Carbon Free Power Project

Application for Limited Work Authorization

Enclosure 2 - Safety Analysis Report

Revision 0
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Enclosure 2 – Safety Analysis Report

1.0 Introduction

This enclosure provides CFPP LLC's safety analysis report (SAR) as required by 10 CFR 50.10(d) to be submitted as part of a limited work authorization (LWA) application. This SAR comprises the following contents:

- Description of Activities Requested (Section 2.0)
- Design and Construction Information (Section 3.0)
- Program Requirements for Construction (Section 4.0)
- Applicant's Technical Qualifications to Engage in the Proposed Activities (Section 5.0)

Regulatory Guide (RG) 1.206, "Applications for Nuclear Power Plants," Revision 1, Section C.2.18 provides guidance for LWA applications. The guidance states that for an LWA application "submitted as part of a phased combined license application," the SAR should include "the final design for any foundation or other work" performed under the LWA, the final design of supported structures, and a safety analysis for the LWA work and supported structures. The Carbon Free Power Project (CFPP) letter entitled "Limited Work Authorization Application Contents of Safety Analysis Report" (Reference 6-1), explains that a final design and safety analysis of the LWA scope and supported structures is infeasible without resolution of site characteristics via the site suitability review. Therefore, this SAR deviates from RG 1.206 in this regard.

2.0 Description of Activities Requested

2.1 Reactor Building and Radioactive Waste Building Subgrade Rock Remediation

2.1.1 Background

CFPP site subsurface investigations conducted to date show a nearly continuous sequence of basaltic rock (i.e., fine-grained, extrusive/volcanic rock produced as flows from shield volcanoes) extending to approximately 750 feet below ground surface. The competency of these subsurface materials varies as a function of rock fracture spacing and the vesicularity of the rock. The latter is a function of variations in the density or number of small cavities (i.e., vesicles) in the basalt resulting from gas bubble entrapment during solidification. This material variability ranges from highly competent, massive rock to relatively soft, highly fractured or highly vesicular rock.

Zones of less stable rock, voids, and sedimentary interbeds resulting from jointing and fracturing of blocky and rubbly basalt layers are expected to be exposed during excavation. Isolated rock gaps/voids and pockets of sediment resulting from the infilling of clefts in original lava flow tumuli, lava channels, and lava tubes may be exposed in the excavation walls and at or below the bottom level of the excavation. Section 3.2.1 of the LWA application identifies remediation of rock gaps or voids in the subgrade underlying the bottom surface of the excavation as a construction activity within the scope of this LWA application. This subgrade rock remediation activity is described in Section 2.1.2.

Remediation of rock gaps or voids in the excavation walls are part of installing the excavation wall shoring system to provide wall stability for worker safety. As described in Section 3.2.1 of the LWA application, NRC approval for the wall shoring system installation is requested separately from the LWA application in the form of an exemption request (Reference 6-2) pursuant to 10 CFR 50.12(b). The RXB and RWB excavation wall shoring system installation, including remediation of wall rock gaps or voids as the system is installed, is described in Reference 6-2.

2.1.2 Description

Remediation of the RXB and RWB subgrade rock begins after completion of the foundation deep excavations. Soft sediment and highly fractured or rubbly basalt exposed at or near the bottom elevations of the RXB and RWB excavations are expected to be fully removed by over-excavation. As a result, significant undulations (up to 5 ft or more) in rock surfaces are likely to be present at the bottom of the excavations.

To address these conditions, flowable fill or compacted aggregate is placed to fill the over-excavated areas and to achieve uniform construction surface levels in preparation for installing the building mud mats and foundations. Preparatory to flowable fill placement, sharp rock surfaces having the potential to induce cracking in the fill concrete are removed, and methods such as air lancing and vacuuming are used to achieve clean rock surfaces.

Before placement of flowable fill concrete, CFPP LLC plans to obtain detailed imaging of excavation foundation subgrade conditions using proven geophysical survey/investigation methodologies such as multichannel analysis of surface waves and electrical resistivity tomography. If these surveys indicate the presence of larger rock gaps or voids, or a thick but laterally non-extensive rubbly zone, targeted grouting may be implemented to improve those isolated areas. This targeted grouting consists of grout holes spaced and arranged to specifically fill the gap, void, or excessive open space in the discrete rubbly zone. For areas of fractured rock and smaller cracks, utilization of dental grout is used, as practicable.

If foundation bottom geophysical surveys or excavation work progress reveal more extensive networks of rock gaps, voids, or rubbly basalt zones, a consolidation grouting program is considered. This program is implemented, as necessary, to fill the discontinuities and improve the structural competency of the subgrade rock mass. The consolidation grouting program comprises: (1) the selection of a grout design amenable to the rock mass discontinuities; and (2) the injection of the grout in injection holes installed in a staggered and appropriately spaced grid arrangement over the affected area(s) (i.e., treatment zone[s]) of the excavations and extending to a depth of approximately 30 ft. The design of the consolidation grouting program grid system and treatment zone(s) is based on the number, extent, and characteristics of the rock discontinuities revealed during excavation and the afore-described geophysical surveys.

2.2 Reactor Building Mud Mat and Vapor Barrier Installation

After leveling of the RXB excavation base level is completed, the RXB mud mat is installed. The RXB mud mat installation involves placement of a permanent vapor barrier and reinforcing wire mesh upon which the mud mat (lean concrete) is poured. The "mud mat system" comprising the vapor barrier, wire mesh, and lean concrete functions as a construction aid and does not serve an RXB structural support function. As such, design and installation of the RXB mud mat system are nonsafety-related activities.

2.3 Reactor Building Permanent Basemat Components Installation

The RXB basemat component installation begins after the RXB mud mat cures sufficiently to provide a suitable working surface for subsequent basemat preparatory work. The RXB basemat component installation activity comprises permanent installation of components primarily serving structural or utility support purposes, such as reinforcing steel (i.e., rebar) and associated supports, spacers, etc.; steel-plate composite (SC) wall base module assemblies, inclusive of integral column anchorages; sumps and drain lines; piping and conduit; grounding; concrete placement forms; and other components in preparation for the basemat concrete pour. Upon placement of the basemat concrete, these components are permanently embedded in the RXB foundation base slab. The RXB basemat concrete placement is performed after COL issuance and is not included in the scope of this LWA request.

This activity includes installation of the safety-related SC wall base course module assemblies comprising wall base modules with welded integral column anchorages

(Figure 3-1). These assemblies are fabricated off-site in sections sized to facilitate transport to the site. After onsite inspection and final preparation, each assembly section is lowered by crane into the RXB and welded to adjacent sections, and the assembly base columns are anchored to the mud mat to provide stability during basemat concrete placement. The basemat rebar is then installed around and within the integral column anchorages and other installed basemat components in preparation for basemat concrete placement. After COL issuance, the RXB basemat concrete is poured to a thickness covering the entire height of the base columns. During basemat concrete placement, concrete is also poured into the SC wall base module assemblies to a height approximately one foot from the top of the base modules (Figure 3-1, Note 2).

3.0 Design and Construction Information

Seismic classification of structures, systems, and components (SSC) is consistent with the guidance of RG 1.29, "Seismic Design Classification for Nuclear Power Plants." Safety-related and nonsafety-related Seismic Category I (SC-I) and Seismic Category II (SC-II) SSC are subject to the pertinent Quality Assurance Program requirements of 10 CFR 50, Appendix B.

The Radioactive Waste Building (RWB) is a reinforced concrete building and primarily houses nonsafety-related SSC. Below grade portions of the building are classified as an RW-IIa structure. The above-grade portion of the building is a steel-framed SC-III structure with the exception of an RW-IIa isolated enclosure used for waste sorting and storage.

The majority of the Reactor Building (RXB) is classified as an SC-I structure. Portions of the RXB are classified as SC-II. The design of the RXB complies with General Design Criterion 2 and 10 CFR 50, Appendix S because SSC are designed to withstand effects of earthquakes without loss of capability to perform their safety functions.

The RXB consists of reinforced concrete basemat, slabs, and steel-plate composite (SC) walls. The RXB is designed to withstand the effects of natural phenomena (earthquake, rain, snow, wind, tornado, hurricane) without affecting operability of the safety-related SSC in the building.

3.1 Subgrade Rock Remediation

3.1.1 Materials, Arrangement, and Dimensions

Flowable fill (i.e., controlled low-strength material) is the engineered backfill material that fills the excavation volume under the RXB and RWB in the case of over-excavation. Flowable fill concrete mixes consist of Type II cement, sand, relatively fine gravel, and water, and have a minimum unconfined compressive strength of 600±50 psi and a shear wave velocity between approximately 2400 fps and 4800 fps. Final design mixes are determined via a laboratory testing program.

3.1.2 Applicable Codes and Standards

Flowable fill used to fill over-excavated areas of the RXB and RWB foundations meets design, construction, and quality-control requirements in American Concrete International (ACI) PRC-229R-13(22) (Reference 6-3). Verification of flowable fill properties is in accordance with American Society for Testing and Materials (ASTM) D4832-16e1 (Reference 6-4), ASTM C39/C39M-21 (Reference 6-5), and ASTM D3999/D3999M-11e1 (Reference 6-6).

3.1.3 Excavation Mapping and Inspection

In accordance with RG 1.132, "Geologic and Geotechnical Site Characterization Investigations for Nuclear Power Plants," and as described in Section 2.1.2, CFPP will conduct detailed geologic mapping of the RXB and RWB excavation walls and excavation floor. Supplemental geophysical surveys of the excavation floors are also planned. The mapping results will be made available to the NRC. Before the placement of backfill, the NRC staff will be provided the opportunity to conduct an inspection of the excavation.

3.2 Mud Mat including Reinforcing Wire Mesh and Vapor Barrier

The mud mat system, including the reinforcing wire mesh and underlying vapor barrier, are nonsafety-related. The mud mat is a thin layer of concrete and does not have significant impact on the structural integrity or the response of the main structural system of the RXB. The reinforcing wire mesh ensures the mud mat provides a stable anchorage point for SC wall base module columns before and during basemat concrete placement.

3.3 Permanent Basemat Components

3.3.1 Materials, Arrangements, and Dimensions

3.3.1.1 Basemat Reinforcement

Figure 3-1 shows the RXB basemat foundation thickness and top and bottom elevations. The nominal grade elevation is 100 ft. Within the ultimate heat sink area, the basemat is depressed by 11.75 inches below the top elevation of the basemat for installation of additional commodities later in the construction process. The basemat footprint measures 231.5 ft by 155.5 ft.

Reinforcing steel for the basemat is deformed billet steel bars conforming to ASTM A615 (Reference 6-7) grade 60 or ASTM A706 (Reference 6-8) grade 60. The placement of concrete reinforcement is in accordance with ACI 349-13 (Reference 6-9). Welded wire fabric for concrete reinforcement conforms to ASTM A185 (plain wire) (Reference 6-10) or A497 (deformed wire) (Reference 6-11). The design does not use coated reinforcing steel. The RXB reinforcing steel design is based on the following material properties:

- Yield stress - 60 ksi (ASTM A615 Grade 60 or ASTM A706 Grade 60)
- Tensile strength - 90 ksi (A615 Grade 60), 80 ksi (A706 Grade 60)
- Elongation - ASTM A615 and A706
- Modulus of elasticity - 29,000 ksi

Table 3-1 outlines the design of the basemat reinforcement. Figure 3-2 and Figure 3-3 show the arrangement and details of the RXB basemat reinforcement.

3.3.1.2 Steel-Plate Composite Wall Base Module Assemblies

The typical thickness for the main structural interior and exterior SC wall base modules is 4 ft. The east and west exterior SC wall base modules are 5 ft thick while the north and south exterior walls are 4 ft thick. Limited wall base modules within the ultimate heat sink region are 4.5 ft thick. Figure 3-1 provides an isometric view of the SC wall base module assemblies.

The structural steel design used in the SC wall base module assemblies with integral column anchorages is based on the following material properties:

- Yield strength of faceplates - 50 ksi
- Yield strength of tie plates - 65 ksi
- Ultimate strength of faceplates - 65 ksi (ASTM A572, Gr. 50) (Reference 6-12) or 90 ksi (ASTM A240, XM-18) (Reference 6-13)
- Ultimate strength of tie plates - 85 ksi
- Yield strength of anchorage columns - 85 ksi
- Ultimate strength of anchorage columns - 107 ksi
- Ultimate strength steel anchor (shear) studs - 65 ksi

Table 3-2 outlines the SC wall base module sections and details for the RXB.

<u>Fabrication</u>

SC wall modular assembly anchorages to the RXB basemat are integral to the layer (course) of SC wall modular assemblies at the base of the RXB.

Anchorages and components are fabricated as a single module and shipped to site to be installed. Additional construction aides interfacing with the basemat are fabricated with the base course/anchorage modules to facilitate construction.

Welding, exclusive of module field splice welding, is completed during off-site fabrication. Faceplates are specified as carbon steel (ASTM A572, Gr. 50) or stainless steel (ASTM A240, XM-18) based on location in the RXB. Faceplates in contact with borated or radioactive water are specified as stainless steel. Integral column anchorages and module ties are specified as carbon steel.

<u>Connection to the Basemat</u>

Anchorage to the basemat is provided by integral column assemblies that extend through the basemat. Shear studs are attached to the web and flanges of columns to facilitate the connection of the columns to the reinforced concrete basemat. Steel studs meet ASTM A108 (Reference 6-14) and American Welding Society D1.1/D1.1M (Reference 6-15).

Welding electrodes vary based on base metal strength. Welds between tie plates and faceplates are typically EXX80 (ultimate strength 85 ksi minimum). Welds between faceplate and integral column elements, or welds between integral column element are EXX110. Construction aids may utilize lesser weld strength in accordance with design requirements. Welds in the field are used to join adjacent base course/anchorage SC wall modular assemblies before pouring of concrete.

Field welding of modular assembly splices includes welding of carbon steel faceplates to stainless steel faceplates, as well as stainless steel faceplates to stainless steel faceplate. Welds with stainless steel faceplate base metal requires a weld material with 90 ksi minimum ultimate strength.

3.3.2 Applicable Codes, Standards, and Specifications

Design-Specific Review Standard Sections 3.8.4 and 3.8.5 rely on independent standards to cover the design, materials, fabrication, testing, and inspections of SC-I structures and basemats. Design of SC wall base modules is based on ACI 349-13 (Reference 6-9) and AISC N690-18 (Reference 6-16). Design of the basemat reinforcement is based on ACI 349-13. The design uses the latest endorsed version of ASTM standards at the time of construction.

Table 3-1: Design Properties of Reinforced Concrete Basemat

Section Thickness (in.)	Clear Cover (in.)	Out-of-plane Bending Reinforcement (EFEW)	Out-of-plane Shear Reinforcement (EW)
96	3.0	2#11@12”	#4@12”

Note:
The thickness of basemat is 96 in. (8 ft) except at the region within the ultimate heat sink where an additional 12 in. layer is provided for non-structural reasons.

Table 3-2: Design Properties of SC Wall Base Module Assemblies

SC Wall	Total Wall Thickness (in)	Faceplate Thickness (in)	Anchor Diameter (in)	Anchor Spacing[(a)] (in)	Tie Plate Area (in^2)	Tie Plate Spacing[(a)] (in)
RX-1	60	0.75	1.0	8.0	6.0	30.0
RX-2	48	0.75	1.0	8.0	6.0	24.0
RX-2_4	54	0.75	1.0	8.0	6.0	27.0
RX-3	54	0.75	1.0	8.0	6.0	27.0
RX-4	48	0.75	1.0	8.0	6.0	24.0
RX-5	48	0.75	1.0	8.0	6.0	24.0
RX-6	60	0.75	1.0	8.0	6.0	30.0
RX-A	48	0.75	1.0	8.0	6.0	24.0
RX-B	48	0.75	1.0	8.0	6.0	24.0
RX-C	48	0.75	1.0	8.0	6.0	24.0
RX-D	48	0.75	1.0	8.0	6.0	24.0
RX-E	48	0.75	1.0	8.0	6.0	24.0
Pool Walls	48	0.75	1.0	8.0	6.0	24.0
Walls between NPMs[(b)]	48	0.75	1.0	8.0	6.0	24.0

Notes:

[a] Same spacing is used for horizontal and vertical directions

[b] These walls are located on gridlines RX-4.3 and RX-4.6 and in output contour plots the labels Wall RX-4.3 and Wall RX-4.6 are used.

Figure 3-1: Steel-plate Composite Wall Base Module Assemblies With Integral Column Anchorages

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}}NuScale 2(a)(c)

Figure 3-2: Reinforcement Layout of Reactor Building Basemat

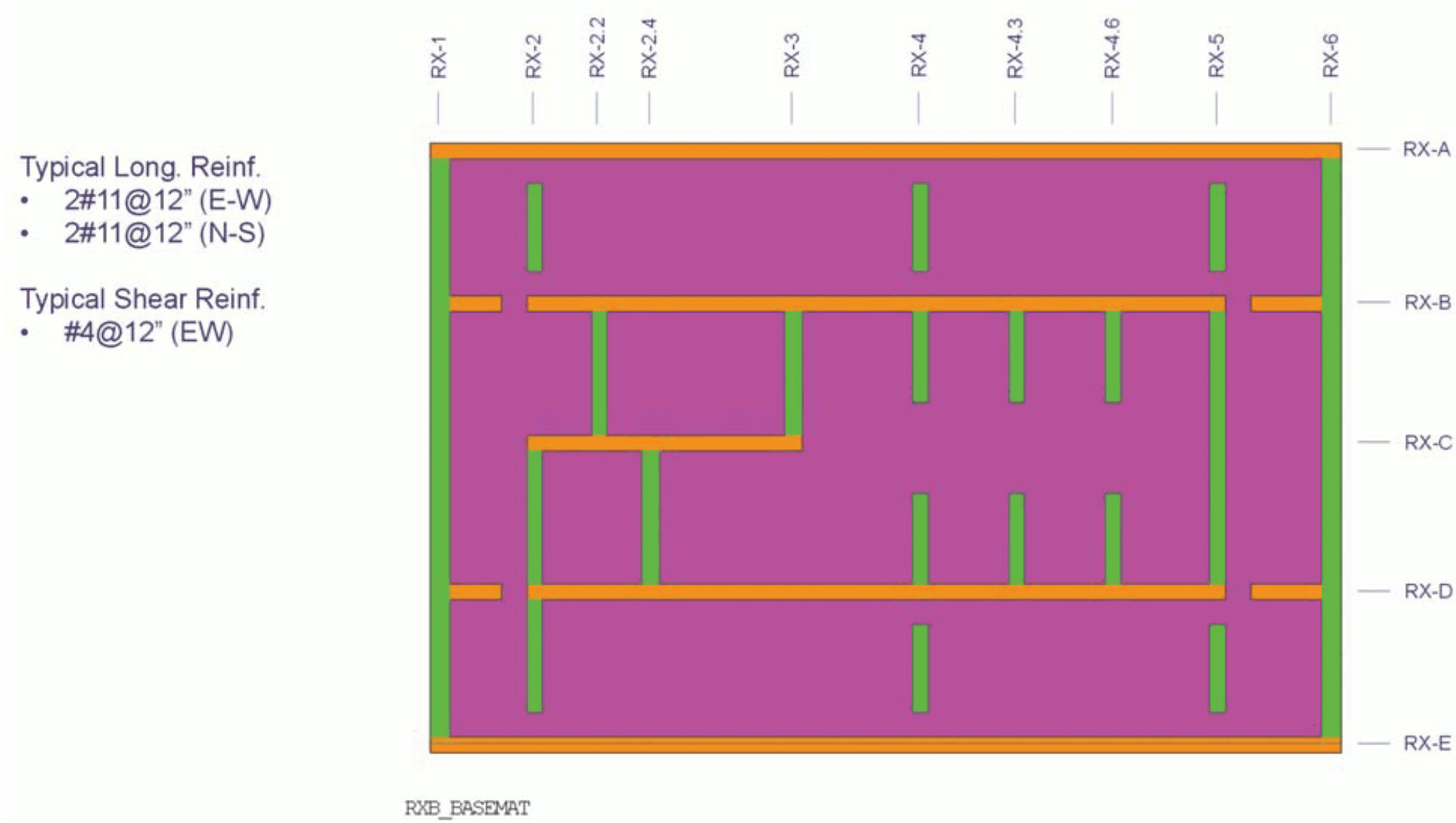
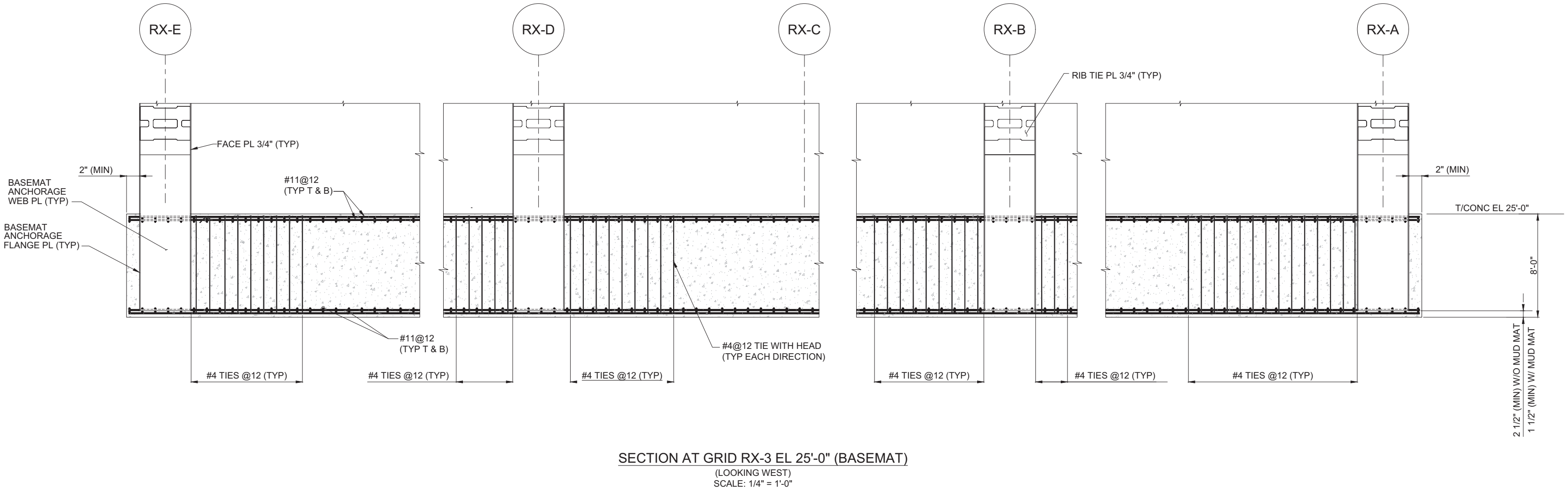


Figure 3-3: Typical Reinforcement Layout of Reactor Building Basemat



4.0 Program Requirements for Construction

This section describes the programs CFPP LLC will implement to ensure LWA activities are conducted in accordance with applicable NRC quality, security, and safety requirements and guidance.

4.1 Quality Assurance Program

As the applicant for the CFPP combined licenses (Enclosure 1), CFPP LLC is responsible for the establishment and execution of quality assurance program requirements during the design, construction, and operations phases of the CFPP.

Revision 6 of CFPP Quality Assurance Program Description (QAPD) (Reference 6-17) expands the scope of the previous NRC-approved CFPP QAPD, Revision 5, to govern CFPP construction phase activities. The CFPP QAPD implements the applicable requirements of 10 CFR 50, Appendix B. The QAPD is based on the requirements and guidance of ASME NQA-1 2015 for those activities within the scope of the QAPD. CFPP QAPD Revision 6 governs CFPP design, procurement, and construction activities, including LWA construction. Revision 6 of the CFPP QAPD is incorporated by reference into the CFPP LWA application.

4.2 Construction Security

Before commencing safety-related construction activities, CFPP LLC will implement construction site security measures consistent with the guidance of Nuclear Energy Institute (NEI) 09-01, Revision 0 (Reference 6-18). As detailed further in Reference 6-18, the following security measures provide reasonable assurance the capabilities of SSC are not impacted by undetected adverse conditions:

- control of personnel, material, and vehicles as defined in site procedures
- access controls as defined in site procedures
- pre-employment screening
- fitness-for-duty program (Section 4.3 below)
- security force qualifications
- audits

4.3 Construction Fitness-for-Duty Program

This section provides a description of the CFPP construction fitness-for-duty (FFD) program and implementation as required by 10 CFR 26.401(b).

The CFPP construction FFD program is compliant with the requirements of 10 CFR 26. The program is consistent with NRC Regulatory Guide 5.84, which endorses NEI 06-06, Revision 6 (Reference 6-19) with one exception related to compliance with FFD requirements for individuals who perform duties described under 10 CFR 26.4(e). The CFPP construction FFD program meets the FFD requirements of 10 CFR 26 as follows:

- Construction workers and first line supervisors are covered by the CFPP construction FFD Program (10 CFR 26, Subpart K) except when escorted by a construction escort.
- Personnel contracted for construction management and oversight are covered by the CFPP construction FFD Program (10 CFR 26, Subparts A - H, N, and O).
- Security personnel are covered by the CFPP construction FFD Program (10 CFR 26, Subparts A - H, N, and O).
- FFD program personnel are covered by the CFPP construction FFD program (10 CFR 26, Subparts A, B, D - H, N, O, and C per applicant's/licensee's discretion).
- The CFPP construction FFD program is implemented, with appropriate site procedures and instructions in place, before allowing individuals subject to the requirements of 10 CFR 26 to commence construction activities[1]. The CFPP construction FFD program remains in effect until the construction site transitions to a phase requiring site-wide implementation of 10 CFR 26, Subparts A - I, N and O.

1. As defined in 10 CFR 26.5, for the purposes of implementing 10 CFR 26, "construction activities" are those site work tasks that include fabricating, erecting, integrating, and testing safety- and security-related SSCs, and the installation of their foundations.

5.0 Applicant's Technical Qualifications to Engage in the Proposed Activities

This section summarizes the technical qualifications of CFPP LLC and the principal engineering, procurement and construction (EPC) team performing construction activities (i.e., "LWA activities"). This information facilitates the determination required by 10 CFR 50.10(e)(1)(iii) for issuance of an LWA. As allowed under 10 CFR 2.101(a)(9)(ii), further details demonstrating the technical qualifications of CFPP LLC and its EPC team to engage in design, construction, and operational activities proposed in the COL application are provided in the second part of the phased CFPP COL application.

5.1 Applicant - Program Manager for Limited Work Authorization Activities

As the applicant for the CFPP, CFPP LLC is the program manager providing oversight and direction for the LWA activities. CFPP LLC retains project management, risk management, design engineering, procurement, construction, oversight, geotechnical, security, quality assurance, and other services from key nuclear industry consultants and suppliers. The principal consultants and suppliers supporting the LWA activities are summarized in Section 5.2.

5.2 Principal Consultants and Suppliers for Limited Work Authorization Activities

5.2.1 NuScale Power, LLC

NuScale Power, LLC (NuScale) is the original equipment manufacturer (OEM) and has overall design responsibility for the US460 NPP standard design CFPP LLC will incorporate by reference into the second part of the phased COL application. As such, NuScale is supporting deployment of the US460 NPP on the CFPP site. These deployment support activities include engineering support services, as applicable, to CFPP LLC for site-specific design and construction associated with the LWA activities.

5.2.2 Fluor Corporation

Fluor Corporation (Fluor) is the primary engineering, procurement, and construction (EPC) contractor for CFPP. Fluor, a Fortune 500 company, is one of the world's largest publicly traded EPC and project management companies. Fluor has served the nuclear power industry for more than 75 years, having provided nuclear power plant engineering, design, procurement, construction, licensing, maintenance, and decommissioning support for more than 25 nuclear power plants. Since 2011, Fluor has been a majority shareholder in NuScale Power, LLC.

Fluor provided the balance-of-plant design described in the NuScale US460 standard design that will be incorporated by reference into the second part of the CFPP phased COL application. Fluor is responsible for managing the integrated team that: (1) supports preparation of the CFPP COL application, including this LWA application; and (2) provides post-LWA application and COLA submittal support during the NRC review process. Fluor also is responsible for activities to support deployment of the US460 NPP on the CFPP site, including planning and performance of the LWA construction activities and other pre-COL site preparatory activities prerequisite to or conducted concurrently with the construction activities within the scope of this LWA application.

5.2.3 Owner's Engineers

5.2.3.1 MPR Associates Inc.

MPR Associates Inc. (MPR) is a nuclear industry leader in providing engineering and project management solutions. MPR is at the forefront of development and deployment of new nuclear technology, leading and making key contributions to enable technology, project, and industry success. MPR fulfills the role as one of two Owner's Engineers (OEs) to CFPP LLC.

5.2.3.2 Burns & McDonnell

Burns & McDonnell has extensive experience in large scale domestic and international engineering and construction projects across the power industry. Burns & McDonnell performs nuclear power plant design activities for SMRs, advanced reactors, and Department of Energy and Department of Defense projects. Burns & McDonnell provides owner's engineering services for new nuclear power plants currently under design and construction, as well as program management, project controls and oversight services for plants undergoing large scale refurbishments. Burns & McDonnell provides OE services to CFPP LLC in the areas of vendor oversight, quality assurance, program governance development, document management, and technical review and approval of vendor engineering deliverables. Burns & McDonnell fulfills the role as one of two OEs to CFPP LLC.

5.2.4 Sargent & Lundy

Sargent & Lundy (S&L) has been actively involved in the licensing and design of new nuclear power plants and facilities for nearly 70 years. Founded in 1891, S&L provides consultancy, design, architectural and engineering services to the power and energy industry including the fleet of existing operating nuclear power stations, and provides design, licensing, and construction support to suppliers of the next generation of advanced reactor nuclear power plants. S&L is responsible for supporting deployment of the US460 NPP on the CFPP site, including engineering and design of CFPP nuclear island SSC.

5.2.5 RIZZO International, Inc.

RIZZO International, Inc. (RIZZO) is an engineering and earth sciences consulting firm with expertise in specialty civil, geotechnical, and structural analysis and design; hydrologic and hydraulic modeling; probabilistic and deterministic seismic and volcanic hazards analysis; geologic and hydrogeologic investigations; and materials testing and inspection. In support of the LWA activities described herein, RIZZO provides the CFPP with an array of engineering services, including but not limited to engineering geological and geotechnical subsurface investigations and corresponding foundation interface design analyses.

5.2.6 S&ME, Inc.

S&ME, Inc. (S&ME) has delivered a broad range of services to the nuclear industry for over 30 years. S&ME supplies geotechnical and environmental services in support of COL applications for proposed new advanced reactor plants. S&ME provides independent technical and quality assurance (QA; per 10 CFR 50, Appendix B, and NQA-1) oversight of the CFPP site investigation field activities performed by RIZZO and associated laboratory testing and analysis activities.

6.0 References

6-1 NuScale Power, LLC, “Submittal on behalf of CFPP LLC Carbon Free Power Project (CFPP) Combined License Application (COLA) Entitled ‘Limited Work Authorization Application Contents of Safety Analysis Report’," June 8, 2023, ML23159A196.

6-2 NuScale Power, LLC, "NuScale Power, LLC Submittal on Behalf of CFPP LLC Carbon Free Power Project (CFPP) Combined License Application (COLA) Entitled 'Request for Exemption to Authorize Early Construction of CFPP Excavation Wall Treatments'," LO-145324, July 31, 2023.

6-3 American Concrete Institute, “Controlled Low Strength Materials,” ACI PRC-229R-13(22), Farmington Hills, MI.

6-4 American Society for Testing and Materials International, “Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders,” ASTM D4832-16e1, ASTM International, West Conshohocken, PA.

6-5 American Society for Testing and Materials International, “Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens,” ASTM C39/C39M-21, ASTM International, West Conshohocken, PA.

6-6 American Society for Testing and Materials International, “Standard Test Methods for the Determination of the Modulus and Damping Properties of Soils Using the Cyclic Triaxial Apparatus,” ASTM D3999/D3999M-11e1, ASTM International, West Conshohocken, PA.

6-7 American Society for Testing and Materials International, “Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement,“ ASTM A615, ASTM International, West Conshohocken, PA.

6-8 American Society for Testing and Materials International, “Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement,“ ASTM A706, ASTM International, West Conshohocken, PA.

6-9 American Concrete Institute, "Code Requirements for Nuclear Safety-Related Concrete Structures and Commentary," ACI 349-13, Farmington Hills, MI.

6-10 American Society for Testing and Materials International, “Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete,“ ASTM A185, ASTM International, West Conshohocken, PA.

6-11 American Society for Testing and Materials International, “Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete,“ ASTM A497, ASTM International, West Conshohocken, PA.

6-12 American Society for Testing and Materials International, “Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel,“ ASTM A572, ASTM International, West Conshohocken, PA.

6-13 American Society for Testing and Materials International, “Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications,“ ASTM A240, ASTM International, West Conshohocken, PA.

6-14 American Society for Testing and Materials International, “Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished,“ ASTM A108, ASTM International, West Conshohocken, PA.

6-15 American National Standards Institute/American Welding Society, “Structural Welding Code - Steel,” ANSI/AWS D1.1/D1.1M, Danvers, MA, 2020.

6-16 American National Standards Institute/American Institute of Steel Construction, "Specification for Safety-Related Steel Structures for Nuclear Facilities," ANSI/AISC N690-18, Chicago, IL.

6-17 Topical Report TR-121172-NP, Revision 4, "Carbon Free Power Project Nuclear Quality Assurance Program Description," Revision 006, July 2023.

6-18 Nuclear Energy Institute, "Security Measures During New Reactor Construction," NEI 09-01, Revision 0, September 2009.

6-19 Nuclear Energy Institute, "Fitness for Duty Program Guidance for New Nuclear Power Plant Construction Sites," NEI 06-06, Revision 6, May 2012.