DEPARTMENT OF ENERGY
OFFICE OF SCIENCE, NUCLEAR PHYSICS
OFFICE OF SCIENCE, NUCLEAR PHYSICS, ISOTOPES PROGRAM
OFFICE OF NUCLEAR ENERGY
NATIONAL NUCLEAR SECURITY ADMINISTRATION, OFFICE OF DEFENSE NUCLEAR NONPROLIFERATION R&D

NUCLEAR DATA INTERAGENCY WORKING GROUP / RESEARCH PROGRAM

FUNDING OPPORTUNITY ANNOUNCEMENT (FOA) NUMBER:
DE-FOA-0002114

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FOA Issue Date:	**April 19, 2018**
Submission Deadline for Letters of Intent:	**May 15, 2019, at 5 PM Eastern** **A Letter of Intent is required**
Application Encouragement Date	**June 1, 2019, at 5 PM Eastern**
Submission Deadline for Applications:	**June 28, 2019, at 5 PM Eastern**

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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 letters of intent 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." 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

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

ACKNOWLEDGMENT OF FEDERAL SUPPORT

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

Section I – FUNDING OPPORTUNITY DESCRIPTION

GENERAL INQUIRIES ABOUT THIS FOA SHOULD BE DIRECTED TO:

Technical/Scientific Program Contacts:

DOE SC, Nuclear Physics, and general information:
Dr. Timothy Hallman, Nuclear Physics
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DOE SC, Nuclear Physics, Isotope Program:
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NNSA Defense Nuclear Nonproliferation R&D:
Dr. Donald Hornback, Office of Defense Nuclear Nonproliferation R&D
Program Manager, Near-field Detection
202-586-6522
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STATUTORY AUTHORITY

Public Law 95-91, US 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 Nuclear Physics (NP), the NP Isotopes Program (IP), the DOE Office of Nuclear Energy (NE) and the DOE National Nuclear Security Administration (NNSA) Office

of Defense Nuclear Nonproliferation Research and Development (NA-22) hereby announce their interest in receiving applications to the Nuclear Data Interagency Working Group / Research program for research projects intended to answer nuclear data questions of interest to the research communities supported by those programs and offices.

SUPPLEMENTARY INFORMATION

Program Objective

The range of nuclear physics has a broad range of uses in modern society. Notable examples include fundamental research in nuclear physics, which motivates the development of accelerator technology, high-speed electronics, and special materials for sensitive detectors and targets; nuclear reactors, which have applications including the generation of electrical power, the production of isotopes, and tests of the properties of materials using neutrons; national security and nonproliferation applications, such as safeguards, nuclear forensics, and the detection of special nuclear materials (SNM); nuclear medicine, and the associated production, testing, distribution and use of isotopes in medical diagnostics and treatment; and applications to more familiar industrial problems, such as the use of radioisotopes in geological resource surveys. This FOA seeks research applications that will enhance understanding of the basic characteristics of isotopes without respect to particular uses.

These applications require accurate quantitative information regarding the properties of nuclei and their interactions with matter and radiation. In reference to the applications cited above, without the appropriate nuclear data, the accurate simulation and design of experiments for fundamental research would not be possible, nuclear reactor design and operation would suffer from problematic uncertainties, it would not be possible to determine the correct dose levels in medical procedures involving nuclear isotopes, and one could not predict the sensitivity of novel remote sensing techniques.

Extensive databases dedicated to nuclear data do already exist, notably those developed and maintained by NP through the US Nuclear Data Program (USNDP) at Brookhaven National Laboratory (BNL). However, a critical examination of the existing nuclear data often finds that it is inadequate for current applications. This may be due for example to limits on the sensitivity of experiments that were carried out in previous decades, studies that accessed only a few experimental parameters (such as limited beam energies or angular coverage), or attempts to constrain a large number of parameters with limited data. One may also require information about the nuclear properties of materials that simply did not exist previously, or that were never adequately studied under conditions that are now considered important.

From the viewpoint of NP, this FOA was originally motivated by the 2014 USNDP Review, which confirmed that experimental efforts to address gaps in nuclear data are within the scope of the USNDP program. This is expressed in the updated USNDP Mission Statement, which states that

"*The mission of the United States Nuclear Data Program (USNDP) is to provide current, accurate, authoritative data for workers in pure and applied areas of nuclear science and*

engineering. This is accomplished primarily through the compilation, evaluation, dissemination, and archiving of extensive nuclear datasets. The USNDP also addresses gaps in the data, through targeted experimental studies and the use of theoretical models."

This identification of an experimental role for the USNDP was followed by NP-sponsored reviews of nuclear data needs that could be addressed through such an experimental program, both for applications [1] and for basic research [2].

Accordingly, the purpose of the research program associated with this FOA is to support new activities (*e.g.* experiments, infrastructure, models, and so forth) that will provide new nuclear data or related predictions where needed in areas in which the existing data is inadequate or does not exist, and insure that the new data is transferred to the USNDP databases in a timely manner. Data generated from authorizations under this FOA must be made publicly available through the USNDP databases. Submission of data to the USNDP databases does not confer Government ownership of the data.

One challenge with updating our nuclear data through new experiments is that these experiments can be quite demanding on the limited resources available for this type of use-inspired research. Fortunately, recent "Nuclear Data Needs" reviews [1,2] show that there are often similar data needs associated with different applications, so there can be considerable economic benefit in different federal offices jointly supporting a given set of new nuclear data measurements. This advantage of a combined measurement program was the original motivation for the formation of the Nuclear Data Interagency Working Group (NDIAWG), and is the primary motivation for this FOA.

This FOA invites researchers to submit applications for new nuclear data activities. The Program Managers listed at the beginning of this Section under Technical/Scientific Program Contacts welcome inquiries from potential applicants interested in discussing new nuclear data activites: The discussions may shed light on which Office or Agency would be most interested in particular activities. As discussed elsewhere in this FOA, proposals will be reviewed by NP, using reviewers proposed by the interested Offices or Agencies. Following a successful review, the interested Offices or Agencies will discuss the proposal with the PI, and will endeavor to provide suitable funding for the components of the proposed work that they wish to support.

Since this FOA is intended to address gaps in our databases in a timely manner, funds may be requested within each application to support a named USNDP staff member, the "USNDP POC," who will be associated with the experiment or other activity, and will be responsible for incorporating the new data, results, or procedures in the USNDP program. USNDP personnel at DOE/NNSA National Laboratories will be funded directly by DOE, but personnel at academic institutions may be proposed as subawardees or consultants.

Nuclear Data Questions by Office

In the following section, principal areas and topics in which each of the participating Offices perceives a public benefit for improved nuclear data are described. Potential PIs are encouraged

to review this section when preparing their applications and to discuss topics of interest with the relevant Program Managers. In this manner, the PIs may be able to identify "cross-cutting" nuclear data needs that could increase the probability of attracting support from multiple Offices. The Offices, their associated Program Managers, and descriptions of the specific nuclear data questions are listed below.

DOE SC NP
Dr. Timothy Hallman (timothy.hallman@science.doe.gov)

NP has two general goals in this FOA:

1) To improve the effectiveness of USNDP databases in addressing the needs of the broad community of nuclear data users, and

2) To address nuclear data needs of special interest to NP-supported researchers.

Regarding part 1), NP would anticipate supporting activities that increase the efficiency of the "Nuclear Data Pipeline," for example through the incorporation of improved computational techniques and procedures USNDP evaluations; assisting in the identification of the most important data needs in the USNDP databases; supporting experimental activities to address these needs; assisting with the publication of new nuclear data, and the transfer to and dissemination from the appropriate USNDP archive(s). These activities will likely require the participation of USNDP through a USND point of contact (POC). Timothy Hallman, DOE-NP Associate Director and Acting NP Program Manager for Nuclear Data (timothy.hallman@science.doe.gov) is available to assist in directing inquiries as to a USNDP point of contact if needed.

In part 2), the NP-specific topics that might be proposed for nuclear data experiments are summarized in the recent 2015 Long Range Plan for Nuclear Science [3]. These general topics are Quantum Chromodynamics, Nuclei and Nuclear Astrophysics, and Fundamental Symmetries and Neutrinos. Measurements of quantities that are needed to advance our NP research programs in these areas would be especially appropriate for this FOA. As examples, recent "pilot" programs in nuclear data supported by NP include extended measurements of beta decays required to model antineutrino fluxes and decay heat from nuclear reactors, using the ORNL Modular Total Absorption Spectometer (MTAS); measurements of nuclear structure and radiative transitions using Gammasphere (Argonne National Laboratory—ANL); measurements of isotope production cross sections at Los Alamos National Laboratory—LANL and Lawrence Berkeley National Laboratory —LBNL; and a nuclear theory "Topical Collaboration" study of nuclear fission and r-process nucleosynthesis, co-funded by NNSA (NA-22) and NP.

NP also envisages possibilities for participation in the Nuclear Data effort that leverage emerging technology to improve the efficiency of nuclear data curation and dissemination. Examples of areas of interest include:

1) Improvement in the computational infrastructure associated with the "Nuclear Data Pipeline," notably including the computational enhancement of USNDP Evaluations;

2) The development of procedures for the application of High Performance Computing (HPC) to experimental nuclear data analysis, as was illustrated recently by a NERSC-NP pilot project [4]; and

3) The use of HPC to carry out computational studies of the properties of nuclei and nuclear systems of importance to basic research, and to nuclear applications.

Regarding the "Nuclear Data Pipeline," the nuclear data community has noted that several tasks need to be addressed to reduce the time required to carry out nuclear data evaluations. These include for example issues of data formats, data processing, data visualization and dissemination, quality assurance, and uncertainty quantification, which are familiar challenges in a number of SC program areas. A judiciously formulated research program in these areas which leverages progress in these areas across SC maybe able to combine nuclear community and otherexpertise to dramatically improve workflow and time to completion in activities associated with updating and maintaining USNDP databases.

Collaboration between nuclear scientists and computational experts from other program with relevant expertise such as the SciDAC Institutes, or FASTMath and RAPIDS may serve to accelerate progress in improving the efficiency of USNDP activities and is encouraged. .

The Frameworks, Algorithms and Scalable Technologies for Mathematics (FASTMath) Institute seeks to introduce leading-edge computational math technologies and enable the research community to develop and deploy high-performance software, using DOE supercomputers as readily-available test platforms. The Resource and Application Productivity through Computation, Information, and Data Science (RAPIDS) Institute addresses data understanding, platform readiness, and scientific data management challenges through deep engagements with applications. The FASTMath and RAPIDS Institutes provide expertise in the following topics (among many others) that may be of relevance to an application in response to this FOA:

- Management, analytics and visualization of massive and heterogeneous scientific data sets; data curation and interoperability; usability and user experience;
- Machine learning; neural-network and deep-learning models;
- Performance modeling and benchmarking, tuning and analysis, code profiling and optimization, load balancing; fault tolerance and resilience;
- Adaptive error estimation and UQ-aware methods; emulators; stochastic and numerical optimization; low-rank approximation; linear, integer, mixed-integer programming; inverse methods; Monte Carlo and quasi-Monte Carlo methods; automatic differentiation; adaptive basis sets for integration and optimization; formal V&V methods and task scheduling;
- Runtime systems, portable programming, advanced debugging capabilities and computational methods for hybrid, many and multi-core architectures, and efficient use of new and emerging memory systems;
- Workflow management, rapid prototyping, parallel I/O tools, and storage systems.

Additional information regarding these SciDAC Institutes can be found at the following links:

- FASTMath: https://fastmath-scidac.llnl.gov/

- RAPIDS: https://rapids.lbl.gov

DOE IP
Dr. Ethan Balkin (Ethan.Balkin@science.doe.gov)

The DOE IP Mission is to assure the availability of radioactive and enriched stable isotopes that are in short supply.

DOE IP supports the generation of nuclear data that is useful for non-Federal parties engaged in achieving its mission. The needed data are cross sections/excitation functions for reactor neutron capture (n, gamma and n, fission), high energy neutron reactions (n, x) in accelerators and reactors, charged particle reactions (proton, deuteron, or alpha induced; as well as heavy ion, x), and electron accelerator-based photo-transmutation reactions (gamma, x).

Nuclear data relevant to the types of reactions described in the previous paragraph are all used in the design of targets for practical radioisotope production. These data are essential to predicting yields of desired isotopes and impurities during irradiations. Additionally, a need exists for nuclear data to support advancements in medically relevant Auger electron emitters. In order to enable more complete characterization of their therapeutic potential, measurement of the Auger electron spectra for medically relevant isotopes over a span of atomic numbers is needed.

The highest priority data are p,d,or α, x reaction cross sections; n, x reaction cross sections; and gamma, x reaction cross sections, specifically related to production of radioisotopes that are in short supply for research and applications.

A detailed list of the specific reactions of interest to isotope production activities is included in Section IX, Appendix A, and are listed according to priority, based upon requests to the National Isotope Development Center for specific isotopes, input from Federal Workshops, and isotopes captured in the 2015 Nuclear Data Needs Whitepaper.

DOE Office of Nuclear Energy (NE):
Mr. David Henderson (david.henderson@nuclear.energy.gov)

NE conducts research and deploys scientific results, expertise, computational tools and other advanced capabilities otherwise not commercially available for use in advancing nuclear power as a resource capable of meeting the Nation's clean energy, environmental, and national security needs. NE's leading-edge work on modelling and simulation is being made available to help accelerate early stage concepts relevant to small modular reactors, and advanced reactors across several technology areas.

NE also conducts high-priority activities to not only expand and enhance the research done through its Nuclear Science User Facilities, but also to apply new capabilities and technologies to the advancement of nuclear fuels, fuels cycles, and fuel disposition. A primary focus for NE is engagement with industry and other users through the Gateway for Accelerated Innovation in Nuclear (GAIN); please see https://gain.inl.gov/ .

NE is interested in proposals that address nuclear data needs in these mission areas, provided that these needs are clearly demonstrated to be a limiting factor in nuclear fuel and reactor design, analysis, safety, and licensing calculations. Use of sensitivity and uncertainty analysis methods in proposed efforts is encouraged to demonstrate these needs. Some nuclear data needs for NE may be found in the NEA Nuclear Data High Priority Request List [5]. Recent studies of key safety and operational parameters highlight areas of nuclear data needs relevant to NE's mission.

Precisely determined differential cross section data and associated uncertainties are needed for certain high-priority nuclides and reactions, including but not limited to:

- 235U capture in the intermediate energy range
- 23Na and 56Fe elastic scattering
- 35Cl(n,p) in the intermediate and fast energy range
- Thermal neutron scattering kernels for fluorine-based molten salts
- New measurements or evaluations of nu-bar measurements for 239Pu at thermal energies

Re-evaluation of nuclides important to nuclear energy applications, with an emphasis on data "tuning" beyond the typical k-eff responses, to ensure the accuracy of energy-dependent reactions in the predictive calculation of reactor power distributions, control rods worth, etc. are also encouraged. In particular, reviews of the ENDF/B-VIII.0 evaluations for 235U, 239Pu, 1H, 16O, and 56Fe are needed.

Cross section covariance data useful for application analysis that account for correlations introduced in that data "tuning" process are also needed for uncertainty quantification, assessment of similarity of benchmark experiments for validation, and determination of safety margins.

Self-consistent fission product yield data is also needed, were the independent yields sum to the same values as the cumulative yields for reactor applications, especially with respect to the delayed neutron branching fractions. Associated covariance data for fission product yields is also needed.

All applications must clearly demonstrate relevant utility within NE's research scope and include a strategy foster a public benefit by deploying the updated data evaluated data to the end user community, such as inclusion on ENDF or ENDSF.

NNSA / Defense Nuclear Nonproliferation Research and Development (NA-22):
Dr. Donald Hornback (donald.hornback@nnsa.doe.gov)

NNSA seeks to advance capabilities in modeling and simulation of national security applications. This will be achieved by improving the accuracy of nuclear data that are used by the physics and engineering codes developed for specific applications relevant to the NNSA mission. In many cases there are hundreds of different components of nuclear data that are used in any given calculation, but only some subset of those typically dominate the uncertainty on the final answer. Furthermore, in many cases it is unclear if reducing the uncertainty on a given nuclear data quantity will require improved reaction theory, new experiments, or perhaps a re-evaluation of existing experimental information.

Defense Nuclear Nonproliferation R&D (DNN R&D) is requesting 9-month scoping studies that will inform future calls for proposals in specific technical areas. The scoping studies should include sensitivity studies that identify isotopes and reactions with high impact on important quantities for specific applications and assess their uncertainties. The scoping studies are also expected to determine the feasibility of significantly advancing the understanding of applications by improving nuclear data and make a set of recommendations for a 3-5 year project.
Scoping studies are sought in three different areas:

- **Non-destructive assay for Safeguards**. UF_6 is the most abundant material in the fuel cycle, and the inventory of this material can be verified using non-destructive assay (NDA) by measuring neutrons produced primarily in the (α,n) reaction on fluorine. A 10% uncertainty on the cross section of this reaction can represent several significant quantities (SQ) of uncertainty in the unaccounted material for certain facility processes. NNSA is seeking proposals for scoping studies of alpha-induced reaction on fluorine for Safeguards, as well as other light isotopes relevant to nuclear science and technology.
- **Active interrogations with neutrons.** Active interrogation can be used in a number of non-proliferation and national security mission areas, particular in cases when passive measurements are unpractical due to low signal-to-noise ratio. Modeling and simulation of active interrogation systems require accurate nuclear data for the interrogated material. NNSA is requesting scoping studies for nuclear data relevant to active interrogation with neutrons. The most significant gaps in nuclear data are expected to be related to the gamma response from various materials during active interrogation, so proposals that addresses this area are highly encouraged.
- **Other nuclear data for national security.** In addition to the previous two topics the NNSA is also considering proposals for scoping studies on nuclear data in other areas of national security. If a strong case to be made for nuclear data needs within NNSA's mission space, proposals in that area will be considered as part of this FOA.

In addition, please note the requirements contained in Section IV, Part D, below, relating to the preparation of a budget request and its justification.

References:

[1] "Nuclear Data Needs and Capabilities for Applications" (LBNL, May 27-29, 2015); https://bang.berkeley.edu/events/NDNCA/whitepaper .

[2] "Nuclear Data Needs and Capabilities for Basic Science" (Univ. of Notre Dame, Aug. 10-11, 2016); meetings.nscl.msu.edu/2016ND_workshop/ND-WhitePaper2017.pdf .

[3] "Reaching for the Horizon; the 2015 Long Range Plan for Nuclear Science" (Kitty Hawk, Apr. 16-20, 2015).

[4] "Results from Large Scale STAR Raw Data Reconstruction on NERSC HPC," R.J. Porter, J. Lauret, M. Mustafa, and J. Balewski; https://drupal.star.bnl.gov/STAR/starnotes/public/sn0688

[5] "NEA Nuclear Data High Priority Request List;" https://www.oecd-nea.org/hprl

[6] N. Touran, "Sensitivities and Uncertainties due to Nuclear Data in a Traveling Wave Reactor" (NEA/OECD/WPEC SG 39 Meeting, May 10, 2016).

Open Science

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.

Collaboration

Collaborative applications submitted from different institutions 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.

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

Collaboration vs. Subawards

The following points of advice to applicants may be helpful:

1. Both collaborative applications and proposed subawards are methods by which multiple institutions can work together to reach the scientific objectives described in this FOA.
    a. Collaborative applications are assembled from multiple identical applications submitted by the proposing institution. Such applications may be submitted under this FOA in Grants.gov and the companion Lab announcement (LAB FY-2114) in

PAMS. The multiple applications will be assembled into one joint collaborative proposal, which will be merit-reviewed as one proposal, with recommendations to fund or decline the application made at the level of each independent application.

b. Subawards exist when multiple institutions work together to submit one application with a designated prime awardee and multiple potential subawardees.
c. DOE National Laboratories may be proposed as subawardees, but the value of any such proposed subaward will be removed from any such prime award: DOE will make separate awards to its laboratories.

2. Choose the appropriate structure based on the nature of the scientific work being proposed. If multiple institutions will be functioning as a network of peer-level researchers, a collaborative structure would be more appropriate. If multiple institutions will be functioning with leadership and direction coming from one institution, a subaward arrangement would be more appropriate.
3. A well-thought-out research plan and its associated budget(s) should leave no confusion about which institution will do which parts of the research.

All entities submitting applications to this FOA must recognize the moral and legal obligations to comply with export controls and policies that limit the transfer of technologies with potential dual use. Applicants are reminded that international collaboration must comply with nonproliferation, sanction, and other protocols described at https://www.export.gov and https://www.state.gov/strategictrade/overview/

International activities related to special nuclear materials (SNM) are subject to additional requirements. Please see 10 CFR 810 for further information.

This FOA is to support scientific endeavors that could be described in scholarly publications. Do not submit applications containing restricted data or unclassified nuclear information as defined in the Atomic Energy Act of 1954, as amended, 42 USC 2011 et seq., 10 CFR 1017, 10 CFR 1045.

Section II – AWARD INFORMATION

A. TYPE OF AWARD INSTRUMENT

DOE anticipates awarding grants under this FOA.

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

B. ESTIMATED FUNDING

DOE expects that a grand total of $12 million will be available to support all years of all awards under this FOA and its companion Program Announcement to the DOE National Laboratories (LAB 19-2114), subject to appropriation of funds by Congress.

DOE is under no obligation to pay for any costs associated with preparation or submission of applications. DOE reserves the right to fund, in whole or in part, any, all, or none of the applications submitted in response to this FOA.

C. MAXIMUM AND MINIMUM AWARD SIZE

(See B. Estimated Funding above.)

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

Ceiling

$1,000,000 per year

Floor

$150,000 per year

D. EXPECTED NUMBER OF AWARDS

(See B. Estimated Funding above.)

Approximately 4 to 25 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

(See B. Estimated Funding above.)

It is anticipated that award sizes may range from $150,000 per year to $1,000,000 per year, typically less than $500,000 per year, with a median award size between $350,000 per year and $400,000 per year.

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

F. PERIOD OF PERFORMANCE

(See B. Estimated Funding above.)

Research Grant Awards are expected to be made for a period of three years.

Continuation funding (funding for the second and subsequent budget periods) is contingent on: (1) availability of funds appropriated by Congress and future year budget authority; (2) progress towards meeting the objectives of the approved application; (3) submission of required reports; and (4) compliance with the terms and conditions of the award.

G. TYPE OF APPLICATION

DOE will only accept 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 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 domestic applicants are eligible to apply, except nonprofit organizations described in section 501(c)(4) of the Internal Revenue Code of 1986 that engaged in lobbying activities after December 31, 1995.

DOE National Laboratories, other Federal agencies, and their Federally Funded Research and Development Center (FFRDC) contractors are not eligible to receive financial assistance awards and are therefore ineligible to submit applications *as sole applicants or as the lead of a collaboration*. They may, however, be proposed as a team member on another institution's application (as a subaward) or as a collaborator (with multiple applications from multiple members of a team). A parallel, companion announcement (LAB 19-2114) is available for application by DOE laboratories, including DOE/NNSA FFRDC contractors. If selected as a subwardee or collaborator, DOE laboratories and their FFRDC contractors will be paid directly by DOE. If selected for funding, other Federal agencies and their FFRDC contractors will be paid through interagency awards.

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.

Applications from for-profit organizations that propose research related to current commercial activity may be declined without merit review.

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."

Non-DOE/NNSA Federal Agencies and their FFRDC Contractors

Non-DOE/NNSA Federal agencies and their FFRDC contractors are not eligible for a prime award under this announcement, 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-0002114 by the following statutory authority (insert statute name, citation, and section) ."

UNINCORPORATED CONSORTIA

Unincorporated consortia (team arrangements), which may include domestic and foreign entities, must designate one member of the consortium to serve as the prime recipient/consortium representative (lead organization). The prime recipient/consortium representative must be incorporated (or otherwise formed) under the laws of a State or territory of the United States.

Upon request, unincorporated consortia must provide the DOE contracting officer with a collaboration agreement, commonly referred to as the articles of collaboration, which sets out the rights and responsibilities of each consortium member. This agreement binds the individual consortium members together and should discuss, among other things, the consortium's:

- Management structure;
- Method of making payments to consortium members;
- Means of ensuring and overseeing members' efforts on the project;
- Provisions for members' cost sharing contributions; and
- Provisions for ownership and rights in intellectual property developed previously or under the agreement.

Note that a consortium is applied for in one application and results in one award with subawards to consortia members. Collaborations are applied for separately with identical applications and result in multiple awards to the collaborating institutions.

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..

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-0002114) 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

LETTER OF INTENT DUE DATE

See Section IV, Part F.

RESPONSE DATE

See Section IV, Part F.

A Letter of Intent is required and must be submitted by the deadline in Section IV, Part F.

The LOI is to help in planning the review and the selection of potential reviewers for the application. For this purpose, the LOI must include the following:

- A cover sheet containing the name and mailing address of the sponsoring institution; the planned title of the research application; the name, e-mail address, and telephone number of the PI, additional Senior Investigator(s), and Senior/Key personnel expected to be involved in the planned application.

Applications that are not related to an LOI may be declined without merit review.

The LOI must be submitted electronically through the DOE SC Portfolio Analysis and Management System (PAMS) website https://pamspublic.science.energy.gov/. It is important that the LOI be a single file with extension .pdf, .docx, or .doc. The filename must not exceed 50 characters. 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 letter of intent. **All PIs and those submitting LOIs 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 Letter of Intent:

- Create your letter of intent 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 Letter of Intent" from the dropdown.
- On the Submit Letter of Intent page, select the institution from which you are submitting this LOI 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 LOI; 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 LOI. Save the LOI for later work by clicking the "Save" button at the bottom of the screen. It will be stored in "My Letters of Intent" for later editing.
- Enter a title for your letter of intent.
- Select the appropriate technical contact from the Program Manager dropdown.
- To upload the LOI 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 LOI to DOE.
- Upon submission, the PI will receive an email from the PAMS system <PAMS.Autoreply@science.doe.gov> acknowledging receipt of the LOI.

You are encouraged to register for an account in PAMS at least a week in advance of the LOI 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 LOI 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, 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-0002114.

2. Pre-application

Not applicable.

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 should not be included in the application.

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)

A **new** application is one in which DOE support for the proposed research is being requested for the first time. Please only submit new applications in response to this FOA.

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. (http://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.

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.energy.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 include the following items:

- The project title
- Applicant/Institution:
- Street Address/City/State/Zip:
- Postal Address:
- Lead PI name, telephone number, email:
- Administrative Point of Contact name, telephone number, email:
- FOA Number: DE-FOA-0002114
- DOE/SC Program Office: Nuclear Physics
- DOE/SC Program Office Technical Contact: Dr. Timothy Hallman
- PAMS Letter of Intent tracking number:
- Research area or areas as identified in Section I of this FOA:

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 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.

If the project is a collaboration, provide the following information on a separate page as a supplement to the cover page.

- List all collaborating institutions by name with each institution's PI on the same line.
- Indicate the lead PI who will be the point of contact and coordinator for the combined research activity.
- Provide a statement explaining the leadership structure of the collaboration.
- Include a description of each collaborating institution's facilities, equipment, and resources that will be made available to the collaborative group.
- If applicable, explain how students and junior researchers will be trained and mentored by the collaborators.
- Include a table modeled on the following chart providing summary budget information from all collaborating institutions. Provide the total costs of the budget request in each year for each institution and totals for all rows and columns.

Collaborative Application Information						
	Names	**Institution**	**Year 1 Budget**	**Year 2 Budget**	**Year 3 Budget**	**Total Budget**
Lead PI						
Co-PI						
Co-PI						
Co-PI						

Example budget table ($ in thousands)

* Note that collaborating applications must be submitted separately.

PROJECT NARRATIVE (FIELD 8 ON THE FORM)

The project narrative **must not exceed 20 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.

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."

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 (if any) 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.

Project Objectives: This section should provide a clear, concise statement of the specific objectives/aims of the proposed project.

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: Each collaborating institution must submit an identical common narrative. Collaborative proposals will necessarily be longer than single-institution proposals. The common narrative may exceed the page limit described for the research narrative by 50%; i.e., if the page limit is 12 pages, a collaboration is subject to a limit of 18 pages. 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:

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.

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. 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). 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.energy.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.energy.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.
5. **PLEASE NOTE:** One novel and very important purpose of this program is to provide a direct, rapid link between the new nuclear data experiments being supported and the USNDP databases, so that the new nuclear data generated by the experiment can be made publicly available in a timely manner. Accordingly, except in special circumstances, each application to this FOA should identify and include appropriate support for a named USNDP staff member, the "USNDP POC," who will be associated with the proposed work, participate in the plans for new data generation or the development of new procedures, and be responsible for making the new data available in the appropriate USNDP databases or incorporating the new procedures in the USNDP effort. Information regarding the identity of the USNDP POC and their planned activities should be included in the DMP. For additional information regarding this aspect of the proposal, please contact Timothy Hallman, DOE-NP Associated Director and Program Manager for Nuclear Data (timothy.hallman@science.doe.gov) and Alejandro Sonzogni, NNDC Chair (sonzogni@bnl.gov).

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.energy.gov/funding-opportunities/digital-data-management

- This appendix should not exceed 5 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: 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.

- **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.

BUDGET AND BUDGET JUSTIFICATION SPECIAL INSTRUCTIONS

Here we provide some special instructions regarding budget formulation that are specific to this FOA.

An application submitted in response to this FOA should normally include a request for support for a specified USNDP staff member, the "USNDP POC," who will be associated with the experiment, and will be responsible for transferring data generated in the experiment to the appropriate USNDP databases in a timely manner. These activities should be described both in the proposal narrative and in the Data Management Plan (DMP); see Section IV.C.2, Appendix 6. It may be useful to contact Timothy Hallman, DOE-NP Associated Director and Program Manager for Nuclear Data (timothy.hallman@science.doe.gov) and Alejandro Sonzogni, NNDC Chair (sonzogni@bnl.gov) to make appropriate arrangements with USNDP. In certain circumstances, such as an application that already includes suitable USNDP staff as participants in the experiment, it may not be necessary to identify a specified USNDP POC.

The budget should not propose a partition of the requested funding between Offices; in the event of a successful application: if necessary, this partition will be arranged by DOE in consultation with the applicant. Each supporting Office would then independently provide funding through their preferred funding mechanism, subject to the availability of funding.

Each institution should also submit a detailed Budget Justification for their individual budgets. For applications that envision receiving funding from more than one Office, this budget justification may include a discussion of the separate activities that might be supported by each Office, for example through a partition of the overall application into Tasks.

We recommend that PIs discuss their budget plans with the relevant Program Managers before submission of an application. (See the **Technical/Scientific Program Contacts** at the top of Section I.)

GENERAL INSTRUCTIONS

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.energy.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 applicable. 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 the required supporting information for the following costs (See R&R Budget instructions): equipment; domestic and foreign travel; participant/trainees; materials and supplies; publication; consultant services; ADP/computer services; subaward/consortium/contractual; equipment or facility rental/user fees; alterations and renovations; and indirect cost type. Provide any other information you wish to submit to justify your budget request. **Attach a single budget justification file for the entire project period in field L.** The file automatically carries over to each budget year.

You may wish to include the indirect cost rate agreement as a part of the budget justification.

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

Budgets for Subawardees: You must provide a separate R&R budget 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
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

May 15, 2019, at 5 PM Eastern Time

You are encouraged to submit your Letter of Intent well before the deadline. LOIs may be submitted at any time between the publication of this FOA and the stated deadline.

DOE plans to provide feedback in the form of encouragement or discouragement to submit applications by June 1, 2019, at 5 PM Eastern Time.

2. Pre-application Due Date

Not applicable

3. Application Due Date

June 28, 2019, at 5 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

Applications received after the deadline will not be reviewed or considered for award.

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/SAM_Guide/SAM_User_Guide.htm.

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-0002114.

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-0002114.

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; and
- Reasonableness and Appropriateness of the Proposed Budget.

Merit reviewers will be asked to evaluate one additional criterion of equal significance to the criteria established by regulation.

- Importance of the Proposed Contribution to Nuclear Data for Applications and Research.

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

- Is the Data Management Plan suitable for the proposed research and to what extent does it support the validation of research results?

APPROPRIATENESS OF THE PROPOSED METHOD OR APPROACH

- Does the proposed effort employ innovative concepts or methods?
- How logical and feasible are the approaches?
- Are the conceptual framework, methods, and analyses well justified, adequately developed, and likely to lead to scientifically valid conclusions?
- Does the applicant recognize significant potential problems and consider alternative strategies?

COMPETENCY OF APPLICANT'S PERSONNEL AND ADEQUACY OF PROPOSED RESOURCES

- Does the proposed work take advantage of unique facilities and capabilities?
- What is the past performance of the team?
- How well qualified is the team to carry out the proposed work?
- Are the environment and facilities adequate for performing the proposed effort?

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?

IMPORTANCE OF THE PROPOSED CONTRIBUTION TO NUCLEAR DATA FOR APPLICATIONS AND RESEARCH

- What is the level of importance of the proposed contribution to nuclear data that would be provided through this proposal to the applications and/or research communities?
- If an experiment is proposed, has the PI selected the most important nuclear data in the chosen area that can be addressed experimentally using the proposed facilities? Are there additional, related nuclear data needs that the PI should also consider?
- If changes or developments in the "Nuclear Data Pipeline" are proposed, would these be expected to provide a level of improvement in USNDP operations commensurate with the costs incurred?

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.energy.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
- Ensuring an appropriate balance of activities within SC programs
- Performance under current awards
- Maximizing the use of DOE user facilities
- Commitment to sharing the results of research

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 and 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) General Terms and Conditions; 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.energy.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-0002114

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	DOE SC NP (and general information) Dr. Timothy Hallman 301-903-3613 timothy.hallman@science.doe.gov DOE IP Dr. Ethan Balkin 301-903-1861 ethan.balkin@science.doe.gov DOE NE Mr. David Henderson 301-903-9991 david.funk@nuclear.energy.gov NNSA / Defense Nuclear Nonproliferation R&D (NA-22): Dr. Donald Hornback 202-586-6522

	donald.hornback@nnsa.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 the project narrative and specifies the pages of the application which are to be restricted:

"The data contained in pages _____ of this application 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

Appendix A: 2019 Nuclear Data Needs List for Isotope Production

The following tables summarize nuclear needs relevant to the production of radioisotopes important to applications and research.

1. Charged particles

A. NUCLEAR REACTIONS FOR PROTON FLUX MONITORING

Production cross sections are needed as a function of particle energy. Care must be taken in the 80-200 MeV range to address potential secondary neutron related concerns.

Nuclear reaction	Energy range
$^{nat}Nb(p,4n)^{90}Mo$	Up to 200 MeV
$^{nat}Cu(p,xn)^{62,64}Zn$	Up to 200 MeV
$^{nat}Ti(p,x)^{48}V$	Up to 200 MeV

B. EXCITATION FUNCTIONS FOR ISOTOPE PRODUCTION

Production cross sections are needed as a function of particle energy.

Isotope	Target	Incident particle	Measurement type	Energy range
^{236}Np	^{235}U	d	Excitation functions for production of $^{236m,236g}Np$	Up to 50 MeV
		d	Excitation functions for production of co-produced impurity: $^{234,235}Np$	Up to 50 MeV
	^{236}U	p	Excitation functions for production of $^{236m,236g}Np$	Up to 30 MeV
		p	Excitation functions for production of co-produced impurity: $^{234,235,237}Np$	Up to 30 MeV
	^{236}U	d	Excitation functions for production of $^{236m,236g}Np$	Up to 50 MeV
		d	Excitation functions for production of co-produced impurity: $^{234,235,237,238}Np$	Up to 50 MeV
	^{238}U	p	Excitation functions for production of $^{236m,236g}Np$	Up to 50 MeV
		p	Excitation functions for production of co-produced impurity: $^{234,235,237,238,239}Np$	Up to 50 MeV
^{93m}Nb	^{94}Zr	p	Excitation function for production of ^{93m}Nb	Up to 70 MeV
		p	Excitation functions for production of co-produced impurities: ^{91g,92g,93g,} ^{94g}Nb	Up to 70 MeV

^{202}Pb	^{203}Tl	p	Excitation functions for production of $^{202m,202g}Pb$	Up to 200 MeV
		p	Excitation functions for production of co-produced impurities: $^{198,199,200,201,203}Pb$	Up to 200 MeV
	^{205}Tl	p	Excitation functions for production of $^{202m,202g}Pb$	Up to 200 MeV
		p	Excitation functions for production of co-produced impurities: $^{198,199,200,201,203,204,205}Pb$	Up to 200 MeV
^{205}Pb	^{206}Pb	p	Excitation functions for production of ^{205}Bi, ^{205}Pb	Up to 200 MeV
	^{206}Pb	p	Excitation functions for production of co-produced impurities: $^{198,199,200,201,202,203,204,205,206,207}Bi$	Up to 200 MeV
	^{204}Pb	p	Excitation functions for production of co-produced impurities: $^{198,199,200,201,202,203,204}Bi$	Up to 200 MeV
	^{207}Pb	p	Excitation functions for production of ^{205}Bi and co-produced impurities: $^{198,199,200,201,202,203,204,206,207}Bi$	Up to 200 MeV
	^{208}Pb	p	Excitation functions for production of ^{205}Bi and co-produced impurities: $^{198,199,200,201,202,203,204,206,207,208}Bi$	Up to 200 MeV
^{134}Ce	^{nat}La	p	Excitation function for production of ^{134}Ce	Up to 200 MeV
		p	Excitation functions for production of co-produced impurities: $^{132,133,133,137,139}Ce$	Up to 200 MeV
^{72}Se	^{75}As	p	Excitation function for production of ^{72}Se	Up to 100 MeV
		p	Excitation functions for production of co-produced impurities: $^{70,71,73,75}Se$	Up to 100 MeV
^{47}Sc	^{50}Ti	p	Excitation function for production of ^{47}Sc	Up to 50 MeV
		p	Excitation functions for production of co-produced impurities: $^{43,44,46,48,49}Sc$	Up to 50 MeV
^{67}Cu	^{70}Zn	p	Excitation function for production of ^{67}Cu	Up to 50 MeV
		p	Excitation functions for production of co-produced impurities: $^{61,62,64,66}Cu$	Up to 50 MeV
^{119}Te	^{nat}Sb	p	Excitation functions for production of $^{119m,119g}Te$	Up to 100 MeV
		p	Excitation functions for production of co-produced impurities: $^{116,117,118,121m,g,123m}Te$	Up to 100 MeV
	^{121}Sb	p	Excitation functions for production of $^{119m,119g}Te$	Up to 100 MeV
		p	Excitation functions for production of co-	Up to 100 MeV

			produced impurities: $^{116,117,118,121m,121g,123m}Te$	
^{117m}Sn	^{nat}Sb	p	Excitation function for production of ^{117m}Sn	Up to 100 MeV
		p	Excitation functions for production of co-produced impurities: $^{113,119m,121m,121g}Sn$	Up to 100 MeV
	^{121}Sb	p	Excitation function for production of ^{117m}Sn	Up to 100 MeV
		p	Excitation functions for production of co-produced impurities: $^{113,119m}Sn$	Up to 100 MeV

Other nuclear data needs for intermediate energy production of medical isotopes captured in the 2015 Nuclear Data Needs Whitepaper are listed below. Excitation functions are needed up to 100 MeV (preferably up to 200 MeV) for production of the primary isotope and for all co-produced isotopic impurities. In each case the main production nuclear reaction is indicated but it should be noted that in some cases more than one nuclear reaction contribute to the production of a particular isotope or isotopic impurity. The needs listed below are considered important but of slightly lower priority.

Non-standard p^+ emitters	**SPECT radionuclides and generator parents**	**Therapeutic radionuclides**
$^{55}Mn(p,4n)^{52}Fe$ $^{59}Co(p,3n)^{57}Ni$ $^{68}Zn(p,an)^{64}Cu$ $^{71}Ga(p,4n)^{68}Ge$ $^{75}As(p,3n)^{73}Se$ $^{85}Rb(p,3n)^{83}Sr$ $^{88}Sr(p,3n)^{86}Y$ $^{125}Te(p,2n)^{124}Te$	$^{124}Xe(p,pn)^{123}Xe$ $^{124}Xe(p,2p)^{123}I$ $^{45}Sc(p,2n)^{44}Ti$ $^{69}Ga(p,2n)^{68}Ge$ $^{nat}Br(p,x)^{72}Se$	$^{68}Zn(p,2p)^{67}Cu$ $^{107}Ag(p,an)^{103}Pd$ $^{232}Th(p,x)^{225}Ac$

2. Photons

A. EXCITATION FUNCTIONS FOR ISOTOPE PRODUCTION

Production cross sections are needed as a function of photon energy.

Nuclear reaction	Photon energy range
$^{48}Ti(\psi,p)^{47}Sc$	Up to 50 MeV
$^{48}Ti(\psi,pn)^{46}Sc$	Up to 50 MeV
$^{48}Ca(\psi,n)^{47}Ca$	Up to 50 MeV
$^{48}Ca(\psi,p)^{47}K$	Up to 50 MeV
$^{68}Zn(\psi,p)^{67}Cu$	Up to 50 MeV

$^{48}Ti(\psi,p)^{47}Sc$	Up to 50 MeV
$^{77}Se(\psi,p)^{76}As$	Up to 50 MeV
$^{78}Se(\psi,p)^{77}As$	Up to 50 MeV
$^{78}Se(\psi,pn)^{76}As$	Up to 50 MeV
$^{187}Os(\psi,p)^{186}Re$	Up to 50 MeV
$^{189}Os(\psi,p)^{188}Re$	Up to 50 MeV
$^{190}Os(\psi,p)^{189}Re$	Up to 50 MeV
$^{196}Pt(\psi,p)^{195}Ir$	Up to 50 MeV
$^{196}Pt(\psi,n)^{195m}Pt$	Up to 50 MeV
$^{197}Au(\psi,pn)^{195m}Pt$	Up to 50 MeV
$^{197}Au(\psi,n)^{196}Au$	Up to 50 MeV
$^{162}Dy(\psi,p)^{161}Tb$	Up to 50 MeV
$^{162}Dy(\psi,pn)^{160}Tb$	Up to 50 MeV
$^{226}Ra(\psi,n)^{225}Ra$	Up to 50 MeV
$^{226}Ra(\psi,2n)^{224}Ra$	Up to 50 MeV

B. ACTIVATION OF CONVERTER MATERIALS

Production cross sections are needed as a function of photon energy for all activation products, with the highest priority on the major gamma dose drivers (both long-lived and short-lived).

Converter materials	Photon energy range
Tungsten	Up to 50 MeV
Tantalum	Up to 50 MeV
Gold	Up to 50 MeV
Copper	Up to 50 MeV
Stainless steel	Up to 50 MeV
Aluminum	Up to 50 MeV
Magnesium	Up to 50 MeV
Lead	Up to 50 MeV
Rhenium	Up to 50 MeV
Platinum	Up to 50 MeV

3. Neutrons

A. NUCLEAR REACTIONS FOR FAST NEUTRON FLUX CHARACTERIZATION

Production cross sections are needed as a function of neutron energy.

Nuclear reaction	Energy range
$^{209}Bi(n,3n)^{207}Bi$	Up to 200 MeV

$^{209}Bi(n,4n)\ ^{206}Bi$	Up to 200 MeV
$^{209}Bi(n,5n)\ ^{205}Bi$	Up to 200 MeV
$^{209}Bi(n,6n)\ ^{204}Bi$	Up to 200 MeV
$^{nat}Lu(n,xn)^{173}Lu$	Up to 200 MeV
$^{nat}Lu(n,xn)^{172}Lu$	Up to 200 MeV
$^{nat}Lu(n,xn)^{171}Lu$	Up to 200 MeV
$^{nat}Lu(n,xn)^{170}Lu$	Up to 200 MeV
$^{nat}Lu(n,xn)^{169}Lu$	Up to 200 MeV
$^{169}Tm(n,3n)^{167}Tm$	Up to 200 MeV
$^{169}Tm(n,4n)^{166}Tm$	Up to 200 MeV
$^{169}Tm(n,5n)^{165}Tm$	Up to 200 MeV

B. FAST NEUTRON INDUCED REACTIONS: ISOTOPE PRODUCTION VIA THRESHOLD REACTIONS

Production cross sections are needed as a function of neutron energy.

Nuclear reaction	Energy range
$^{232}Th(n,x)^{225}Ac$	Up to 200 MeV
$^{232}Th(n,x)^{227}Ac$	Up to 200 MeV
$^{36}S(n,x)^{32}Si$	Up to 200 MeV
$^{nat}K(n,x)^{32}Si$	Up to 200 MeV
$^{37}Cl(n,x)^{32}Si$	Up to 200 MeV
$^{35}Cl(n,x)^{32}Si$	Up to 200 MeV
$^{68}Zn(n,x)^{67}Cu$	Up to 200 MeV
$^{70}Zn(n,\ ,\alpha)^{67}Ni$	Up to 200 MeV
$^{50}Ti(n,x)^{47}Sc$	Up to 200 MeV
$^{50}Ti(n,\ ,\alpha)^{47}Ca$	Up to 200 MeV
$^{226}Ra(n,2n)^{225}Ra$	Up to 200 MeV

Other nuclear data needs for fast neutron production of medical isotopes captured in the 2015 Nuclear Data Needs Whitepaper are listed below. These measurements are also considered important but of slightly lower priority. Excitation functions are typically needed up to 200 MeV.

$^{32}S(n,p)^{32}P$ $^{47}Ti(n,p)^{47}Sc$ $^{64}Zn(n,p)^{64}Cu$	$^{67}Zn(n,p)^{67}Cu$ $^{89}Y(n,p)^{89}Sr$ $^{105}Pd(n,p)^{105}Rh$	$^{149}Sm(n,p)^{149}Pm$ $^{153}Eu(n,p)^{153}Sm$ $^{159}Tb(n,p)^{159}Gd$	$^{161}Dy(n,p)^{161}Tb$ $^{166}Er(n,p)^{166m,166g}Ho$ $^{169}Tm(n,p)^{169}Er$	$^{175}Lu(n,p)^{175}Yb$ $^{177}Hf(n,p)^{177m,g}Lu$

C. LOW ENERGY NEUTRON REACTIONS: ISOTOPE PRODUCTION VIA REACTORS

Energy-resolved cross sections as well as effective cross sections for both thermal neutrons and epi-thermal neutrons are needed for production at U.S. based reactors (*e.g.* HFIR and ATR).

Nuclear reaction	Nuclear reaction	Nuclear reaction
Data for production of ^{229}Th and other isotopes ^{227}Ra(n,y)^{228}Ra - confirmation measurement needed ^{228}Ra(n,y)^{229}Ra ^{228}Ac(n,y)^{229}Ac ^{227}Th(n,y)^{228}Th - confirmation measurement needed ^{228}Th(n,y)^{229}Th - confirmation measurement needed ^{229}Th(n, y)^{230}Th - confirmation measurement needed ^{229}Th(n,fission) - confirmation measurement needed ^{227}Th(n,fission) - confirmation measurement needed ^{187}W(n,y)^{188}W - reported value not reliable ^{133}Ba(n,y)^{134}Ba - confirmation measurement needed ^{107}Ag(n,y)^{108}Ag→^{108}Cd(n, y)^{109}Cd - confirmation measurements needed	**Data for SHE target isotopes production** ^{248}Cm(n,y) low energy resonances ^{249}Bk(n,y) ^{250}Cf (n,y) and ^{250}Cf (n,f) ^{251}Cf(n,y) and ^{251}Cf (n,f) – first resonance	**Data for ^{252}Cf production** ^{245}Cm(n,y) ^{247}Cm(n,y) ^{248}Cm(n,y) ^{249}Bk(n,y) ^{250}Cf(n,g) and ^{250}Cf (n,f) ^{251}Cf(n,g) and ^{251}Cf (n,f) ^{252}Cf(n,X) - resonance near 1eV in particular

In addition to the tabulations above, further information on the present status and future needs for nuclear data relevant to the production and medical applications of radionuclides may be found in this review article: Qaim, S.M., *Nuclear data needs for production and applications of radionuclides: Present status and future needs.* Nucl. Med. Biol., 2017; 44:31-49.

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.