**PROJECT TITLE**

Lead Organization (City, State), Principal Investigator Name,

Technical Category

Total Project Cost

Project Duration

**EXECUTIVE SUMMARY**

Summarize the objective(s) and technical approach of the proposed effort at a technical level appropriate for scientific and engineering peers**.**

**INSTRUCTIONS for Cover Page and Executive Summary Section:**

1. The Project Title should be brief and descriptive of the proposed technology.
2. Identify the most relevant Technical Category for the proposed technology from the “Technical Categories of Interest” in Section I.E of the FOA. Select only one Technical Category unless the FOA specifically allows applications to name multiple categories.
3. Enter the estimated Total Project Cost in U.S. dollars and percentage cost share in parentheses.
4. Enter the Project Duration in months.
5. The Executive Summary shall not exceed 1 page in length.
6. The Executive Summary may contain graphics, figures, or tables as needed to summarize the technical concept.

NOTICE OF RESTRICTION ON DISCLOSURE AND USE OF DATA

*Pages [1 through\_\_] of this document may contain trade secrets or commercial or financial information that is privileged or confidential and exempt from public disclosure. Such information shall be used or disclosed only for evaluation purposes or in accordance with a financial assistance or loan agreement between the submitter and the Government. The Government may use or disclose any information that is not appropriately marked or otherwise restricted, regardless of source.*

**INSTRUCTIONS FOR SECTIONS 1-5:**

**The cumulative length of Sections 1-5 shall not exceed 23 pages.**

**1. INNOVATION AND IMPACT**

Describe how the proposed work offers an innovative approach to achieve the program objectives of the FOA and how it will impact the mission areas of ARPA-E.

**1.1 Overall Description.**

* Describe the conceptual basis for the project and how the proposed technology works with minimal jargon.
* Explain the objective(s) and performance characteristics of the proposed effort.

**1.2 Potential Impact.**

* Clearly identify the problem that is being solved with the proposed technology.
* Explain the project’s potential to be disruptive relative to the existing technology or how the project establishes a basis for new innovations.

Indicate and briefly justify the primary and any secondary technology areas that best describe the proposed concept as described in Section I.E of the FOA. Additionally, describe how the proposed technological innovation, if successful, would affect the impact areas described in Section I.D of the FOA.

|  |  |  |
| --- | --- | --- |
| **Impact Area** | **Effect relative to SOA (positive/negative/neutral)** | **Description or justification** |
| Economics |  |  |
| Existing Infrastructure Utilization |  |  |
| Regulatory Requirements |  |  |
| Resource Utilization |  |  |
| Safeguards and Security |  |  |
| Siting Options and Requirements |  |  |

All proposals must also provide detailed information for all waste and waste streams reasonably anticipated to be generated because of the proposed technology implementation.

* Describe how the proposed effort represents an innovative and potentially transformational solution to the technical challenges posed by the FOA.
* Explain the concept’s potential to be disruptive compared to existing or emerging technologies.
* To the extent possible, provide quantitative metrics in a table that compares the proposed technology concept to current and emerging technologies and to the Technical Performance Targets in Section I.F of the FOA for the appropriate Technology Category in Section I.E of the FOA. Provide any additional information requested for each category as defined in Section I.F of the FOA.

Provide the additional information below for each primary and secondary category.

For technology category 1, provide the information requested in Section I.F.I of the FOA and table I.FI.1.

| **Table I.FI.1: Process Technology Description** | |
| --- | --- |
| **Property** | **Description** |
| Describe proliferation resistance properties |  |
| For each waste stream, on a metric ton of heavy metal (MTHM) processed basis, provide the following information:  •Waste Source or Process Step,  •Waste Type (HLW, LLW, GTCC, etc.),  •Waste Composition (including isotopic and chemical composition),  •Waste Quantity,  •Waste Form (glass, cermet, etc.),  •Waste Form Quantity, and  •Disposition Path (Repository, interim storage, etc.) |  |
| Describe each waste stream and waste form from process, including the NRC-approval state of the waste form, and the need (if any) for the waste form to be co-developed? |  |
| Provide a description of the fuel stock(s) produced |  |
| Estimated commercial scale processing facility capital expenditure (CapEx) and annual Operating and Maintenance (O&M) costs |  |
| Provide scale of facility/modules in units of MT HLW/year. |  |

For technology category 2, provide the information requested in Section I.F.II of the FOA, table I.FII.1, and table I.FII.2 for each measurement used to determine the fissile mass accountancy.

| **Table I.FII.1: System Definition** | |
| --- | --- |
| **Property** | **Description** |
| Process location(s) where sensor is located |  |
| Description of mass accountancy validation (must include realistic sensor data rates, for both signal and backgrounds both from target mass and external sources) |  |
| Latency or throughput of measurement |  |
| Sampling methodology |  |
| Comparison to State-of-the-Art |  |
| Validation Methodology for accuracy determination (including recalibration schedule) |  |
| Scale of technology demonstration to actual operating conditions. |  |
| Estimated Total System Cost |  |
| Schedule for, and cost estimates of, maintenance (include all types of maintenance required, time required for actual servicing, operational or chronological time periods between required maintenance, and any replacement components or consumables needed) |  |
| Mean Time Before Failure (include basis) |  |

| **Table I.FII.2: Measurement Description** | |
| --- | --- |
| **Technology Attribute** | **Description** |
| Allowed gamma flux (part/s/cm2) |  |
| Gamma energy min/max (keV) |  |
| Allowed neutron flux (part/s/cm2) |  |
| Neutron energy min/max (keV) |  |
| Latency (sec) for result |  |
| Operating atmosphere? |  |
| Maximum allowed temperature (C) |  |
| Estimated unit cost ($) |  |
| Estimated annual O&M ($) |  |
| Estimated lifetime (years) |  |

For technology category 3, proved the information requested in Section I.F.III of the FOA and address each of the bullets below.

* Summarize the waste loading capacity of the waste matrix, and briefly describe any limiting factors for consideration (% waste loading capacity)
* Describe the degradation rate of the waste matrix (either fractional dissolution rate or g/m2/yr), including the standard used to determine the rate, the alteration product of the waste matrix, and how radionuclides are immobilized
* For the above enumerated repository (or borehole) types, summarize the significant beneficial or detrimental repository/waste form interactions
* Briefly describe the methodology and results used to determine the waste form’s stability at the likely thermal output from radionuclide inventory
* Briefly describe the methodology and results used to determine the waste form’s stability at the likely radiation output from the radionuclide inventory
* Briefly describe the methodology and results used to determine the waste form’s mechanical stability during pre- and post-emplacement time periods
* Briefly describe the methodology and results used to determine the waste form’s inherent resistance to fire
* Summarize the maturity of the large-scale manufacturing technology associated with the potential scale-up of the proposed technology
* Briefly describe the methodology and results used to determine the unit and total cost estimate for the final product that is suitable for repository emplacement
* Briefly describe the methodology and results used to determine the waste form’s annual O&M cost estimate
* For each waste stream, on a metric ton of heavy metal (MTHM) processed basis, provide the following information:
* Waste Source or Process Step,
* Waste Type (HLW, LLW, GTCC, etc.),
* Waste Composition (including isotopic and chemical composition),
* Waste Quantity,
* Waste Form (glass, cermet, etc.),
* Waste Form Quantity, and
* Disposition Path (Repository, interim storage, etc.)

**1.3 Innovativeness.**

* Describe how the proposed effort represents a new and innovative solution to the overall program challenge described in the FOA.
* Indicate the technical goals and anticipated results, using appropriate metrics, for the project. Provide a description of how the metrics were derived, citing key previous results and/or assumptions.
* Include and discuss, as appropriate, a table in which the targeted performance of the proposed technology is compared with the “Technical Performance Targets” in Section I.F of the FOA and with other competing or emerging technologies that might achieve the FOA Technical Performance Targets.

**INSTRUCTIONS for the Innovation and Impact Section:**

1. The Innovation and Impact Section may include figures, tables, and graphics.
2. The suggested length of the Innovation and Impact Section is 6 pages.

**2. PROPOSED WORK**

Describe and discuss for the proposed effort the technical background and approach, the R&D tasks, and the key technical risks. This Section should justify the proposed approach as being appropriate to achieve the project’s objective(s).

**2.1 Approach.**

* Describe the technical approach and how this approach will achieve the proposed project objective(s).
* Discuss alternative approaches considered, if any, and why the selected approach is most appropriate for the identified objective(s).
* Describe the background, theory, simulation, modeling, experimental data, or other sound engineering and scientific practices or principles that support achieving the project objective(s). Provide specific examples of supporting data and/or appropriate citations to the scientific and technical literature.

**2.2 Technical Risk.**

* Identify potential technical issues and risks, e.g., the approach requires a never-before-demonstrated fabrication technique or greater-than-previously-demonstrated sub-component performance, etc.
* Describe appropriate mitigation techniques and plans, if any, for each identified issue and risk.

**2.3 Schedule.**

* Provide a schedule for the proposed effort by major tasks, including major milestones or Go/No-Go decision points as appropriate. (**A Gantt chart is recommended**.)

**2.4 Task Descriptions.**

* Identify and provide a full technical description for each main task in the proposed effort.
* Discuss the reason the identified tasks are appropriate and sufficient for the identified approach.
* Describe the key technical milestones and how these define the critical path for successful completion of the task.
* Indicate how completion of each task relates to reducing technological uncertainty and achieving the overall project objective(s).

**INSTRUCTIONS for the Proposed Work Section:**

1. The Proposed Work Section may include figures, tables, and graphics.
2. The suggested length of the Proposed Work Section is 9-10 pages.

xxxx-xxxx

**3. TEAM ORGANIZATION AND CAPABILITIES**

Describe and discuss the organization, capabilities, and management of the team and how these enable successful execution of the proposed effort.

**3.1 Organization.**

* Indicate roles and responsibilities of the organizations on the proposed Project Team, e.g., subrecipient, consultant, subcontractor, or lead organization for each of the project tasks. Include relevant organization charts and teaming organization charts, as applicable.
* Identify Key Personnel, describe how their qualifications relate to the proposed effort, and indicate their roles and responsibilities for each of the project tasks.
* Identify previous collaborative efforts among team members if relevant to the proposed effort.

**3.2 Capabilities, Facilities, Equipment, and Information.**

* Identify capabilities of the Applicant or proposed Project Team, e.g., relevant experience, previous or current R&D efforts, or related government or commercial projects that support the proposed effort.
* Identify all required facilities, equipment, and information for the proposed effort and discuss their adequacy and availability.
* Indicate any key equipment that must be fabricated or purchased.

**INSTRUCTIONS for the Team Organization and Capabilities Section:**

1. This Section may include figures, tables, and graphics.
2. The suggested length of the Team Section is 3 to 4 pages.

**4. TECHNOLOGY TO MARKET**

The significant impact sought by ARPA-E depends upon successful projects finding a path to large-scale adoption. ARPA-E projects are not required to achieve commercial deployment by the end of the project period, but the agency asks the Applicant to define a reasonable path for the proposed technology toward commercial adoption.

**4.1 Technology to Market Strategy.**

* Describe how the proposed technology is expected to transition from the lab to commercial deployment, including a description of the eventual product, potential near- and long-term market entries, likely commercialization approach (startup, license, etc.), specific organizations expected to be involved in the transition (partners, customers, etc.), and the commercialization timeline.
* Discuss manufacturing, cost, and scalability risks associated with the technology.
* Describe anticipated resource needs for the next phase of development following the end of the ARPA-E project.
* Explain why the proposed research is not being pursued by industry today.
* Discuss the anticipated roles for the proposed research team in the commercialization of the technology.

**4.2 Intellectual Property.**

* Describe existing intellectual property, if any, that will be used to develop the new intellectual property; and
* Discuss new intellectual property and data that is anticipated to be created as part of this effort, if any.

**INSTRUCTIONS for the Technology to Market Section:**

1. The Technology to Market Section may include figures, tables, and graphics.
2. The suggested length of the Technology to Market Section is 2 pages.

**5. BUDGET**

Indicate the budget, in US dollars, and provide a high-level budget summary, demonstrating that the budget is reasonable and appropriate for the proposed effort.

**5.1 Budget Breakdown.**

Provide in tabular form following the template give below, a breakdown of the project budget by entity and major task in US dollars.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Task Name** | **[Prime]** | **[Sub #1]** | **[Sub #2]** | **[Sub #3]** | **[Sub #4]** | **Total** |
| [Task #1] |  |  |  |  |  |  |
| [Task #2] |  |  |  |  |  |  |
| [Task #3] |  |  |  |  |  |  |
| [Task #4] |  |  |  |  |  |  |
| **Total** |  |  |  |  |  |  |

Replace “Prime” with name of the primary (lead) entity and “Sub #n” with the name of the sub-recipient or sub-contractor entities, if applicable. Task names should clearly correspond to major tasks listed in Section 2.4. Expand or contract the table as needed to add/subtract entities (columns) or tasks (rows).

**5.2 Budget Summary.**

Provide a high-level summary for the project by major budget category, including at least these three:

* Key Personnel and technical staff to be utilized (e.g., scientists, engineers, technicians, postdocs, graduate students, etc.)
* Equipment
* Materials and Supplies

**5.3 Cost Share.**

Provide a description of the cost share by value of the contribution (in dollars) and percentage of the Total Project Cost (TPC):

* List each source of cost share, the type of contribution (cash or in-kind), the value of the contribution (in dollars), and the value as a percentage of TPC.
* For all in-kind contributions, provide a detailed description of the contribution and its relevance to the project objectives

**INSTRUCTIONS for the Budget Section:**

1. The Budget Section may include figures, tables, and graphics.
2. The suggested length of the Budget Section is 2 pages.

**6. BIBLIOGRAPHIC REFERENCES**

Provide a list of references appropriate to Sections 1-5.

**INSTRUCTIONS for the Bibliographic References Section:**

1. Only bibliographic information may be contained in the references. No additional text or commentary is allowed.
2. There is no page limit for the Bibliographic References Section, which is outside of the overall 23 -page limit for Sections 1-5.

**7. PERSONAL QUALIFICATION SUMMARIES**

A Personal Qualification Summary (PQS) is required for the PI and all other Key Personnel. Each PQS must include a description of the following only:

* Education and training
* Employment history
* Awards and honors
* A list of no more than 10 peer-reviewed publications related to the proposed project
* A list of no more than 10 other peer-reviewed publications demonstrating capabilities in the broad field
* A list of no more than 10 non-peer-reviewed publications and patents demonstrating capabilities in the broad field

**INSTRUCTIONS for the Personal Qualification Summaries Section:**

1. Each Personal Qualification Summary is limited to 3 pages in length and there is no page limit for this Section, which is outside of the 23-page limit for Sections 1-5.
2. **Curriculum Vitae should not be submitted**.

**TECHNICAL VOLUME TEMPLATE**

**INSTRUCTIONS**

**CONTENT REQUIREMENTS (See Section IV.D of the FOA for Content Requirements):**

1. The Technical Volume template may be used to prepare Technical Volumes for Full Applications.
2. Applicants should ensure the accuracy of their Technical Volume by reviewing and/or printing prior to the Full Application submission.
3. ARPA-E may not review or consider noncompliant and/or nonresponsive Full Applications (see Section III.F of the FOA).
4. Each Full Application should be limited to a single concept or technology. Unrelated concepts and technologies should not be consolidated into a single Full Application.
5. Confidential, proprietary, or privileged information should be indicated by including in the header and footer of every page the following language: “Contains Confidential, Proprietary, or Privileged Information Exempt from Public Disclosure.” In addition, the cover sheet of the Technical Volume must also include the disclaimer provided in Section VIII.I of the FOA, and every line and paragraph containing proprietary, privileged, or trade secret information must be clearly marked with double brackets or highlighting. See Section VIII.I of the FOA for additional information on marking confidential information.
6. Applicants must provide sufficient citations and references to the primary research literature to justify the claims and approaches made in the Technical Volume. ARPA-E and reviewers may review primary research literature in order to evaluate applications. However, ARPA-E and reviewers are under no obligation to review cited sources (e.g., Internet websites)
7. Delete these template instructions and delete the prompts in each of the section above prior to submitting Full Applications.

**FORMAT REQUIREMENTS (See Section IV.D of the FOA for Format Requirements):**

1. Technical Volumes must be submitted in Adobe PDF format, be written in English, use black 12 point or larger Times New Roman font (except in figures and tables), use 8.5 inch by 11 inch paper, be single-spaced, and have margins no less than 1 inch on every side.
2. Technical Volumes must not exceed the maximum page lengths specified for each section of the Technical Volume, if any, in Section IV.D of the FOA. If applicants exceed the maximum page length, ARPA-E will review only the authorized number of pages and disregard any additional pages.
3. The ARPA-E assigned Control Number, Lead Organization Name, and Principal Investigator’s (PI’s) Last Name must be in the upper right hand corner of the header of every page. Page numbers must be included in the footer of every page.