REPLOY Power, Inc.
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Enclosure 1
REPLOY Power
Regulatory Engagement Plan

Revision 1

April 2025

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Table of Contents

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1.0 Introduction

The REPLOY Power Submersible Power System (SPS) is a concept for nuclear power plant design that builds upon extensive experience in the existing nuclear industry paired with the economics of centralized manufacturing and servicing. The SPS is designed with robust safety features and standardization with a goal of increased deployment flexibility. Submerged vessels are less susceptible to wave action, storm surges, electromagnetic pulse radiation, and seismic damage than traditional land-based reactors as well as being more resilient to malicious harm. A submerged light water reactor can also take advantage of the virtually limitless cooling water supply. With 40% of the world's population located within 100 km of the coast, offshore siting allows for deployment where power is needed most, while remaining in unpopulated zones.
The REPLOY Power SPS nuclear power plant is currently undergoing design and engineering with expected deployment in the early 2030s. REPLOY Power recognizes the value of early and frequent interaction with regulators while we develop and license the SPS concept. This document details the plans for engagement with the U.S. Nuclear Regulatory Commission related to the REPLOY Power SPS concept.

1.1 Purpose of Regulatory Engagement Plan (REP)

This document communicates the key aspects of the REPLOY Power (hereafter REPLOY) SPS concept to aid future interactions with the US NRC. REPLOY is proposing a licensing process which starts with a pre-application engagement phase, followed by a future licensing phase which applies 10 CFR Part 52 pathways for the standard plant design and Part 50 pathways for a prototype plant. The pre-application phase will be focused on engaging with US NRC staff on technological or policy matters that are unique or innovative in the SPS design. The strong project economics of the SPS design led us to believe that these areas of innovation are worth reviewing and developing within the existing regulatory frameworks. REPLOY anticipates that this REP will be a living document, to be updated and communicated on a regular basis.

1.2 Contact Information

Donald J. Statile
Director of Licensing, Safety, and Quality Assurance
REPLOY Power Inc.

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1.3 Company Description

REPLOY POWER Inc. (Trading as REPLOY Power) is a wholly owned subsidiary of Pathfinder Development Corporation of Nevada. REPLOY has registered headquarters in Austin, Texas.

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]$^{(b)(4)}$ REPLOY anticipates that a small number of additional strategic equity investors will eventually be required to complete the full licensing and construction. Currently no grants or external programs are funding REPLOY, although REPLOY is seeking grants and contracts from the DOE and DOD to help fund portions of the development. However, our investors are financially capable and willing to continue to invest in REPLOY for the long term, including throughout the pre-application phase if additional external funding is not received.

The majority of REPLOY's staff are US based. Systems, controls and appropriate user access restrictions are continuously implemented as required under US export controls and security and information control requirements. For example, much of REPLOY's IT infrastructure is hosted on U.S. based servers which are only accessible by U.S. citizens.

REPLOY has partnered with engineering, procurement, consulting, and construction firm Black & Veatch in maturing its licensing plan and technology development. We expect Black & Veatch to remain in a long-term consulting role, supporting multiple aspects of the project development. It will be REPLOY staff leading the engagements with the US NRC on licensing interactions. REPLOY is also in the process of implementing an NQA-1 and 10 CFR 50 Appendix B quality assurance program, with guidance from Black & Veatch.

1.4 Strategic Project Approach and Goals

The REPLOY SPS is a power plant design intended to allow for standardization and rapid deployment of light water reactor technologies. The design features a relatively standard pressurized water reactor (PWR) in a containment structure designed for operation underwater at offshore sites. Centralized manufacturing, maintenance, refueling, waste storage, and decommissioning are expected to reduce the operating costs of individual units while ensuring public safety. Off-shore siting reduces the barriers to deployment by enabling simplified siting with minimal site preparation, characterization studies, and minimal emergency planning zones (EPZ). Accounting for engineering and regulatory timelines, REPLOY anticipates deployment of the first unit by the early to mid-2030s. The overall REPLOY deployment and operations model is illustrated in Figure 1.

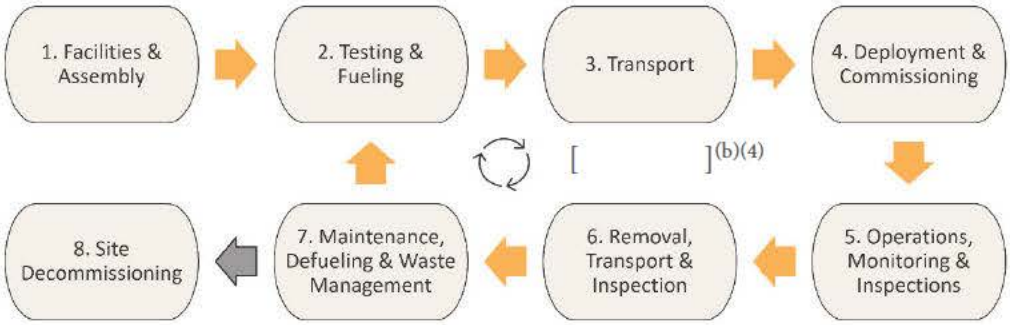

FIGURE 1. REPLOY SPS LIFECYCLE

REPLOY intends to explore regulatory pathways with the US NRC within the pre-application process. It is anticipated that the 10 CFR Part 52 licensing framework is currently the most

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appropriate for the REPLOY Submersible Power System, however a construction permit and operating license for a prototype facility may be sought under the 10 CFR Part 50 framework.
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2.0 Concept and Technology

The Submersible Power System is a power station design built upon the wealth of experience with PWR technology within both the civilian nuclear power industry and naval nuclear sector. PWRs have proven themselves safe and efficient with thousands of reactor-years of operating experience across the world. The SPS makes use of state-of-the-art passive Small Modular Reactor technology packaged into a submersible containment vessel which also contains auxiliary systems and power generation and transmission systems. Conceptual design highlights for the SPS are included below.

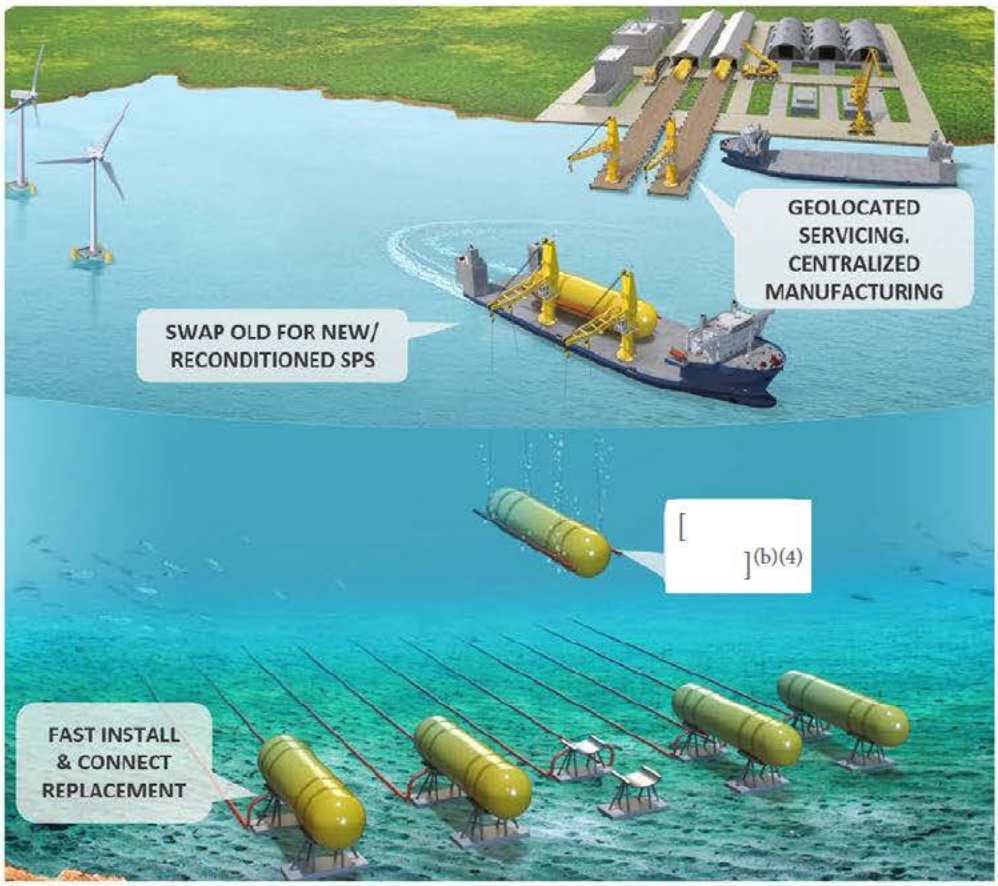

FIGURE 2. OVERVIEW OF SPS DEPLOYMENT CONCEPT

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Reactor Details:

- Power: 300 MWe (~1000 MW_{th})
- Fuel:
  - Standard PWR fuel purchased from existing fuel vendors
  - LEU [b)(4)
  - Standard zirconium alloy cladding
- Cooling:
  - Light water moderator / coolant
  - Passive emergency cooling with natural circulation
  - pH control
  - Horizontal steam generators
  - Seawater surrounding the hull is the ultimate heat sink

Notional SPS unit sizing and siting:

- [ ](b)(4)
- [ ](b)(4)
- Deployable in waters 50-200 m depth or within coffer dam. In shallower waters, a pit may be dredged on the sea floor to lessen the profile of the SPS to storm surge
- Footprint with concrete footings approximately [ ](b)(4)
- Seismic and wave isolation struts allow siting in areas with seismic activity
- Multi-unit minimum spacing approximately [ ](b)(4)

SPS units will be produced in a centralized facility which provides manufacturing, maintenance, refueling, and decommissioning services for the fleet of SPS units. The central facility will resemble a standard shipyard for construction of sea-going vessels. Such facilities regularly construct complex engineered vessels of size and mass exceeding that of the SPS. Transportation of the SPS by waterways allows for an entire PWR power plant to be delivered to an offshore site ready to operate.

While SPS technology builds on well-known technologies, it constitutes a new deployment scenario. Some key considerations when moving from conventional land-based PWRs to the SPS model include:

- standardization of units
- factory fabrication of complete units
- use of horizontal steam generators
- submerged operation
- smaller containment volume per unit power
- large volume of internal cold fresh ballast water within the hull
- cooling of ballast through the hull
- motion of the hull during hurricanes and other storms
- remote control capability
- transport of the units between the refueling facility and deployment sites

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- undersea transmission of electricity between the SPS unit and shore
- Simplified retrieval and return of units requiring repair and refueling to a central maintenance, refueling, and decommissioning facility
- non-proliferation inspections at central refueling facility
- use of remote instrumentation and inspection techniques

While the ultimate goal is to produce and maintain a large number of SPS units, REPLOY plans to take a phased approach to deployment with an initial prototype unit and subsequent early production units before moving to full-scale production. Key elements of these phases are described below. Note that the decision has not at this time been made to engage in a prototype or on the number and scope of early production models.

Phase 1: Prototype

- Shoreline deployment
- Controlled from shore, incorporating redundant communications conduits and strong cybersecurity systems
- Human access limited for testing and inspection
- Steel hull and external water pressure (submerged) as containment with minimal EPZ
- Transport of a fueled unit by waterway to the deployment site (policy development required), if necessary
- Transport of the used unit (containing used nuclear fuel) back to the central facility, unless operated adjacently to the central facility
- Horizontal steam generators as have been used in U.S. naval reactors and VVER reactors
- Ability to withstand hurricanes in shallow or protected water
- May include a protected pond or enclosure

Phase 2: Early Production

Building on the above with:

- Off-shore deployment in shallow or deep water
- No human access during operation – distant control/operation, inspection, monitoring
- Layered defensive and monitoring/detection systems like those in use by the U.S. submarine force and passive physical security barriers

Phase 3: Full Production

Building on the above with:

- Further, deeper offshore
- Incorporation of longer-range autonomous threat detection and deterrence measures
- Ability to be operated in seismically active areas
- Located more than one day's sailing from the central facility
- Redeployment of refueled and refurbished units

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3.0 Licensing and Design Strategy

In parallel to design phases for the SPS and the central facility, REPLOY proposes to submit pre-application topics via whitepapers and licensing topical reports (LTRs). After the pre-application phase, REPLOY intends to submit a series of applications as described below.

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3.1 NRC Pre-Application Submissions

REPLOY plans to submit white papers and licensing topical reports (LTRs) on key topics related to the SPS design and the REPLOY business model. White papers are generally expected to be limited scope descriptions submitted for agency feedback and identification of policy development needs / proposed solutions. LTRs are to include a greater level of detailed analysis of safety related topics for which feedback and approval by the NRC is desired to sufficiently mitigate licensing risks. Other technical reports may be included by reference into future license applications. The current topics in scope of the desired pre-application engagement are described below. Detailed descriptions and schedule of the anticipated submissions are also included below. As the engineering design matures, the topics listed below may be modified or removed, and additional topics added as appropriate. The topics and descriptions below should be viewed as preliminary and subject to change with future updates to this regulatory engagement plan.

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Second Quarter 2025

Discussion of REPLOY Power Conduct of Operations and Licensing Implications

This discussion will not be a paper submittal. The format will be a set of PowerPoint slides. The slide set will include a brief discussion of the proposed conduct of operations for the REPLOY lifecycle. The focus will be on the proposed licensing pathways and a discussion of licensing challenges.

Quality Assurance Plan Development

This white paper will present the approach REPLOY Power will take to develop the company Quality Assurance Plan, organize the quality assurance function, and outline the implementation plan.

Third Quarter 2025

Operating Concept for the REPLOY Submersible Power System:

This white paper will present for NRC feedback the proposed methodologies to be applied for operation of a submerged power station from a nearby onshore control room. It will also offer high-level architecture for safe and secure control of a remote facility. This will include discussion of the instrumentation, control, and cybersecurity technologies that enable this operating regime. This white paper will also discuss onshore backup power for the power station. REPLOY Power seeks feedback and alignment from the NRC on the proposed means of permitting this operating model within existing licensing frameworks and identification of new / revised policy and guidance required to support this operating model.

Environmental Impact Report Approach for SPS Units:

This white paper will describe the expected approach to analyzing the environmental impacts of SPS units under normal and accident conditions. This paper will discuss the development of a Generic Environmental Impact Report for maritime deployment as well as a proposed methodology REPLOY will use to classify environmental factors in different deployment regions and specific deployment locations.

Introduction of the Prototype Concept for the REPLOY Submersible Power System (tentative)

This white paper will discuss the general approach for a prototype reactor.

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Fourth Quarter 2025:

Environmental Report Process for the REPLOY Hub:

This white paper will describe the expected process for drafting the REPLOY Environmental Report for the REPLOY HUB, which will cover all activities at the central assembly facility and central fuel facility as well as additional site features necessary to enable centralized servicing of SPS units. This white paper will seek feedback and alignment from the NRC on the environmental review process for proposed Hub activities.

NSSS adaptation process for SPS integration

This white paper will discuss the adaptation of a standard PWR NSSS design for use within the SPS. This effort will include the high-level modifications necessary to fit a standard PWR within the SPS as well as the identification of major SPS safety functions and safety related SSCs. In particular, the approach for using horizontal steam generators within the SPS will be considered.

Regulatory Engagement Plan for the Prototype(tentative)

This plan will discuss the delta between this primary REPLOY Power Regulatory Engagement Plan and the specific plan for the prototype SPS facility.

First Quarter 2026:

Transport and Deployment of the SPS in a Maritime Environment

This white paper will present the proposed activities for the transport, deployment, and retrieval of SPS units. The paper will also discuss the preliminary hazards analysis associated with operation and transport and the process used for the identification of SSCs as safety related and defense-in-depth. This paper will discuss the evolution of work required to get the SPS from the hub to the deployment and from deployment back to the hub.

REPLOY Test Plans

This white paper will present the proposed test plans for the SPS. The test plans are for a series of tests in two areas: design verification and analytical code verification and validation.

REPLOY Power V&V Methodology

This white paper will present the methodology REPLOY intends to use for verification and validation of calculations and software used for safety analysis.

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Second Quarter 2026:

Physical Security Concept for the Deployment and Operation of the SPS:

This white paper will present for NRC feedback a proposed security architecture for physical security of the SPS, onshore facilities, and transportation systems. This will incorporate necessary security measures throughout the SPS lifecycle. It will also consider a range of conceptual deployment zones and a variety of proposed transportation schemes. This white paper will seek feedback and alignment from the NRC on the proposed means of ensuring physical security of all nuclear material within existing licensing frameworks and identification of new / revised policy required to support this deployment model.

Nuclear Steam Supply System for the SPS

This LTR will present for NRC evaluation REPLOY's methodology for design and analysis of horizontal steam generators for use in the nuclear steam supply system of the SPS. This will include impacts on the safety analysis for the overall SPS integrated plant and a discussion of prior industry experience with horizontal steam generators in VVER reactors, naval reactors, and non-nuclear applications. This LTR will seek NRC approval of the applied methodologies evaluating the ability of the plant to remove heat from the reactor sufficiently during applicable design basis transient and accident scenarios such that future applications can reference this approval. This LTR will support the development of the SDA or ML for the maritime adaptation of the selected PWR.

Remotely Operated Power Station Architecture:

This LTR will expand upon the results of the white paper of the same topic described above. This LTR will seek NRC approval of the methodologies and system architectures which justify suitability of the SPS' remote operation which meets all applicable regulations such that future applications can reference this approval.

Third Quarter 2026:

Environmental Impact Methodology:

This LTR will expand upon the results of the white paper of the same topic described above. This LTR will seek NRC approval of the proposed environmental assessment and the non-emergency and emergency planning methodologies that will be used to mitigate the environmental impacts from normal operations as well as the measures that will be taken to mitigate any environmental impacts during an emergency. The goal is for this procedure to be used in future applications which reference this approval.

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Submersible Containment Vessel Safety Analysis Methodology:

This LTR will expand upon the results of the white paper of the same topic described above. This LTR will seek NRC approval of the methodologies applied which justify suitability of the SPS submersible containment vessel to meet all applicable regulations for the confinement, transport and storage of radioactive material such that future applications can reference this approval. This methodology will support the development of the SDA for the maritime adaptation of the selected PWR.

Physical Security Concept for the REPLOY Hub:

This white paper will present a proposal for security architecture for physical security of the onshore assembly and fuel facilities (REPLOY hub). This will incorporate necessary security measures to protect the special nuclear material housed at the hub. This white paper will seek feedback and alignment from the NRC on the proposed means of ensuring physical security of all nuclear material within existing licensing frameworks.

Fourth Quarter 2026:

Physical Security Methodology for the REPLOY Power reactor:

This LTR will expand upon the results of the white paper of the same topic described above. This LTR will seek NRC approval of the proposed means of ensuring physical security of all nuclear material within existing, new, and expected licensing frameworks such that future applications can reference this approval.

Refueling and Transportation Methodology:

This LTR will expand upon the results of the white paper of the same topic described above. This LTR will seek NRC approval of the methodologies applied which justify suitability of the SPS deployment model to meet all applicable regulations such that future applications can reference this approval.

First Quarter 2027:

Physical Security Methodology for the Hub:

This LTR will expand upon the results of the white paper of the same topic described above. This LTR will seek NRC approval of the proposed means of ensuring physical security of all nuclear material within existing, new, and expected licensing frameworks such that future applications can reference this approval.

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Factory Acceptance Testing Concept: (tentative)

This white paper will present for NRC feedback a preliminary concept for factory acceptance testing for the SPS systems with the goal of shortening and simplifying the Inspections, Tests, Analysis, and Acceptance Criteria (ITAAC) clearance and startup testing processes. This white paper will seek feedback and alignment from the NRC on the proposed means of construction and operational testing within existing licensing frameworks and identification of new / revised policy required to support this deployment model.

3.2 US NRC Interaction Plan

REPLOY anticipates new challenges to emerge as the SPS project develops. Therefore, the nature and frequency of interactions between our teams will evolve. REPLOY therefore will hold regular meetings at both the technical and project levels with the NRC. For each topic outlined above, REPLOY will discuss the need for pre-submission or post-submission formal discussions or clarification discussions to ensure a mutually agreeable partnership to deploy the REPLOY SPS technology. REPLOY understands that commercial marine applications represent new territory for both the NRC and commercial nuclear industry. REPLOY is also amenable to fostering communication between the NRC and corresponding marine regulatory authorities.

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