

Project Title: Deployable Energy Limited PTS to Advance the Unity Battery Experimental Microreactor R1

Project Description and Purpose:

Revision 1

The purpose of this Project Task Statement (PTS) is to define the scope of work required to support Deployable Energy's experimental objectives. This includes accelerating the development of a Water Tank Core Criticality Test, conducting mechanical testing of cladding materials, performing core modeling and simulation, and developing a digital twin of the microreactor system. Additionally, the project will provide regulatory support to ensure alignment with Department of Energy (DOE) requirements. These tasks are designed to validate core design parameters, demonstrate material performance, and refine system-level control strategies.

Deployable Energy will serve as the design agent and provide the reactor designs, along with financial support for the full execution of each task. All designs will be developed in accordance with applicable quality requirements and conform to the codes and standards of the approved Code of Record (COR). Battelle Energy Alliance (BEA) will apply its core competencies in experimental reactor development, regulatory compliance, and nuclear facility operations to support Deployable Energy through each phase of the project.

The primary objective of this work is to accelerate the development and deployment of advanced microreactor technologies through a series of integrated technical initiatives. A key focus is the Water Tank Core Criticality Test, where the team will work closely with Deployable Energy to expedite the establishment of a test facility (e.g. NRAD NRS subcell). This includes providing technical and regulatory support to enable safe and compliant core criticality testing. The project will also involve the development of a comprehensive safety basis, fuel management strategy, and test execution plan, along with a plan for post-test fuel storage solutions that support future reactor demonstrations.

A critical component of the project is the mechanical testing of tube geometry cladding materials under simulated core conditions, which will be done at INL Research Center (IRC). This includes, but is not limited to, high-temperature/low-pressure and low-temperature/high-pressure creep testing, as well as thermal expansion evaluations. The objective is to refine test parameters and execute rigorous testing protocols that validate the performance and reliability of candidate cladding materials under operational stresses typical of microreactor environments.

Advanced modeling and simulation will be conducted using MOOSE-based tools such as Griffin, BISON, and Pronghorn. These simulations aim to validate core geometry and operating conditions, including transient scenarios and loss-of-coolant accidents (LOCAs). The project will also support code coupling and sensitivity analyses to provide deeper insights into core behavior and system response under a range of conditions.

To support system-level integration and operational readiness, the project will develop a digital twin of the microreactor system. This virtual model will simulate helium-cooled loops, power conversion systems, and fuel tracking mechanisms. Validation will be performed using non-nuclear testbeds, and the digital twin will be used to refine instrumentation and control strategies.

Additionally, the project will include nuclear facility analysis and regulatory support, encompassing facility characterization, required environmental documentation, licensing strategy development, and coordination with DOE and other stakeholders to ensure compliance with all requirements.

The tasks associated with this PTS are as follows:

TASK 1 – Program Support

Task 1.1 - Program & Project Management

Scope: BEA will provide project management services including program and project management oversight, periodic cost reporting, and schedule management. In these roles program/project management personnel will act as the direct liaison between Deployable Energy and BEA resources required to meet the scope performed within this PTS.

Deliverable(s): Cost reporting, schedule updates, change management distributions, request for information submissions and responses, and comprehensive project plans (project execution, etc.) for the Deployable Energy experimental reactor.

Task 1.2 – Configuration and Document Management

Scope: BEA will provide configuration and document management support in the storage of shared information and distributions of information or requests to BEA stakeholders, subject to applicable reviews and data security requirements.

Deliverable(s): Specific document requests following appropriate owner review and export controls.

Task 1.3 – Communications Support

Scope: External communications related to the scope of this PTS may be conducted at the discretion of either party. However, any such communications must be provided to the non-initiating party for prepublication review in accordance with paragraph B of the "Reports and Publications" article within the SPP.

BEA's review will be conducted in accordance with the National Reactor Innovation Center (NRIC) External Communications Plan and is intended to ensure alignment with INL site access protocols, security requirements, and public information standards.

External Communications include, but are not limited to:

Press releases

U.S. Department of Energy- Idaho Operations Office
National Environmental Policy Act
Categorical Exclusion Determination

- Photographs or video recordings of INL sites
- Visit requests to INL for external entities (e.g., press, investors, government officials)
- Publications
- Multi-media content
- Promotional materials
- Public statements and interviews

All communications requests related to this collaboration will be coordinated through the NRIC Technical Program Manager (TPM). Deployable Energy Communications Disclaimer and Indemnification:

BEA's review of proposed external communications shall not constitute an endorsement, validation, or independent verification of the accuracy, completeness, or truthfulness of any statements, representations, or claims made by Deployable Energy.

Deployable Energy shall remain solely responsible for the content and legal compliance of all Deployable Energy external communications, including but not limited to, representations made to investors, stakeholders, or the public. BEA shall bear no liability for any claims, investigations, or legal actions arising from or related to Deployable Energy's external communications, including without limitation, any alleged or actual misrepresentations, fraud, or securities law violations.

Deployable Energy agrees to indemnify and hold BEA and the U.S. Government (Government) harmless from any costs – including costs incurred in enforcing this indemnification, losses, expenses - including reasonable attorneys' fees, claims, damages, or liabilities of any kind arising from or related to any Deployable Energy communications, including without limitation, any alleged or actual misrepresentations, fraud, or securities law violations.

Deliverable: BEA will provide support for Deployable Energy's external communications requests in accordance with the NRIC External Communications Plan.

Task 1.4 – Digital Engineering Support

Scope: Subject to any applicable license requirements or restrictions, BEA will provide Deployable Energy with software access and digital tool capabilities including technical support to enable the development of any test facility or reactor test. This will include access to the digital engineering infrastructure developed within INL to support advanced nuclear reactor projects and may include the incorporation of their existing software or database systems. These tools are approved for data up to Controlled Unclassified Information (CUI) / Official Use Only (OUO) level and are secured in the Azure for Government Cloud under BEA's authority to operate and can be siloed for Deployable Energy use outside of BEA's current user base.

Deliverable(s): Access to Confluence and other digital engineering tools utilized by BEA, subject to any applicable license requirements or restrictions.

TASK 2 – Engineering Support

Task 2.1 – Engineering Support

Scope: BEA will provide engineering data, information, reviews, and technical support to advance the design of the Unity experimental reactor project(s). These include, but are not limited to: utility information, security details, or engineering support from any necessary discipline. Additional support may include reviews for safety, industrial hygiene, radiological controls, facility management, balance of plant, operations, maintenance, and reliability.

Deliverable(s): The following list contains potential deliverables, but is to be determined during course of work:

- Submittal of Deployable Energy's Functional and Operational Requirements documents to INL Electronic Document Management System (EDMS)
- Submittal of Deployable Energy's Technical and Functional Requirements documents to INL EDMS
- Support Deployable Energy in its development of Equipment Technical Specifications for procurements
- Support Deployable Energy in its development of Construction Specification(s) for construction activities
- Support Deployable Energy in its development of operations plans
- Support Deployable Energy in its development of a Fuel Management Plan

Deployable Energy remains ultimately responsible for all designs, specifications, and related documents.

Task 2.2 – Core Analysis and Simulation

Scope: BEA will provide comments and analyses to support both the development of Deployable Energy experiments and the design of Deployable Energy's experimental product. BEA will provide modeling and simulation support. This may include, but is not limited to, MOOSE-based tools including Griffin (neutronics), BISON (fuel performance), and Pronghorn (thermal fluids). The effort will focus on validating the Participant's unique core geometry and operating conditions, including transient and LOCA scenarios. BEA will also support code coupling and

parameter sensitivity studies. Examples of this work include, but are not limited to: fuel performance analysis, reactor core thermal hydraulics analysis, reactor core neutronics analysis, reactor core optimization support, reactor materials support, and reactor safety information.

Deliverable(s): The following list contains potential deliverables, but is to be determined during course of work:

- Initial fuel performance analysis results
- Initial thermal hydraulics analysis results
- Monte-Carlo N-Particle (MCNP) analysis results
- Simulation Setup and Input Files
- Coupled Simulation Results
- Technical Memo on BISON Application and Parameter Sensitivity
- Summary Report on Core Behavior and V&V Gaps

Task 2.3 – Nuclear Safety Support

Scope: BEA will provide nuclear safety analyst support for the technical development of the Deployable Energy facility and experimental reactor nuclear safety analyses. This will require work between Deployable Energy’s nuclear safety team and BEA’s to validate requirements are met and the formal submission of nuclear safety documents from Deployable Energy and BEA to DOE are completed.

Deliverable(s): The following list contains potential deliverables, but is to be determined during course of work:

- Nuclear Safety Design Agreement (NSDA)
- Preliminary Safety Design Report (PSDR)
- Preliminary Documented Safety Analysis (PDSA)
- Final Documented Safety Analysis (FDSA)

DOE ultimately holds approval authority for nuclear safety deliverables under 10 CFR 830.

Task 2.4 – Design Review Support

Scope: BEA will provide all appropriate design reviews necessary to support the retention of BEA’s design authority for the Deployable Energy facility and reactor experiment(s). These will include conceptual design reviews, preliminary design reviews, and final design reviews as required by the design authority. Funding for these activities will be provided in full and in advance of each design review iteration, for that specific iteration, through modifications to this PTS.

Deliverable(s): The following list contains potential deliverables, but is to be determined during course of work:

- Conceptual design comments
- Deployable Energy Preliminary design comments
- Deployable Energy Final design comments

Task 2.5 – Digital Twin Simulation Development

Scope: BEA will work to develop and validate a digital twin of the advanced microreactor system. This includes multi-physics modeling of helium-cooled loops, power conversion integration, and fuel element tracking. BEA will support validation using Deployable Energy’s non-nuclear testbeds and assist in refining instrumentation and control strategies.

Deliverable(s): The following list contains potential deliverables, but is to be determined during course of work:

- Digital Twin Architecture Document
- Validation Report using Non-Nuclear Testbeds
- Instrumentation Specification Guidance
- Control Strategy Optimization Report

Task 2.6 – Cladding Material Testing

Scope: BEA will support the execution of mechanical testing of the Participant’s tube geometry cladding material under simulated core conditions. This includes, but is not limited to, three primary tests: high-temperature/low-pressure creep, low-temperature/high-pressure creep, and thermal expansion at failure conditions. BEA will assist in refining test parameters, executing the tests, and analyzing results to validate material performance. These tests will be conducted at IRC.

Deliverable(s): The following list contains potential deliverables, but is to be determined during course of work:

- Test Parameter Definition Document

- Test Execution Reports for each test condition
- Summary Report on Cladding Performance and Expansion Behavior

Task 2.7 – Water Tank Criticality Test Support

Scope: BEA will work to develop a water tank criticality test of their core. This includes providing technical and regulatory support to ensure the test is capable of executing a core criticality test of the Participant's design. BEA will assist in developing the test plan, identifying a location for the test (e.g. NRAD NRS subcell), test design, facility design, security, developing a safety basis, environmental support, testing area planning, facility placement evaluation, fuel management strategy, post test fuel disposition plan and test execution plan.

Task 2.8 – Technical Subject Matter Expertise Support

Scope: BEA will provide subject matter expertise to support both the development of Deployable Energy's experiments and the design of their desired commercial product. Examples of this work include, but are not limited to: fuel performance analysis, reactor core thermal hydraulics analysis, reactor core neutronics analysis, reactor core optimization support, reactor materials support, reactor safety information, quality assurance experts, material science, policy experts, and regulation experts.

Task 3 – Quality Assurance

Task 3.1 – Quality Assurance Surveillances and Audits

Scope: BEA will conduct a structured evaluation of Deployable Energy's Quality Assurance (QA) program through surveillances, culminating with an audit and approval of Deployable Energy's QA program. This process and the requirements are documented in IAG-1151. These activities will assess activities such as, but not limited to, Deployable Energy's engineering, fabrication, procurement, commercial grade dedication, and test/inspection processes to ensure they comply with their approved QA program. The surveillances will provide ongoing verification of implementation, while the audit will formally confirm conformance and readiness. The outcomes of these efforts will support BEA's approval of Deployable Energy's QA Program, and assurance of design adequacy and resultant delivered product(s). Notwithstanding any reviews, audits, or validation performed by BEA, Deployable Energy still remains responsible for its own engineering, fabrication, quality, procurement, and all other programs and processes. Any reviews, audits, or validation do not constitute assumption by BEA of responsibility for Deployable Energy programs and processes.

Deliverable(s):

- Quality Surveillance Report(s)
- Audit Report(s)

Deployable Energy QA Program Acceptance Letter(s)

Original ECP

This Idaho National Laboratory (INL) Umbrella Cooperative Research and Development Agreement (CRADA) is a collaboration with Deployable Energy Limited (DEL) to provide testing resources, experimental support, and expertise in the deployment of DEL's advanced nuclear systems, including the Unity™ Nuclear Battery. The advanced reactor design Unity™ Nuclear Battery is a small modular reactor which utilizes Low Enrichment Uranium (LEU) fuel and non-exotic material. It will be capable of providing military, government agencies, and commercial customers with responsive, durable, and modular energy generation capability. The reactor concepts will be further developed at the INL, with the support of National Reactor Innovation Center (NRIC) facilities. Each Project Task Statement (PTS) issued under this Umbrella will be reviewed individually and this ECP revised as needed. This Categorical Exclusion (CX) determination only covers the approval of the CRADA which is covered under Appendix A Subpart D of Part 1021 and does not cover any work.

Each PTS under this umbrella CRADA will require further NEPA review, potentially including an Environmental Assessment (EA) or Environmental Impact Statement (EIS). Other PTS scopes may fall under CXs and may be able to progress forward independently of the EA/EIS (if required). The general scope of the Umbrella CRADA includes the following categories. Specific scopes will be developed under individual PTSs:

Category 1: Nuclear Demonstration Support: The Contractor maintains unique capabilities to support nuclear reactor demonstrations of DOE authorized reactors. This includes testing, fuel supply, authorization, and other required support to lead to a successful reactor demonstration. The process of developing the test article and subsequent documentation may necessitate additional work scope in the subsequent work categories.

Category 2: Advanced Manufacturing: The development of the advanced reactors microreactor will involve deployment of advanced materials in novel ways. The Contractor maintains expertise in advanced manufacturing processes and capabilities for many of these materials and can provide support in novel design techniques for nuclear systems.

Category 3: High Performance Computing: The Contractor is primarily responsible for developing and maintaining the NEAMS toolset as well as other advanced simulation tools. The modeling and simulation of the advanced reactor system can benefit greatly from modeling in software such as the Multiphysics Object Oriented Simulation Environment (MOOSE) framework and coupling that to physical testing for hardware. The Contractor also maintains expertise in Monte Carlo N-Particle (MCNP) Serpent, and other nuclear system computational modeling tools which are instrumental in providing design input and regulatory data for reactor designs.

Category 4: Materials Science & Technology: The Contractor employs experts in various materials of interest to the system (i.e. graphite, fuels, moderator, etc) as well as non-irradiation test facilities such as Microreactor Agile Nonnuclear Experimental Testbed (MAGNET) and Single

Primary Heat Extraction and Removal Emulator (SPHERE) to assist in the development and characterization of reactor-based technologies. These experts can provide design reviews and guidance in utilizing advanced materials and technology in novel nuclear systems.

Category 5: Irradiation Testing: The Contractor is a world leader in the field of irradiation testing and maintains several test reactors and facilities to assist in pre- and post-irradiation examination and characterization. As the advanced reactor is developed, end of life testing at the Advanced Test Reactor (ATR) as well as transient fuel testing at Transient Reactor Test Facility (TREAT) may be required to provide potential regulators with sufficient safety case data. The Contractor will provide experiment design and execution capability to support these needs. Please note that reactor and design resource availability is in high demand and will be scheduled and allocated upon Project Task Statement (PTS) submission and successful irradiation work acceptance by the Nuclear Science and Technology (NS&T) Directorate and its INL affiliates.

Category 6: Licensing and Regulatory: The Contractor can provide assistance and guidance in obtaining DOE authorization for an eventual nuclear demonstration unit, as well as leverage expertise in licensing and nuclear safeguards to assist in anticipated Nuclear Regulatory Commission commercial licensing of the Participants' advanced reactors and technologies. Prior to commencing with licensing and regulation support, the Nuclear Safety and Regulatory Research Division of INL must be contacted to ensure no organizational conflict of interest exists and the NRC is aware of the evaluation.

Category 7: Reactor Commissioning and Operation: The Contractor will provide the required support in commissioning and operating the Participant's demonstration reactor at INL. This includes but is not limited to interfacing with the DOE, providing operators and staff required for reactor operation, analysis of operational modes and scenarios, and maintaining proper oversight of the reactor during operation.

Category 8: Reactor Decommissioning: The Contractor will provide the required support to decommission the Participant's demonstration reactors at INL. This may include but is not limited to reactor shutdown, defueling, packaging for removal, shipment of the reactor and spent fuel, and long-term repository.

Category 9: Reactor Design: The Contractor will provide support, consultation, and oversight to the Participant in the design of the advanced reactor concept. This includes but is not limited to support on reactor safety documentation, engineering calculations and evaluation, siting support, quality processes, and procurement.

Category 10: Reactor Siting and Development: The Contractor will provide support, consultation, and oversight to the Participant for the siting of reactors on property owned or managed by the Department of Energy (DOE). The Contractor will leverage the laboratory's core competencies and expertise in the siting, design, surveys, development, construction, and safe operations of experimental reactors and nuclear facilities authorized by the DOE, or the siting of nuclear facilities seeking licensing from the Nuclear Regulatory Commission (NRC) on INL land.

Environmental Aspects or Potential Sources of Impact:

Air Emissions

NA

Discharging to Surface-, Storm-, or Ground Water

NA

Disturbing Cultural or Biological Resources

CULTURAL: At this time the project activities do not require CRMO Review. See Hold Points.

Generating and Managing Waste

No waste is associated with this Umbrella agreement.

Under revision 1 small amounts of industrial/recyclable waste will be generated from the mechanical testing of cladding due to the cutting of metal cladding, including PPE. Estimated to be approximately 1 cubic foot.

All waste will be packaged and dispositioned in accordance with BEA Waste Management Program (WMP) requirements and assistance from the WMP's Waste Generation Services (WGS) subcontractor.

Releasing Contaminants

When chemicals are used during the project there is the potential for spills that could impact the environment (air, water, soil).

Using, Reusing, and Conserving Natural Resources

**U.S. Department of Energy- Idaho Operations Office
National Environmental Policy Act
Categorical Exclusion Determination**

Project activities have the opportunity to reduce the impact on our natural resources by recycling or diverting materials from disposal in the landfill.

Determination.

For Categorical Exclusions (CXs), the proposed action must not: (1) threaten a violation of applicable statutory, regulatory, or permit requirements for environmental, safety, and health, or similar requirements of Department of Energy (DOE) or Executive Orders; (2) require siting and construction or major expansion of waste storage, disposal, recovery, or treatment or facilities; (3) disturb hazardous substances, pollutants, contaminants, or Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)-excluded petroleum and natural gas products that pre-exist in the environment such that there would be uncontrolled or unpermitted releases; (4) have the potential to cause significant impacts on environmentally sensitive resources (see 10 CFR 1021); (5) involve genetically engineered organisms, synthetic biology, governmentally designated noxious weeds, or invasive species, unless the proposed activity would be contained or confined in a manner designed and operated to prevent unauthorized release into the environment and conducted in accordance with applicable requirements, such as those listed in paragraph B(5) of 10 CFR Part 1021, Appendix B. The proposal has not been segmented to meet the definition of a categorical exclusion. Segmentation can occur when a proposal is broken down into small parts in order to avoid the appearance of significance of the total action. However, segmentation does not include proposals that are developed and potentially implemented over multiple phases where each phase results in a decision whether to proceed to the subsequent phase. There is no extraordinary circumstance related to the proposal that is likely to cause a reasonably foreseeable significant adverse effect or for which DOE does not know the environmental effect. Extraordinary circumstances are unique situations presented by specific proposals, including, but not limited to, scientific controversy about the environmental effects of the proposal; uncertain effects or effects involving unique or unknown risks; and unresolved conflicts concerning alternative uses of available resources.

References: B3.6 "Small-scale research and development, laboratory operations, and pilot projects"

Justification: For the DOE regulations regarding the application of categorical exclusions, including the full text of each categorical exclusion, see 10 CFR 1021.102 and Appendix B to 10 CFR Part 1021. Implementing guidance for categorical exclusions can be found in DOE's National Environmental Policy Act Implementing Procedures (June 30, 2025): (See full text in regulations and implementing procedures).

The proposal must fit within the classes of actions listed in Appendix B to 10 CFR Part 1021 and must satisfy the conditions that are integral elements of the classes of actions therein.

There are no extraordinary circumstances related to the proposal that may affect the significance of the environmental effects of the proposal. DOE or an applicant may modify the proposal to avoid reasonably foreseeable adverse significant effects such that the categorical exclusion would apply.

The proposal has not been segmented to meet the definition of a categorical exclusion.

B3.6 Small-scale research and development, laboratory operations, and pilot projects. Siting, construction, modification, operation, and decommissioning of facilities for small-scale research and development projects; conventional laboratory operations (such as preparation of chemical standards and sample analysis); and small-scale pilot projects (generally less than 2 years) frequently conducted to verify a concept before demonstration actions, provided that construction or modification would be within or contiguous to a previously disturbed or developed area (where active utilities and currently used roads are readily accessible). Not included in this category are demonstration actions, meaning actions that are undertaken at a scale to show whether a technology would be viable on a larger scale and suitable for commercial deployment.

Approved by Robert Herzog, DOE-ID NEPA Compliance Officer on: 12/17/2025