APPENDIX 10D

Electrical Engineering Design Criteria

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10D.1 Introduction

This appendix summarizes the codes, standards, criteria, and practices that will be generally used in the design and construction of electrical engineering systems for the City of Vernon Power Plant (VPP). More specific project information will be developed during execution of the project to support detailed design, engineering, material procurement specification, and construction specifications.

10D.2 Codes and Standards

The design of the electrical systems and components will be in accordance with the laws and regulations of the federal government and the State of California, City of Vernon ordinances, and industry standards. The current issue or revision of the documents at the time of filing this Application for Certification will apply, unless otherwise noted. If there are conflicts between the cited documents, the more conservative requirement will apply.

The following codes and standards are applicable to the electrical aspects of the power facility:

- American National Standards Institute (ANSI)
- American Society for Testing and Materials (ASTM)
- Anti-Friction Bearing Manufacturers Association (AFBMA)
- California Building Standards Code 2001
- California Electrical Code 1998
- Insulated Cable Engineers Association (ICEA)
- Institute of Electrical and Electronics Engineers (IEEE)
- Illuminating Engineering Society (IES)
- National Association of Corrosion Engineers (NACE)
- National Electrical Code (NEC)
- National Electrical Manufacturers Association (NEMA)
- National Electrical Safety Code (NESC)
- National Fire Protection Association (NFPA)
- Underwriters Laboratories, Inc. (UL)

10D.3 Gas Insulated Substation and Transformers

10D.3.1 Switchyard

One 230-kV gas insulated substation (GIS) will be included at the VPP site. Each combustion turbine generator unit and the steam turbine generator will connect to the GIS via a generator step-up transformer

The GIS will consist of sulfur hexafluoride (SF6) circuit breakers arranged in a breaker and a half-switching scheme for the transformer connection to the grid. Surge arresters will be provided for the outgoing lines in the area of the takeoff towers.

The switchyard will be located close to the main step-up transformers and will use buried cables for the connection.

The SF6 breakers will be of the dead tank design with current transformers on each bushing. Disconnect switches will be located on each side of the breakers to isolate the breaker, and one switch will be located at each line termination or transformer connection for isolation of the lines or transformer for maintenance. Instrument transformers (current and capacitive voltage transformers) will be included for protection and synchronization. The GIS design will meet the requirements of the National Electrical Safety Code—ANSI C2.

A grounding grid will be provided to control step and touch potentials in accordance with IEEE Standard 80, Safety in Substation Grounding. Metallic equipment, structures, and fencing will be connected to the grounding grid of buried conductors and ground rods, as required for personnel safety. The substation ground grid will be tied to the plant ground grid.

Lightning protection will be provided by shield wires or lightning masts. The lightning protection system will be designed in accordance with IEEE 998 guidelines.

All faults will be detected, isolated, and cleared in a safe and coordinated manner as soon as practical to ensure the safety of equipment, personnel, and the public. Protective relaying will meet IEEE requirements and will be coordinated with the utility.

Each bus will be protected with a bus differential scheme. Each outgoing line will be provided with redundant high-speed relay systems with transfer trip capability. Transmission lines will have microprocessor-based distance relays with communication capability to the remote substation. Relay equipment for the remote ends is not included in this scope.

Each circuit breaker will be provided with independent breaker failure relay protection schemes.

Interface with the utility supervisory control and data acquisition (SCADA) system will be provided. Interface will be at the interface terminal box and the Remote Terminal Units (RTU). Communication between the facility GIS and the substation at the other end of the overhead transmission lines will be included. RTUs will allow interface and remote control of the switchyards.

Revenue metering will be provided on the 230-kV transmission line(s) to record net power to or from the switchyard. Meters and the metering panel will be provided.

10D.3.2 Transformers

The generators will be connected to the 230-kV switchyard through main step-up transformers. The step-up transformers will be designed in accordance with ANSI standards C57.12.00, C57.12.90, and C57.91. The main transformers will be two-winding, delta-wye, OA/FA/FA. The neutral point of high-voltage winding will be solidly grounded. Each main step-up transformer will have metal oxide surge arrestors connected to the high-voltage terminals and will have manual de-energized ("no-load") tap changers located in high-voltage windings.

The auxiliary power to the plant will be provided by two 3-winding auxiliary transformers (15 kV/4.16 kV/13.8 kV). The high-voltage side (15 kV) of the auxiliary transformers will be connected to the line side terminals of each combustion turbine generator's circuit breaker.