RESEARCH CALL TO DOE LABORATORIES

U. S. Department of Energy

National Energy Technology Laboratory

Technical Support for DOCCSS-
Discovery of Carbon Capture Substances and Systems Initiative:
Changing the paradigm to deliver real material solutions

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Issue Date:	**11/03/2016**
Proposal Due Date:	**12/05/2016 at 11:59:59 PM Eastern Daylight Time**

This Laboratory Call will remain open until the Proposal Due Date indicated above. However, proposals may be submitted at any time before this Lab Call closes. Proposals are to be submitted to DOCCSS.LabCall@netl.doe.gov .

SECTION I – RESEARCH CALL DESCRIPTION

A. SUMMARY

The Department of Energy's (DOE) National Energy Technology Laboratory (NETL) on behalf of the DOE, Office of Fossil Energy, is seeking field work proposals from the DOE National Laboratory Complex, which will discover new materials that can be used to capture carbon from fossil-fired power generation systems. This laboratory research call includes four (4) transformational material platform areas:

1) *Sorbent Materials* (e.g., Structured Metal Organic Frameworks or other advanced materials)
2) *Membrane Materials* (e.g., Mixed Matrix and Layered Membranes or other advanced materials)
3) *Non-Aqueous Solvents*
4) *Other (Technology that does not align with material platform areas 1-3)*

B. BACKGROUND

Affordable and abundant fossil energy has fueled decades of national prosperity, and projections indicate that fossil fuel usage will not only continue to figure prominently in the U.S. energy mix for decades to come, but its use will expand globally. To eliminate greenhouse gas emissions, the development of transformational carbon management technologies that can ensure the availability of affordable, abundant and clean fossil energy resources is urgently needed.

Over the past several decades, investments across the DOE in high-performance computing and materials characterization, synthesis and manufacturing have created the foundation for the development of new technologies that have the potential to solve the greenhouse gas emission challenge. The DOE National Laboratories and U.S. research institutions have been the recipients of much of this investment, utilizing these tools to advance scientific understanding and discovery as well as to develop specific technology solutions. A number of research groups are currently focusing their efforts on materials concepts that represent evolutionary advances in solvents, membranes, sorbents, and advanced processes for fossil and other clean energy systems. In almost all cases, the focus is on the development of high-performance materials that exhibit a few targeted characteristics, without *a priori* consideration of the real requirements that will be put on the material in the intended application, or the real costs associated with their implementation at full scale. What is generally missing in this approach is an optimization step (or steps) that considers the material's performance in the context of a real process, thereby enabling the development and utilization of truly *transformational* capture materials in a functional capture system.

Affordable, transformational carbon capture technologies are likely to be invented by holistically coupling the enormous possibilities of new materials (e.g., ionic liquids, metal-organic frameworks, or materials yet to be discovered) with capture processes that are engineered to exploit the materials favorable properties while overcoming negative ones. However, the identification of new materials poses a significant challenge to researchers due to the poly-dimensional nature of materials design, where design criteria including components (periodic table), composition (elementally complex), structure, phase and morphology (countless variability) pose possibilities greater than can be comprehended. This challenge is furthermore compounded when material performance must span scales covering orders of magnitude and translate to service-life and economics, often in very challenging systems or environments.

Approach

The multi-disciplinary research team will work closely with industrial research and stakeholder groups to develop transformational carbon capture material solutions. The DOCCSS initiative will build upon the recent exponential growth in advanced computational capabilities at the national laboratories, the established toolset, and collaborative approaches in strategic partnerships with other lab centers of material development and universities.

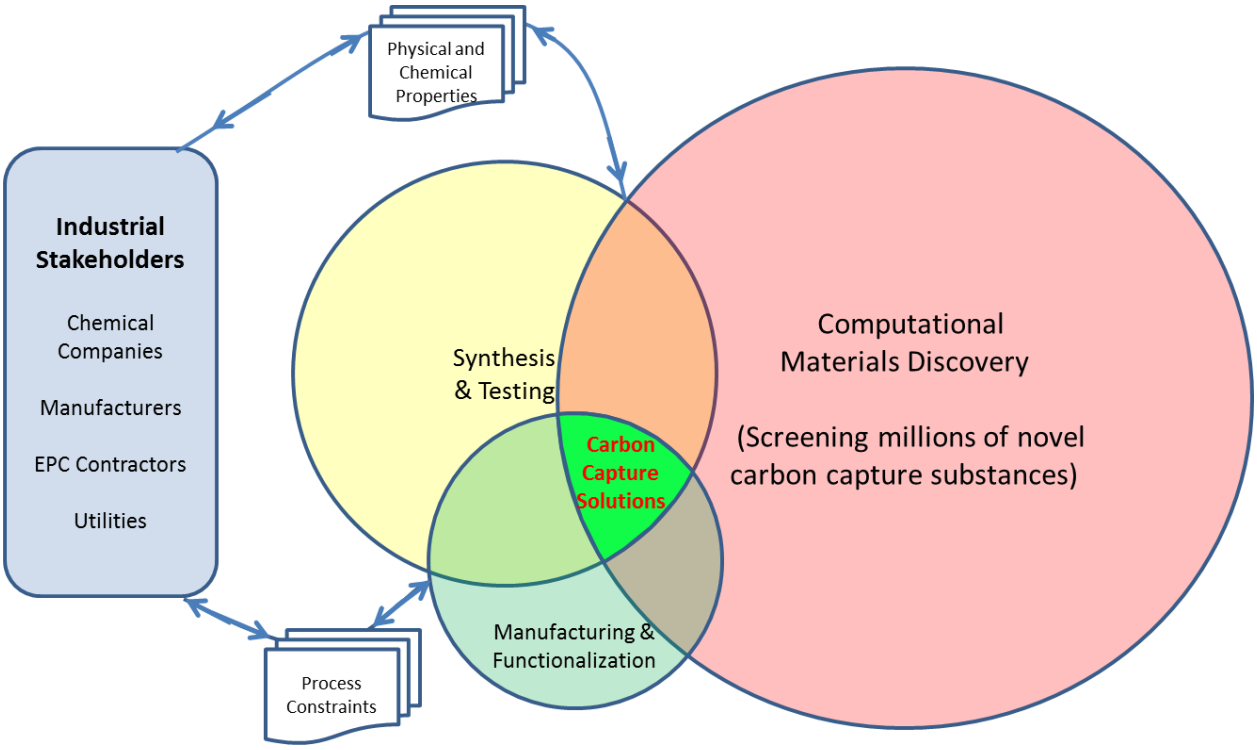

Figure 1. DOCCSS development of materials and advanced capture systems

This initiative will break the traditional paradigm of scientific discovery of materials. Instead, it will implement the strategy of Rational Materials Design (RMD) for carbon capture substances which harnesses the power of advanced computational tools to screen millions of chemicals rather than selecting the best candidate chemical. This RMD for carbon capture substances will facilitate the discovery, synthesis, performance assessment, and functionalization of new carbon capture materials and systems with tailored properties, driven by the requirements of the large-scale process and their integration to commercial facilities.

Success of the DOCCSS initiative will rest on the following critical pillars:

Industrial collaboration. Industry, as the ultimate customers of this effort, will be integrated within the DOCCSS initiative at both the research level for targeted projects and through the business units to ensure relevance of the materials and tools being developed.

Integrated Design Process. The emphasis will be on the multi-directional transfer of knowledge, rather than the more typical top-down, or bottom-up approach. Such an approach to materials design will also allow for the identification, interrogation, and ultimately implementation, of novel structures that are achievable through evolving advanced manufacturing approaches.

Matrixed Research Team. Research teams around key classes of material (e.g. MOFs, polymers, ionic liquids, advanced processes, mixed matrix membranes) will be established from industry, national labs, and universities into key activities that can functionalize these materials into solvents, sorbents, membranes, and process equipment for commercial application.

Synthesis and Experimental Validation. Leverage facilities at the national labs that are focused on batch syntheses and rapid screening of material to validate candidates for functionalization. DOCCSS will leverage experiments along the development continuum to validate the predictions within the virtual framework.

Smart Data. Data generated within the effort, as well as data existing across the scientific community, will be compiled and housed on NETL's Energy Data eXchange (EDX) (https://edx.netl.doe.gov/). This system has the capability to protect data and maintain IP integrity. This database, encompassing multi-scale knowledge, will promote the prediction of materials design through informatics, artificial intelligence, and data mining.

Intellectual Property Protection. Protect the technology developed within the Consortium to provide a strong intellectual property position for licensees, using existing models such as those from CCSI and other Office of Science and academic initiatives.

Areas considered outside the scope of this Lab Call, and will be considered non-responsive include, but are not limited to:

- Pre-combustion CO_2 capture technologies
- Technology field testing
- CO_2 use and conversion technologies
- Oxy-combustion and chemical looping
- CO_2 transport, storage, and/or enhanced oil recovery (EOR)
- Co-firing of biomass
- Biological capture of CO_2
- Use of renewable (e.g. solar, wind, etc.) or nuclear energy as an alternative or replacement power source

C. OBJECTIVE

The objective of this Laboratory Call is to conduct research leading to the development of Transformational Carbon Capture materials and systems that will be available for demonstration by 2025. The new materials and systems will enable DOE to accomplish its goal for Transformational Carbon Capture Technologies that can capture 90% of emitted carbon dioxide (CO_2) with at least 95% CO_2 purity for less than $40/tonne. In addition to materials development, the DOE National Laboratories will have to demonstrate their computational capability, high throughput synthesis and testing that will facilitate and possibly accelerate their proposed platforms.

The laboratories selected from this lab call will also be part of a *Discovery of Carbon Capture Substances and Systems Initiative* (DOCCSS) network which will collaborate on activities to accelerate the rate at which novel materials are commercialized. Similar to previous efforts such as the Carbon Capture Simulation Initiative, it is envisioned that NETL will collaborate and coordinate the activities between a network of DOCCSS laboratories. The first year of this effort will focus on capacity building between the national laboratories, industry and academia, development of IP management strategies, and team arrangements between DOE, selected laboratories, and projects selected through future funding opportunity

announcements (FOA). It is envisioned that a workshop(s) will be conducted to introduce the National Laboratories to the industrial partners that might be interested in partnering with any future FOAs.

This DOCCSS network of national laboratories will be expected to complement and enhance future FOAs that, starting in Fiscal Year (FY) 2017, will be soliciting projects from businesses, such as engineering procurement construction (EPC) companies, which deploy commercially available technologies. The anticipated FY2017 FOA will seek to bring together these companies with the National Labs that are selected as a result of this lab call to provide process designs and ultimately systems for the new material platforms that are developed from this lab call. In a step toward accomplishing this vision, DOE's Carbon Capture program requests proposals that address one of the four (4) platforms.

D. AREAS OF INTEREST

Laboratories should prepare and submit proposals as follows:

- Laboratories may submit more than one proposal; however, the Laboratory must target only one Area of Interest per proposal. Laboratories must submit their proposal under the Area of Interest that they feel best fits the majority of the effort to be performed, and the proposal must clearly identify the Area of Interest being addressed. If the DOE believes a proposal fits more appropriately in an Area of Interest other than the one to which it was submitted, DOE will evaluate the proposal under the more appropriate Area of Interest.

- Laboratories should not submit identical proposals under more than one Area of Interest. As DOE will evaluate the proposal under the most appropriate Area of Interest and all duplicates will be considered nonresponsive and ineligible for award.

Proposals are sought for the following Areas of Interests (AOI):

- **AOI-1 Sorbent Materials –** Engineered sorbents at the atomic level that can be appended with an amine or other functional groups that offer the potential to increase loading capacity and create sorbents with targeted regeneration temperature and pressure conditions that act like a "switch" between absorption and regeneration. Advances in structured sorbents can also increase reactive area, control flow patterns, and reduce pressure drop versus standard packed bed or moving-bed systems.

- **AOI-2 Membrane Materials -** Membranes with very high permeability and selectivity are possible with engineered membranes that incorporate polymeric potting materials with selective/active materials (zeolites, ionic liquids, polymers etc.) that can facilitate transport and increase selectivity while resisting the deleterious effects of contaminants such as sulfur and nitrogen compounds.

- **AOI-3 Non-Aqueous Solvents –** Materials that exhibit higher loading capacities and viscosity, while lowering the regeneration energy and capital costs of the capture systems. Additional efforts are needed to optimize these materials and the processes to utilize them.

- **AOI-4 Other –** Unique materials that do not align with material platform areas 1-3. Additional efforts are needed to optimize these materials and the processes to utilize them.

SECTION II – AWARD INFORMATION

A. TYPE OF AWARD INSTRUMENT

DOE anticipates providing DOE funding for selected projects within the DOE National Laboratory Complex. Any project awarded as a result of the Research Call will be processed through DOE as a Field Work Proposal (FWP) or any other allowable method deemed appropriate by the Government.

B. ESTIMATED FUNDING

Approximately $2.0 million is expected to be available for awards under this Research Call. The Government reserves the right to fund the proposed Government share, in whole or in part, on any, all, or none of the proposals submitted in response to this Research Call for Proposals and will award that number of FWPs which is in the best interest of the Government.

C. EXPECTED NUMBER OF AWARDS

DOE expects to make up to 4 awards under this Research Call. The Government reserves the right to fund, in whole or in part, any, all or none of the proposals submitted in response to this Research Call and will award the number of FWPs which is in the best interest of the Government.

D. ANTICIPATED AWARD SIZE

DOE anticipates that it will issue up to four (4) awards up to $500,000 per award for the first year with options to continue these efforts up to $1,000,000 per year for an additional 3 years. Only the first year of work will be funded at this time, and additional funding is contingent upon the availability of appropriated funds and progress towards meeting the objectives of the award.

E. PERIOD OF PERFORMANCE

DOE anticipates making awards within 90 days from the date of the release of the Research Call with an anticipated performance period of up to 4 years.

F. TYPE OF PROPOSAL

DOE will accept only new proposals under this Lab Call and not any request for renewal of a current project.

SECTION III – ELIGIBILITY INFORMATION

A. ELIGIBLE OFFERORS

Only DOE National Laboratories are eligible to apply for funding under a prime award.

NETL is not considered eligible for an award under this research call.

For-profit entities, educational institutions, and non-profits that are incorporated (or otherwise formed) under the laws of a particular State or territory of the United States are not eligible to apply for funding as a prime or subaward under this research call.

State, local, and tribal government entities are not eligible to apply for funding only under a subaward.

Foreign entities, whether for-profit or otherwise, are not eligible to apply for funding under this research call.

SECTION IV – PROPOSAL AND SUBMISSION INFORMATION

A. SUBMISSION INSTRUCTIONS

Proposals shall be submitted electronically to the following email address (DOCCSS.LabCall@netl.doe.gov**) no later than December 05, 2016 at 11:59:59 PM Eastern Daylight Time.**

B. LATE PROPOSALS, AMENDMENTS AND WITHDRAWALS OF PROPOSALS

A proposal or amendment of a proposal shall be considered timely if it is received on or before the closing date indicated above. Proposals or amendments of proposals may be withdrawn by written notice from an authorized representative to the above address via e-mail.

A second proposal or amendment may then be submitted. The second or subsequent proposal must be submitted before the closing date to be considered. In the event that two or more proposals are received for the same project with the same title, the proposal with the latest postmark will be considered for review. Therefore, it is important that you not merely make page changes and re-submit portions of the proposal that are amended. A complete amended proposal must be sent.

Proposals or amendments received after the closing date will not be considered.

SECTION V – PROPOSAL PREPARATION

1. Submit the following files with your proposal.

1A. Project Narrative File – (File name: Narrative.pdf)

The Project Narrative must not exceed 15 pages double-spaced to address Merit Review Criteria 1, 2 (excluding Project Management Plan, "PMP"), and 3, including cover page, table of contents, 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) with font not smaller than **11 point**. EVALUATORS WILL REVIEW ONLY THE NUMBER OF PAGES SPECIFIED IN THE PRECEDING SENTENCE. Do not include any Internet addresses (URLs) that provide information necessary to review the proposal. See Part VIII.D for instructions on how to mark proprietary proposal information. Save the information in a single file named "Narrative.pdf".

Appendices to the Project Narrative are to be utilized to validate information within the Project Narrative, as appropriate, and shall not be utilized as an extension for information requested to be addressed in the narrative. The font must not be smaller than 11 point. Information in the appendices **WILL NOT** count toward the **15 page limit** of the Project Narrative.

Proposals submitted in response to this Research Call will be evaluated and scored in accordance with the Merit Review Criteria (MRC – see Section VI.A.2. of this Research Call) and the corresponding weights listed with each:

MRC 1. Project Impact (50%) [Recommended 5 pages]
MRC 2. Technical Approach and Project Management (40%) [Recommended 7 pages]
MRC 3. Collaboration (10%) [Recommended 3 pages]

The project narrative file **must** include:

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

-**Relevance and Outcomes/Impacts**: This section shall explain the relevance of the effort to the objectives in the Research Call and the expected outcomes and/or impacts.

-**Merit Review Criterion Discussion**: The section should be formatted to address each of the merit review criterion and sub-criterion listed in Section VI.A. Provide sufficient information so that reviewers will be able to evaluate the proposal in accordance with these merit review criteria. The MRC are to be delineated as Sections MRC-1, MRC-2, and MRC-3 of the Project Narrative. DOE WILL EVALUATE AND CONSIDER ONLY THOSE PROPOSALS THAT ADDRESS SEPARATELY EACH MERIT REVIEW CRITERION AND SUB-CRITERION IN THEIR RESPECTIVE PROJECT NARRATIVE SECTIONS AND THE STAND-ALONE PROJECT MANAGEMENT PLAN (PMP). Each Project Narrative section is to contain a thorough discussion of the respective sub-criterion and requested information per chosen Area of Interest and the Area of Interest referenced Attachments. (**NOTE: Sub-criterion MRC-2 relates to the stand alone PMP with Statement of Project Objectives (SOPO) and Data Management Plan (DMP). The Applicant's response is to ensure that this sub-criterion is addressed in the PMP and SOPO when completing per the format prescribed within this Research Call.**) Proposals that avoid

substantial discussion of the requested information by utilization of references to other publications, Project Narrative appendices, and attachments outside the Project Narrative (except the PMP) will be judged non-responsive to the criterion. Referenced publications, Project Narrative appendices, and attachments are to be supplied to validate the discussion. Numerical values provided shall be expressed in *Système International* (SI) units unless otherwise noted.

Narrative Appendices

- **Bibliography and References Cited Appendix:** 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. 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. In order to reduce the number of files attached to your application, please provide the Bibliography and References Cited information as an appendix to your project narrative. This appendix will not count in the project narrative page limitation.

- **Facilities & Other Resources Appendix:** This information is used to assess the capability of the labratory resources available to perform the effort proposed. Identify the facilities to be used (e.g., Laboratory, 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. In order to reduce the number of files attached to your application, please provide the Facility and Other Resource information as an appendix to your project narrative. This appendix will not count in the project narrative page limitation.

- **Equipment Appendix:** List major items of equipment already available for this project and, if appropriate identify the location and pertinent capabilities. In order to reduce the number of files attached to your application, please provide the Equipment information as an appendix to your project narrative. This appendix will not count in the project narrative page limitation.

- **Senior/Key Person Appendix:** A senior/key person is any individual who contributes in a substantive, measurable way to the scientific/technical development or execution of the project, whether or not a salary is proposed for this individual. No subrecipients and consultants are permitted in this Research Call. For each senior/key person provide a biographic sketch that does not exceed 2 pages when printed on 8.5" by 11" paper with 1 inch margins (top, bottom, left and right) with the font not smaller than 11 point. This appendix will not count in the project narrative page limitation.

(End of Project Narrative)

1B. Project Management Plan File - Mandatory Other Attachment (File name: PMP.doc)

Project Management Plan

This plan shall be formatted to address the following sections with each section to include the information as described below and shall not exceed **thirty (30) pages** in length. Save this

information in a file named "PMP.doc".

Title Page:

PROJECT MANAGEMENT PLAN
{Date Prepared}

SUBMITTED UNDER RESEARCH CALL TO DOE LABORATORIES

Fiscal Year 2017
Technical Support for DOCCSS –
Discovery of Carbon Capture Substances and Systems Initiative:
Changing the paradigm to deliver real material solutions

"TITLE OF PROPOSAL"

SUBMITTED BY

{Laboratory Name}
{Laboratory Address}
{City, State, Zip Code}

PRINCIPAL INVESTIGATOR

{Name}
{Phone Number}
{E-mail}

SUBMITTED TO

U.S. Department of Energy
Office of Fossil Energy
National Energy Technology Laboratory

(End of Title Page)

TABLE OF CONTENTS

1. EXECUTIVE SUMMARY

The proposal shall contain a description of the project that includes the objective, project goals and measurable expected results. The summary should also include a succinct project background and project rationale. In reference to a proposal in response to a Research Call, this information should be a summary of the pertinent information that is generally included in the Project Narrative, so that the PMP is a stand-alone document.

2. ORGANIZATIONAL STRUCTURE AND MANAGEMENT

The proposal shall contain information showing the entity (DOE National Laboratory and its internal business units), relationships, roles (referenced to Statement of Project Objectives Tasks) and lead

personnel for the project team. Specifically identify key personnel, defined as that personnel deemed critical to project success. Describe how staffing and resource assignments will be managed during ramp-up at project start, as well as be managed throughout the project life, to support accomplishment of project objectives on schedule and within the planned expenditure of funds. The DOE Laboratory shall provide the following:

- A discussion of how the organizational structure will facilitate the performance of the tasks described in the Statement of Project Objectives, including the Project Management activities of monitoring and controlling project scope, cost, schedule and risk
- A description of which elements of the laboratory is responsible for the individual tasks
- A discussion of how communication and decision-making will occur within the context of the laboratory structure
- A discussion of how intellectual property issues will be addressed within the context of the laboratory structure
- Organizational chart and sub-organizational charts to illustrate the above

3. RISK MANAGEMENT

The proposal shall contain a summary description of the proposed approach to identify, analyze, and respond to perceived risks associated with the proposed project. Project risk events are uncertain future events that, if realized, impact the success of the project. Since risk is inherent to all projects, regardless of the level of complexity, cost or visibility, project risk must be addressed to the appropriate level for every project. It is recognized that the depth of analysis and the complexity and cost of the resulting risk management approach (and plan) will differ from project to project and among laboratories.

As a minimum, the proposal should contain sufficient information to demonstrate an appropriate approach to managing risks during project execution. This must include the initial identification of significant technical, resource and management issues that have the potential to impede project progress and strategies to minimize impacts from those issues. The tabular format is provided in Table 1with the expectations that a minimum of 3 risks will be identified for each category. For fundamental research and modeling studies, it is anticipated that risks would focus on technical uncertainties that are the result of this type of work.

Table 1 – Project Risks and Mitigation Strategies

Description of Risk	Probability (Low, Moderate, High)	Impact (Low, Moderate, High)	Risk Management Mitigation and Response Strategies
Technical Risks:			
Resource Risks:			
Management Risks:			

4. PROJECT TIMELINE AND MILESTONES

Project Timeline

The proposal shall contain a timeline of the project broken down by each task and subtask, as described in the Statement of Project Objectives. The resulting figure (see Figure 1) shall include:

- A timeline of the project identifying each task and subtask per the outline provided by the Laboratory's Statement of Project Objectives.
- The start date and end date for each task and subtask in a column next to the task list of the timeline. All tasks and subtasks shall be completed within the fiscal year in which initiated, except Task 1, Project Management and Planning. If the time required to complete the activities within a task exceeds 9 months, additional definition of this task through the use of subtasks is expected.
- The total cost of each task in a column next to the task start date and end date column.
- The team members participating on the task/subtask.
- The interdependencies between tasks, as appropriate.
- The milestones that are identified in the Milestone Log (*see below*).

It is highly recommended that the Laboratory consider using a commercial software package to generate the timeline as a Gantt chart or other applicable format. Figure 2 provides an example of an appropriate format for the project timeline.

Figure 2 – Project Timeline

The example below is for a hypothetical project with total project costs of $3.5 million over four fiscal years. Performance periods should not exceed a fiscal year (October 1 thru September 30).

				Fiscal Year 1			Fiscal Year 2				Fiscal Year 3				Fiscal Year 4			
				01/01/17 - 09/30/17			10/01/17 - 09/30/18				10/01/18 - 09/30/19				10/01/19 - 09/30/20			
	Start Date	End Date	Cost	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15
Task 1.0 - Project Management and Planning	1/1/2017	9/30/2020	$200,000															
Subtask 1.1 - Project Management and Plann	1/1/2017	9/30/2020																
Subtask 1.2 - Briefings and Reports	1/1/2017	9/30/2020																
Milestones																		
- List milestone here																		
- List milestone here																		
Task 2.0 - Descriptive Title	1/1/2017	9/30/2017	$450,000															
Subtask 2.1 - Descriptive Title	1/1/2017	6/30/2017																
Subtask 2.2 - Descriptive Title	3/31/2017	9/30/2017																
Milestones																		
- List milestone here																		
- List milestone here																		
Task 3.0 - Descriptive Title	10/1/2017	9/30/2018	$950,000															
Subtask 3.1 - Descriptive Title	10/1/2017	6/30/2018																
Subtask 3.2 - Descriptive Title	3/31/2018	9/30/2018																
Milestones																		
- List milestone here																		
- List milestone here																		
Task 4.0 - Descriptive Title	10/1/2018	9/30/2019	$950,000															
Subtask 4.1 - Descriptive Title	10/1/2018	3/31/2019																
Subtask 4.2 - Descriptive Title	1/1/2019	9/30/2019																
Milestones																		
- List milestone here																		
- List milestone here																		
Task 5.0 - Descriptive Title	10/1/2019	9/30/2020	$950,000															
Subtask 5.1 - Descriptive Title	10/1/2019	12/31/2019																
Subtask 5.2 - Descriptive Title	1/1/2020	9/30/2020																
Milestones																		
- List milestone here																		
- List milestone here																		

Milestone Log

The proposal shall contain a milestone log with a minimum of two milestones for each fiscal year of the project. Each milestone is to include a title, planned completion date and a description of the method/process/measure used to verify completion. The milestones developed should be quantitative and show progression towards the project goals. At the time of award negotiations, a suite of milestones sufficient to adequately assess progress shall be developed cooperatively by the Laboratory and the DOE Federal Project Manager.

Milestones are different than success criteria (Section 6) in that milestones typically show progress through the execution of the project, whereas success criteria are used by the DOE to determine if specific goals were met during the project execution.

The format for the Milestone Log is shown in Table 2. The Milestone Log shall include the milestones shown below, in addition to the milestones developed in the proposal. The proposal shall report progress against the Milestone Log in the Progress Reports submitted quarterly and annually, throughout the duration of the award.

Table 2 – Milestone Log

Fiscal Year	ID	Task Number	Description	Planned Completion Date	Actual Completion Date	Verification Method
1	a	1	Updated Project Management Plan	12/31/20XX		Project Management Plan file
1	b	1	Kickoff Meeting	01/30/20XX		Presentation file

5. FUNDING AND COSTING PROFILES

Project Funding Profile

The proposal shall contain a Project Funding Profile table that shows, by fiscal year, the amount of government funding going to the Laboratory. The table shall also calculate totals. An example Project Funding Profile is provided in Table 3.

Project Costing Profile

The proposal shall contain two Project Costing Profile tables (e.g. see Tables 4 and 5). In the first profile, the Laboratory shall provide a table that projects, by quarter, the expenditure of government funds for the project.

While it is recognized that a detailed quarterly costing profile is less certain for subsequent fiscal years, as the appropriate allocation of available resources among the specific Statement of Project Objectives tasks is dependent on the results of the yet to be completed RD&D approach, the Laboratory needs to estimate the quarterly costing profile for subsequent fiscal years to the extent practical. The quarterly costing profile

shall be updated as necessary at the beginning of each fiscal year. An example quarterly project costing profile is provided in Table 4.

The Laboratory shall report against the quarterly project costing profile in the Research Performance Progress Reports submitted quarterly, throughout the duration of the award.

In the second profile, the Laboratory shall provide a table that projects, by fiscal year, the expenditure of government funds for the Laboratory. An example fiscal year project costing profile is provided in Table 5.

Additional Guidance Regarding Funding and Costing Profiles

Funding and costing profiles shall reflect the project needs based on the timing of the scope of work.

For large, complex projects, additional project funding and costing profile detail may be needed. For example, it may be necessary for the Laboratory to provide the project funding profile and project costing profile information for each Task within the Statement of Project Objectives. The need for additional project funding and costing profile detail will be determined on a project-by-project basis by the Federal Project Manager and the cognizant Supervisor.

The PMP shall be revised to update the information in these tables ONLY at the time of award or in the event of amendments or modifications to the award that affect the project budget. Table 3 – "Project Funding Profile" and Table 4 – "Project Costing Profile" shall be consistent with the DOE-approved budget for the project at all times.

Table 3 – Project Funding Profile

Example below is for a hypothetical project with total project costs of $3.5 million

	Fiscal Year 1 1/1/2017 - 09/30/2017	Fiscal Year 2 10/01/2017 -09/30/2018	Fiscal Year 3 10/01/2018 -09/30/2019	Fiscal Year 4 10/01/2019 -09/30/2020	Total Project 1/01/2017 -09/30/2020
	Government Share	Government Share	Government Share	Government Share	Government Share
Laboratory	$500,000	$1,000,000	$1,000,000	$1,000,000	$3,500,000
Total	$500,000	$1,000,000	$1,000,000	$1,000,000	$3,500,000

Table 4 – Quarterly Project Costing Profile

The example below is a hypothetical project with total project costs of $3.5 million with four fiscal years of 3, 4, 4, and 4 quarters respectively.

	Fiscal Year 1					
	1/1/17 – 03/31/17		4/1/17 – 6/30/17		7/1/17 – 9/30/17	
	Q1	Total Project	Q2	Total Project	Q3	Total Project
Federal Share	$150,000	$150,000	$200,000	$350,000	$150,000	$500,000
Total Planned	$150,000	$150,000	$200,000	$350,000	$150,000	$500,000

	10/1/17 – 12/31/17		1/1/18 – 3/31/18		4/1/18 – 6/30/18		
	Q4	Total Project	Q5	Total Project	Q6	Total Project	Q7
Federal Share	$150,000	$650,000	$350,000	$1,000,000	$250,000	$1,250,000	$250,000
Total Planned	$150,000	$650,000	$350,000	$1,000,000	$250,000	$1,250,000	$250,000

	10/1/18 – 12/31/18		1/1/19 – 3/31/19		4/1/19 – 6/30/19		
	Q8	Total Project	Q9	Total Project	Q10	Total Project	Q11
Federal Share	$150,000	$1,650,000	$350,000	$2,000,000	$250,000	$2,250,000	$250,000
Total Planned	$150,000	$1,650,000	$350,000	$2,000,000	$250,000	$1,250,000	$250,000

	Fiscal Year 4							
	10/1/19 – 12/31/19		1/1/20 – 3/31/20		4/1/18 – 6/30/20		7/1/18 – 9/30/20	
	Q12	Total Project	Q13	Total Project	Q14	Total Project	Q15	Total Project
Federal Share	$150,000	$2,650,000	$350,000	$3,000,000	$250,000	$3,250,000	$250,000	$3,500,000
Total Planned	$150,000	$2,650,000	$350,000	$3,000,000	$250,000	$3,250,000	$250,000	$3,500,000

Table 5 – Fiscal Year Project Costing Profile

Planned Costs Fiscal Year	Fiscal Year (year in which the cost will be incurred, not appropriated)	Performing Organization	Planned Costs
			Federal Share
1	FY2017	Laboratory	$500,000
2	FY2018	Laboratory	$1,000,000
3	FY2019	Laboratory	$1,000,000
4	FY2020	Laboratory	$1,000,000

6. SUCCESS CRITERIA AND DECISION POINTS

The proposal shall contain success criteria for each fiscal year of the project. The success criteria shall be objective and stated in terms of specific, measurable, and repeatable data. Usually, the success criteria pertain to desired outcomes, results, and observations from the R&D efforts. Typically, the expected performance parameters are established with a technical and economic comparison made to the competing technologies or methods.

Table 6 provides the format for identifying success criteria.

Table 6 – Success Criteria

Fiscal Year	Date	Success Criteria

Success Criteria are not deliverables such as reports. Success Criteria are different than milestones (see Section 4) in that milestones typically show progress through the execution of the fiscal year and project, whereas success criteria are used by the DOE to determine if specific goals and objectives were met at fiscal year end dates. Typically, these goals and objectives represent requirements established by the R&D program as evidence of progress in advancing a technology area or scientific/engineering knowledge. The success criteria may be used to assist DOE in deciding whether to proceed to the subsequent fiscal years if required.

7. REVISION HISTORY

This section shall provide the revision history of the Project Management Plan. Each revision shall be accompanied by a detailed explanation and the date of the change. Each revision shall be identified by a new revision letter - the revision letter on the title page shall be incremented accordingly. Examples of reasons for revision include amendments or modifications to the FWP that change the approved budget, project schedule and/or SOPO, changes to the organizational structure, etc. All revisions require the concurrence of the DOE Federal Project Manager. (In practice, the PMP is to be maintained as a Word.doc and all requested changes to this document are to be made via track changes to clearly highlight the modifications requested when delivered to the Federal Project Manager for review and approval.)

PMP APPENDICES

Include the following documents as appendices to the Project Management Plan (included in recommended 30 page limit of PMP):

- Appendix A - Statement of Project Objectives (SOPO)
- Appendix B - Data Management Plan (DMP)

Appendix A: Statement of Project Objectives

The Department of Energy's National Energy Technology Laboratory uses a specific format for Statement of Project Objectives (SOPO) in its awards. In research calls such as this one, where the Government does not provide a SOPO, the Laboratory is to provide one in the following format, which the DOE will then use to generate a stand-alone document to be included in the award.

The SOPO details how the project objectives will be met. The SOPO must contain a clear, concise description of all activities to be completed during project performance and follow the structure discussed below. **The SOPO may be released to the public by DOE in whole or in part at any time.** It is therefore required that it shall **not** contain proprietary or confidential business information.

The SOPO is generally less than 15 pages in total for the proposed work and is included in the recommended 30-page count of the Project Management Plan.

Laboratories shall prepare the SOPO in the following format:

PROJECT TITLE

(Insert the project title. It shall be concise, descriptive, and consistent with that used throughout the proposal process.)

A. OBJECTIVES

Include one paragraph on the overall objective(s) of the work. Also, include objective(s) for each Fiscal Year of the work.

B. SCOPE OF WORK

This section should not exceed one-half page and shall summarize the effort and approach to achieve the objective(s) of the work for each Fiscal Year.

C. TASKS TO BE PERFORMED

This section provides a brief summary in outline form of the planned approach to this project.

Guidelines for developing the Task/Subtask structure are:

- Tasks and subtasks shall include a concisely written summary, provided in a logical sequence that outlines the Technical Approach provided in the Project Narrative and apportioned within the Fiscal Years as appropriate.

- Tasks shall be numbered consecutively throughout the entire duration of the project, starting with Task 1.0 as outlined below.
- Task 1.0, Project Management and Planning, shall be the only task that is active throughout the duration of the project and shall be active in multiple Fiscal Years.
- The duration of a Tasks shall be defined by the logical termination point of project activities (i.e. complete design, construction, shakedown, testing, etc.) such that no task activities (except Task 1.0) are continued into the next Fiscal Year.
- If the time required to complete the activities within a task exceeds 9 months, additional definition of this task through the use of subtasks is expected.

Task 1.0 – Project Management and Planning

(THIS TASK IS MANDATORY AND MUST ADDRESS THE FOLLOWING)

This Task shall include the necessary activities to ensure coordination and planning of the project with DOE/NETL and other project participants. These activities shall include, but are not limited to, the monitoring and controlling of project scope, cost, schedule, and risk, and the submission and approval of required National Environmental Policy Act (NEPA) documentation.

[Note: The project is restricted from taking any action using Federal funds, which would have an adverse effect on the environment or limits the choice of reasonable alternatives prior to DOE providing final NEPA decision regarding this project.]

This Task shall also include all work elements required to maintain and revise the Project Management Plan, and to manage and report on activities in accordance with the plan.

[Note: Successful Laboratories shall revise the version of the Project Management Plan that is submitted with their proposal by including details from the negotiation process and through consultation with the Federal Project Officer. This Project Management Plan will be updated by the Laboratory as the project progresses, and will report schedule and budget variances against this plan.]

An updated project management plan and data management plan (DMP) shall be submitted within 30 days of the award that include any updates since applying to this research call (e.g. as a result of negotiations, etc.). The DMP will also be updated as needed to reflect significant changes to any aspect of the plan.

Task 2.0 – (Title)

(Description)

Subtask 2.1 – (Title)

(Description)

Subtask 2.2 – (Title)

(Description)

Task 3.0 – (Title)

(Description)

Subtask 3.1 – (Title)

(Description)

Subtask 3.2 – (Title)

(Description)

Task 4.0 – (Title)

(Description)

(Continue with Tasks as necessary)

D. DELIVERABLES

The periodic, topical, and final reports shall be submitted to the Federal Project Manager. The Laboratory will include the following reporting requirements as part of the deliverables list.

- Quarterly Reports.
- Fiscal Year Report.
- Comprehensive Final Report.

[Note: The Laboratory shall provide a list of deliverables other than those identified above that will be delivered. These reports shall also be identified within the text of the Statement of Project Objectives.

E. BRIEFINGS/TECHNICAL PRESENTATIONS (INSERT THE FOLLOWING INTO THE SOPO)

The Laboratory shall prepare detailed briefings for presentation to the Project Officer at the Project Officer's facility located in Pittsburgh, PA or Morgantown, WV. The Laboratory shall make a presentation to the NETL Project Officer/Manager at a project kick-off meeting held within 90 days of project start date. Annual briefings shall also be given by the Laboratory to explain the plans, progress, and results of the technical effort. A final project briefing at the close of the project shall also be given. The Laboratory shall also complete a minimum of one presentation at a National Conference, which may be defined by the Project Officer as the NETL Carbon Capture Technology Meeting. [Note: As the first task in the Statement of Project Objectives, successful Laboratories will revise the version of the Project Management Plan that is submitted with their proposals by including details from the negotiation process. This Project Management Plan will be updated by the Laboratory as the project progresses, and the Laboratory must use this plan to report schedule and budget variances.]

*****ENDING OF FORMAT FOR SOPO*****

(End of SOPO)

Appendix B: Data Management Plan

DATA MANAGEMENT PLAN

The Data Management Plan must not exceed six (6) pages when printed using standard 8.5" by 11" paper with 1-inch margins (top, bottom, left, and right) single spaced. EVALUATORS WILL REVIEW ONLY THE NUMBER OF PAGES SPECIFIED IN THE PRECEDING SENTENCE. The font must not be smaller than 11 point. Do not include any Internet addresses (URLs) that provide information necessary to review the proposal. See Part VIII.D for instructions on how to mark proprietary proposal information.

Laboratories are required to submit a Data Management Plan with their Full Proposal. The Data Management Plan outlines the proposed plan for data sharing or preservation. Guidance for preparing a Data Management Plan is included in Attachment 1 of the Research Call.

In addition to the guidelines set forth in Attachment 1, the Data Management Plan should include: (1) a description of the types of data that will be generated under this project, (2) a description of the types of data that will be made publically available, and (3) a description of any restrictions that will be placed on the data. If software is anticipated to be developed under the award, the Data Management Plan should also include a plan for its distribution (e.g., open source or commercial licensing).

(End of DMP)

(End of Project Management Plan)

Budget for DOE/NNSA Federally Funded Research and Development Center (FFRDC) Contractor, if applicable

A DOE/NNSA FFRDC contractor performing work must provide a DOE Field Work Proposal in accordance with the requirements in DOE Order 412.1 Work Authorization System. This order and the DOE Field Work Proposal form are available at https://www.directives.doe.gov/directives-documents/0412.1-BOrder-A-admchg1. Use the FFRDC name as the file name (up to 10 letters) and attach to the email with the other documents required.

Budget Justification

Provide the required supporting information for the following costs (See R&R instructions): equipment; domestic and foreign travel; participant/trainees; material 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. The file automatically carries over to each fiscal year.

Laboratories shall use the Detailed Budget Justification form (OMB Number 1910-5162) provided as an attachment to this Research Call and also embedded below. Save the information in a single file named "LaboratoryBudgetJustification.xls or xlsx".

OMB Form
1910-5162 RecipientB

SECTION VI – PROPOSAL REVIEW INFORMATION

A. CRITERIA

1. Initial Review Criteria

Prior to a comprehensive merit evaluation, DOE will perform an initial review to determine that (1) the applicant is eligible for an award; (2) the information required by the Research Call has been submitted; and (3) the proposal is responsive to the objectives of this Research Call and addresses one of the specified Areas of Interest (AOI). Proposals 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

Proposals submitted in response to this Research Call will be evaluated and scored in accordance with the criteria and weights listed below:

Criterion 1: Project Impact (50%)

This criterion will evaluate the degree to which the proposed technology will impact Transformational carbon capture in terms of uniqueness and the ability to meet DOE's goals of <$40/tonne of CO_2 captured.

- Significance of the benefits and impact of the proposed technology compared to current 2nd Generation Technologies.
- Feasibility that the proposed technology or product is truly Transformational in nature and will address the need or problem.
- Extent to which the benefits and impact of anticipated performance improvements, including technical, operational and environmental performance: cost savings; societal benefits; and the potential for the project to meet or exceed the DOE program goals or program vision.
- Capability of the proposing organization in terms of material and computational capability.

Criterion 2: Technical Approach and Project Management (40%)

This criterion will evaluate the approach taken by the Laboratory and the degree to which the proposed technology or methodology meets the stated objectives of the Research Call:

- Soundness of the proposed approach and likelihood of success as demonstrated through scientific or engineering merit of the proposed approach.
- Reasonableness and completeness of the proposed Statement of Project Objectives (SOPO) to achieve project objectives and measure success.

- Degree to which the Laboratory understands the amount of development necessary for their material platform prior to engaging with industry/vendor to accelerate development.
- Adequacy, appropriateness, and reasonableness of the budget. This includes the labor distribution, purchases, and effort by work breakdown budget structure to accomplish the stated objectives.
- Degree to which the Laboratory demonstrates sound management principles, and plans for project oversight in the Project Management Plan (PMP) to achieve the project objectives on time and within budget.

Criterion 3: Collaboration (10%)

This criterion will evaluate the degree to which the Laboratory builds on past efforts and collaborations to achieve the best possible outcomes at the best value for the government including**.**

- Effectiveness of the proposed strategic approach to establish a partnership with industry and vendors for collaborations.
- Extent to which the Laboratory's approach would lead to dissemination of lessons learned and foster collaboration with entities not immediately involved with the project.
- Degree to which the Laboratory understands what types of industry/vendor they need to interact with in order to accelerate development of their material platform.
- Degree to which the Laboratory has had any previous interaction with industry/vendor discussing their material platforms. Degree to which interest in collaboration to the proposed project is demonstrated by including letters of intent from all proposed team members.

SECTION VII - QUESTIONS/AGENCY CONTACTS

A. QUESTIONS

Questions regarding the content of the Research Call must be submitted by email to *DOCCSS.LabCall@netl.doe.gov* .

Questions and comments concerning this Research Call shall be submitted not later than fourteen (14) calendar days prior to the proposal due date. Questions submitted after that date may not allow the Government sufficient time to respond.

B. AGENCY CONTACT

Name: José D. Figueroa
E-mail: ***DOCCSS.LabCall@netl.doe.gov***

As stated in paragraph A, questions must be submitted through ***DOCCSS.LabCall@netl.doe.gov***, as appropriate, and shall **not** be submitted to the Agency Contact. If questions are submitted directly to the Agency Contact, he will advise the interested party to submit the question via the appropriate portal and will not respond to questions via email.

SECTION VIII - OTHER INFORMATION

A. MODIFICATIONS

Notices of any modifications to this Lab Call will be posted on the NETL Business website. There will be no email notifications when a modification or an announcement message is posted. Therefore, it is recommended that you visit the NETL website regularly to ensure you respond to the latest version of this Research Call.

B. GOVERNMENT RIGHT TO REJECT OR NEGOTIATE

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

C. COMMITMENT OF PUBLIC FUNDS

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

D. PROPRIETARY PROPOSAL INFORMATION

Patentable ideas, trade secrets, proprietary or confidential commercial or financial information, the disclosure of which may harm the Laboratory, should be included in a proposal 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 proposal which are to be restricted:

"The data contained in pages [*Insert pages*] of this proposal 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 Laboratory receives an award as a result of or in connection with the submission of this proposal, 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 Laboratory."

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 Laboratory) requests not be released to persons outside the Government, except for purposes of review and evaluation."

Laboratories shall NOT identify the entire Project Narrative as proprietary and shall only identify those specific pages and lines that do indeed contain proprietary information.

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 Laboratory t, by submitting its proposal, consents to the use of non-Federal reviewers/administrators. Non-Federal reviewers must sign a conflict of interest and non-disclosure agreements prior to reviewing a proposal. Non-Federal personnel conducting administrative activities must sign a non-disclosure agreement.

ATTACHMENT 1 – Data Management Plan (DMP) Instructions

A data management plan (DMP) explains how data generated in the course of the work performed under this award will be shared and preserved or, when justified, explains why data sharing or preservation is not possible or scientifically appropriate.

DMP Requirements

In order for a DMP to be considered acceptable, the DMP must address the following:

At a minimum, the DMP must describe how data sharing and preservation will enable validation of the results from the proposed work, or how results could be validated if data are not shared or preserved.

The DMP must provide a plan for making all research data displayed in publications resulting from the proposed work digitally accessible 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 in accordance with the principles stated above. 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.

The DMP should consult and reference available information about data management resources to be used in the course of the proposed work. In particular, a DMP that explicitly or implicitly commits 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 DOE 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 DOE facilities can be found in the additional guidance from the sponsoring program.

The DMP must protect confidentiality, personal privacy, Personally Identifiable Information, and U.S. national, homeland, and economic security (e.g., protected critical infrastructure information -- PCII); 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 laws (e.g., export control laws), and DOE regulations, orders, and policies.

Data Determination for a DMP

The Principal Investigators from the Laboratories should determine which data should be the subject of the DMP and, in the DMP, propose which data should be shared and/or preserved in accordance with the DMP Requirements noted above.

For data that will be generated through the course of the proposed work, the Principal Investigator should indicate what types of data should be protected from immediate public disclosure by DOE (referred to as "protected data") and what types of data that DOE should be able to release immediately (referred to as "unlimited rights data"). Similarly, for proprietary data developed outside of the proposed work at private expense that will be used in the course of the proposed work (referred to as "limited rights data"), the Principal Investigator should indicate whether that type of data will be subject to public release or kept confidential. Any use of limited rights data

or labeling of data as "protected data" must be consistent with the DMP Requirements noted above.

Suggested Elements for a DMP

The following list of elements for a DMP provides suggestions regarding the data management planning process and the structure of the DMP:

- Data Types and Sources: A brief, high-level description of the data to be generated or used through the course of the proposed work and which of these are considered digital research data necessary to validate the research findings or results.

- Content and Format: A statement of plans for data and metadata content and format including, where applicable, a description of documentation plans, annotation of relevant software, and the rationale for the selection of appropriate standards.

  Existing, accepted community standards should be used where possible. Where community standards are missing or inadequate, the DMP could propose alternate strategies for facilitating sharing and should advise the sponsoring program of any need to develop or generalize standards.

- Sharing and Preservation: A description of the plans for data sharing and preservation. This should include, when appropriate: the anticipated means for sharing and the rationale for any restrictions on who may access the data and under what conditions; a timeline for sharing and preservation that addresses both the minimum length of time the data will be available and any anticipated delay to data access after research findings are published; any special requirements for data sharing, for example, proprietary software needed to access or interpret data, applicable policies, provisions, and licenses for re-use and re-distribution, and for the production of derivatives, including guidance for how data and data products should be cited; any resources and capabilities (equipment, connections, systems, software, expertise, etc.) requested in the research proposal that are needed to meet the stated goals for sharing and preservation (this could reference the relevant section of the associated research proposal and budget request); and whether/where the data will be preserved after direct project funding ends and any plans for the transfer of responsibilities for sharing and preservation.

- Protection: A statement of plans, where appropriate and necessary, to 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; and avoid significant negative impact on innovation, and U.S. competitiveness.

- Rationale: A discussion of the rationale or justification for the proposed data management plan including, for example, the potential impact of the data within the immediate field and in other fields, and any broader societal impact.

Additional Guidance

In determining which data should be shared and preserved, researchers must consider the data needed to validate research findings as described in the Requirements, and are encouraged to consider the potential benefits of their data to their own fields of research, fields other than their

own, and society at large.

DMPs should reflect relevant standards and community best practices and make use of community accepted repositories whenever practicable.

Costs associated with the scope of work and resources articulated in a DMP may be included in the proposed research budget as permitted by the applicable cost principles.

To improve the discoverability of and attribution for datasets created and used in the course of research, DOE encourages the citation of publicly available datasets within the reference section of publications and the identification of datasets with persistent identifiers such as Digital Object Identifiers (DOIs). In most cases, DOE can provide DOIs free of charge for data resulting from DOE-funded research through its Office of Scientific and Technical Information (OSTI) DataID Service.

Definitions

Data Preservation: Data preservation means providing for the usability of data beyond the lifetime of the research activity that generated them.

Data Sharing: Data sharing means making data available to people other than those who have generated them. Examples of data sharing range from bilateral communications with colleagues, to providing free, unrestricted access to anyone through, for example, a web-based platform.

Digital Research Data: The term digital data encompasses a wide variety of information stored in digital form including: experimental, observational, and simulation data; codes, software and algorithms; text; numeric information; images; video; audio; and associated metadata. It also encompasses information in a variety of different forms including raw, processed, and analyzed data, published and archived data.

Research Data: The recorded factual material commonly accepted in the scientific community as necessary to validate research findings, but not any of the following: preliminary analyses, drafts of scientific papers, plans for future research, peer reviews, or communications with colleagues. This 'recorded' material excludes physical objects (e.g., laboratory samples).

> Research data also do not include:
> (A) Trade secrets, commercial information, materials necessary to be held confidential by a researcher until they are published, or similar information which is protected under law; and
>
> (B) Personnel and medical information and similar information the disclosure of which would constitute a clearly unwarranted invasion of personal privacy, such as information that could be used to identify a particular person in a research study.

Validate: In the context of DMPs, 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 new experiment or analyses; or by some other means.