produce fair, equitable, and objective examinations of applications based on an evaluation of scientific or technical merit or other relevant aspects of the application. The review is performed by experts (reviewers) in the field of endeavor for which support is requested. Merit review is intended to provide guidance and to the DOE individuals responsible for making award decisions.
Monitoring	*Monitoring* means a process whereby the programmatic and business management performance aspects of a grant are assessed by reviewing information gathered from various required reports, audits, site visits, and other sources.
No-cost extension	*No-cost extension* means an extension of time to a project period and/or budget period to complete the work of the grant under that period, without additional Federal funds or competition.
Non-Federal share	*Non-Federal share* means when cost sharing or matching is required as a condition of an award, the portion of allowable project/program costs not borne by the Federal government.
Obligations	*Obligations* when used in connection with a non-Federal entity's utilization of funds under a Federal award, *obligations* means orders placed for property and services, contracts and sub-awards made, and similar transactions during a given period that require payment by the non-Federal entity during the same or a future period.

OMB circulars	*OMB circulars* means government-wide guidance issued to Heads of Federal agencies by the Director of OMB. OMB Circulars directly pertinent to grants include the following: • cost principles (OMB Circular A-21, OMB Circular A-87, and OMB Circular A-122); • uniform administrative requirements (OMB Circular A-102 and OMB Circular A-110); • audit requirements for non-profit organizations (OMB Circular A-133). Some (but not all) of these OMB Circulars have been reissued in Title 2 of the Code of Federal Regulations. DOE administrative regulations are located in Title 10 of the Code of Federal Regulations.
Other significant contributors	Other significant contributors means individuals who have committed to contribute to the scientific development or execution of the project, but are not committing any specified measurable effort (i.e., person months) to the project. These individuals are typically presented at "effort of zero person months" or "as needed." Individuals with measurable effort may not be listed as Other Significant Contributors (OSCs). Consultants should be included if they meet this definition.
Program participant	*Program participants* are the recipients of service or training provided at a workshop, conference, seminar, symposium or other short-term instructional or information-sharing activity funded by an external grant or award, or the training beneficiaries of the project or program funded by an external grant or award. A participant is not involved in providing any deliverable to the grantee or a third party or would not be terminated or replaced for failure to perform.
Participant support costs	*Participant support costs* means direct costs for items such as stipends or subsistence allowances, travel allowances, and registration fees paid to or on behalf of participants or trainees (but not employees) in connection with conferences, or training projects.
Person months	*Person months* is the metric for expressing the effort (amount of time) PD/PI(s), faculty and other senior/key personnel devote to a specific project. The effort is based on the type of appointment of the individual with the organization; e.g., calendar year, academic year, and/or summer term; and the organization's definition of such. For instance, some institutions define the academic year as a 9-month appointment while others define it as a 10-month appointment.
Pre-application or pre-proposal	*Pre-application or pre-proposal* means a brief outline or narrative of proposed work and sometimes budget, for informal review by a sponsor to determine whether an application should be submitted. Three predominant reasons for requiring submission of a preliminary pre-application are: • Reduce the applicant's unnecessary effort in proposal preparation when the chance of success is very small. This is particularly true of exploratory initiatives where the community senses that a major new direction is being identified, or competitions that will result in a small number of actual awards. • Increase the overall quality of the submission. • Distill the number of applications that will be submitted to the agency and the number of anticipated reviewers needed to review.
Pre-award costs	*Pre-award costs* means any cost incurred prior to the beginning date of the project period or the initial budget period of a competitive segment (under a multi-year award), in anticipation of the award and at the applicant's own risk, for otherwise allowable costs.
Prior approval	*Prior approval* means written approval from the designated contracting officer required for specified post-award changes in the approved project or budget. Such approval must be obtained before undertaking the proposed activity or

	spending DOE funds
Program Director/ Principal Investigator	*Program Director/ Principal Investigator* means the individual(s) designated by the applicant organization to have the appropriate level of authority and responsibility to direct the project or program to be supported by the award. The applicant organization may designate multiple individuals as program directors/principal investigators (PD/PIs) who share the authority and responsibility for leading and directing the project, intellectually and logistically. When multiple PD/PIs are named, each is responsible and accountable to the applicant organization, or as appropriate, to a collaborating organization for the proper conduct of the project or program including the submission of all required reports. The presence of more than one PD/PI on an application or award diminishes neither the responsibility nor the accountability of any individual PD/PI.
Program income	*Program income* means gross income earned by the non-Federal entity that is directly generated by a supported activity or earned as a result of the Federal award during the period of performance except as provided in 2 CFR 200.307 paragraph (f). (See 2 CFR 200.77 Period of performance.) Program income includes but is not limited to income from fees for services performed, the use or rental or real or personal property acquired under Federal awards, the sale of commodities or items fabricated under a Federal award, license fees and royalties on patents and copyrights, and principal and interest on loans made with Federal award funds. Interest earned on advances of Federal funds is not program income. Except as otherwise provided in Federal statutes, regulations, or the terms and conditions of the Federal award, program income does not include rebates, credits, discounts, and interest earned on any of them. See also 2 CFR 200.407 Prior written approval (prior approval). See also 35 USC 200-212 "Disposition of Rights in Educational Awards" applies to inventions made under Federal awards.
Program Manager	*Program Manager* means the DOE official responsible for the programmatic, scientific, and/or technical aspects of a grant. The same role is filled by Program Directors, Program Officers, or Project Directors at other Federal agencies.
Progress report	*Progress report* means periodic, frequently annual, report submitted by the grantee and used by DOE to assess progress and to determine whether to provide funding for the budget period subsequent to that covered by the report.
Project/performance site	*Project/ performance site* means location(s) of where the work described in the research plan will be conducted.
Project period	*Project period* means the total time for which Federal support of a project has been programmatically approved as shown in the award documents; however, it does not constitute a commitment by the Federal government to fund the entire period. The total project period comprises the initial competitive segment, any subsequent competitive segments resulting from a renewal award(s), and extensions.
Proposal	See application.
Re-budgeting	*Re-budgeting* means reallocation of funds available for spending between budget categories to allow best use of funds to accomplish the project goals.
Recipient	*Recipient* means the organizational entity or individual receiving a grant or cooperative agreement.
Renewal application	*Renewal application* means an application requesting additional funding for a period subsequent to that provided by a current award. Renewal applications compete for funds with all other peer reviewed applications and must be developed as fully as though the applicant is applying for the first time.
Research	*Research* means a systematic, intensive study intended to increase knowledge or understanding of the subject studied, a systematic study specifically directed

	toward applying new knowledge to meet a recognized need, or a systematic application of knowledge to the production of useful materials, devices, and systems or methods, including design, development, and improvement of prototypes and new processes to meet specific requirements. Also termed "research and development."
Research misconduct	Research misconduct means fabrication, falsification, plagiarism, or other practices that seriously deviate from those that are commonly accepted within the scientific community in proposing, performing, or reporting research, or in reporting research results; does not include honest error or honest differences in interpretations or judgments of data.
SAM.gov	*SAM.gov* is the System for Award Management (SAM), the Government-wide system that consolidated the Central Contractor Registration (CCR), the Excluded Parties List System (EPLS), the Online Representations and Certifications Application (ORCA), and the Federal Agency Registration (FedReg).
Scope of work	*Scope of work* means the aims, objectives, and purposes of a grant; as well as the methodology, approach, analyses or other activities; and the tools, technologies, and timeframes needed to meet the grant's objectives. This includes the research or training plan included with the original grant application, along with any approved modifications.
Senior/Key Personnel	*Senior/Key personnel* means the PD/PI and other individuals who contribute to the scientific development or execution of a project in a substantive, measurable way, whether or not they receive salaries or compensation under the grant. Typically, these individuals have doctoral or other professional degrees, although individuals at the masters or baccalaureate level may be considered senior/key personnel if their involvement meets this definition. Consultants and those with a postdoctoral role also may be considered senior/key personnel if they meet this definition. "Zero percent" effort or "as needed" is not an acceptable level of involvement for Senior/Key Personnel.
Significant re-budgeting	*Significant re-budgeting* means a threshold that is reached when expenditures in a single direct cost budget category deviate (increase or decrease) from the categorical commitment level established for the budget period by more than 25 percent of the total costs awarded. Significant re-budgeting is one indicator of change in scope.
Small business concern	*Small business concern* means a business that is independently owned and operated and not dominant in its field of operation; has its principal place of business in the United States and is organized for profit; is at least 51 percent owned, or in the case of a publicly owned business, at least 51 percent of its voting stock is owned by U.S. citizens or lawfully admitted permanent resident aliens; has, including its affiliates, not more than 500 employees; and meets other regulatory requirements established by the SBA at 13 CFR 121.
Solicitation	See Funding Opportunity Announcement
Sub-award	*Sub-award* means a legal instrument by which a recipient provides funds (or property in lieu of funds) to an eligible sub-recipient (or a lower-tier transaction) to perform a substantive portion of the grant-supported program or project. The term includes such financial assistance when provided by any legal agreement (even if the agreement is called a contract) but does not include any form of assistance which is excluded from the definition of a grant, including the recipient's procurement of property or services needed to carry out the project or program. The term includes consortium agreements.
Sub-recipient	*Sub-recipient* means a non-Federal entity that receives a sub-award from a pass-through entity to carry out part of a Federal program; but does not include an individual that is a beneficiary of such program. A sub-recipient may also be a recipient of other Federal awards directly from a Federal awarding agency.

Supplement	*Supplement* means a request for an increase in support during a current budget period for expansion of the project's scope or to meet increased costs unforeseen at the time of the new or renewal application. A supplement may increase support for future years in addition to the current year. Supplements require applications and are subject to administrative and merit review.
Terms and conditions of award	*Terms and conditions of award* means all legal requirements imposed on a grant by DOE, whether based on statute, regulation, policy, or other document referenced in the grant award, or specified by the grant award document itself. The award documents may include both standard and special conditions that are considered necessary to attain the grant's objectives, facilitate post-award administration of the grant, conserve grant funds, or otherwise protect the Federal government's interests.
Unallowable costs	*Unallowable costs* means specific categories of costs that cannot be charged, directly or indirectly, to federally sponsored agreements in accordance with federal regulations or the terms and conditions of the award.
Unliquidated obligation	*Unliquidated obligations* means, for financial reports prepared on a cash basis, obligations incurred by the non-Federal entity that have not been paid (liquidated). For reports prepared on an accrual expenditure basis, these are obligations incurred by the non-Federal entity for which an expenditure has not been recorded.
Unobligated balance	*Unobligated balance* means the amount of funds under a Federal award that the non-Federal entity has not obligated. The amount is computed by subtracting the cumulative amount of the non-Federal entity's unliquidated obligations and expenditures of funds under the Federal award from the cumulative amount of the funds that the Federal awarding agency or pass-through entity authorized the non-Federal entity to obligate.
Validate	In the context of the data management plan requirements, *validate* means to support, corroborate, verify, or otherwise determine the legitimacy of the research findings. Validation of research findings could be accomplished by reproducing the original experiment or analyses, comparing and contrasting the results against those of a news experiment or analyses, or by some other means.