Pico Power Project

Appendix 10-F
Chemical Engineering Design Criteria

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APPENDIX 10F

CHEMICAL ENGINEERING DESIGN CRITERIA

10 F1 INTRODUCTION

This appendix summarizes the codes, standards, criteria, and practices that will be generally used in the design and installation of chemical engineering systems for the Pico Power Project (PPP). More specific project information will be developed prior to PPP construction to support detailed design, engineering, material procurement specifications, and construction specifications as required by the California Energy Commission.

10 F2 DESIGN CODES AND STANDARDS

The design and specification of all work performed will be in accordance with the laws and regulations of the federal government and the State of California. Industry codes and standards partially unique to chemical engineering design, to be used in design and construction of the PPP, are summarized below.

- ANSI—American National Standards Institute
  - ANSI B31.1—Power Piping Code
- ASME—American Society of Mechanical Engineers
  - ASME—Performance Test Code 31, Ion Exchange Equipment
- ASTM—American Society for Testing and Materials.
  - ASTM D859-94—Referee Method B for Silica as SiO_2
  - ASTM D888-96—Referee Method A for Dissolved Oxygen
  - ASTM D513-96—Referee Method D for CO_2
- OSHA—Occupational Safety and Health Administration
- SSPC—Steel Structures Painting Council Standards
  - SSPC SP3—Power Tool Cleaning
  - SSPC SP7—Brush-Off Blast Cleaning
  - SSPC SP1—Solvent Cleaning
  - SSPC SP6—Commercial Blast Cleaning
  - SSPC SP5—White Metal Blast Cleaning
- UL—Underwriters Laboratories
- AWWA—American Waterworks Association
  - WWA 2540-95—Method C for TDS

Other recognized standards will be used as required to serve as design, fabrication, and construction guidelines when not in conflict with the above-listed standards.

Codes and industry standards used for design, fabrication, and construction will be the codes and industry standards, including all addenda, in effect as stated in equipment and construction purchase or contract documents.

10 F3 GENERAL CRITERIA

10 F3.1 Design Water Quality

10 F3.1.1 Circulating Water

PPP will use recycled water from the City of Santa Clara Waste Water Treatment Plant (WWTP) for circulating water makeup. The reclaimed water is suitable for use as cooling tower makeup and as feedwater for the power cycle makeup water treatment system. No additional treatment is expected to be required for the makeup water to the cooling tower and process.

Data from the City of Santa Clara WWTP indicate that the effluent has the characteristics defined in Section 8.15, Water Resources.

10 F3.1.2 Service Water

The reclaimed water is suitable to meet non-potable general service water requirements, plant wash water, and other miscellaneous uses, as well as influent water to the R/O - DI water treatment system to meet the DI system process needs for HRSG and gas turbine water injection. Firewater will be obtained from the City's 12-inch main located in Pico Way.

A typical water analysis range for this water is presented in Section 8.15.

Water for potable/sanitary, fire fighting and plant wash down uses will be supplied from the municipal water supply.

10 F3.1.3 Cycle Makeup

Service water will be supplied to the Cycle Makeup Treatment System (demineralization system). The high quality effluent from the Cycle Makeup Treatment System will serve as makeup to the steam cycle. In addition, cycle makeup water will also be used to supply water for CTG water injection for NOx control, Sprint power augmentation and minor various other uses.

Water for cycle makeup will be the highest quality practical. Minimum quality requirements for cycle makeup water will be as follows:

- Total dissolved solids--0.1mg/l
- Silica as SiO_2--0.02 mg/l
- Specific conductance at demineralizer effluent--0.2 μS/cm
- pH--6.5 to 7.5

10 F3.1.4 Construction Water

Water for use during construction will be supplied from the Municipal Water supply.

10 F3.1.5 Fire Protection Water

Water for fire protection will be obtained from the City water system located in Pico Way.

10 F3.2 Chemical Conditioning

10 F3.2.1 Cycle Chemical Conditioning

Condensate-feedwater chemical conditioning will consist of an oxygen scavenger supplemented as required by amines for corrosion control.

HRSG chemical feed will consist of a mixture of sodium phosphates to control boiler water pH, minimize scale formation, and provide boiler water buffering capacity.

10 F3.2.2 Circulating Water System Chemical Conditioning

Circulating water chemical conditioning will consist of chemicals to minimize corrosion and to control the formation of mineral scale and biofouling. Corrosion and scaling will be controlled by the use of sulfuric acid for alkalinity adjustment in conjunction with inhibitors, as required. Chlorination utilizing sodium hypochlorite or utilizing sodium bromide will minimize biofouling of the condenser tubes and the cooling tower.

10 F3.2.3 Closed-Cycle System Chemical Conditioning

Bypass chemical feeders will provide water-conditioning chemicals to the Closed Cycle Cooling System. Makeup water to the closed systems will be condensate quality and an inhibitor (compatible with demineralized water) will be used for corrosion control.

10. F3.2.4 Reverse Osmosis Chemical Conditioning

Sodium bisulfite will be introduced upstream of the reverse osmosis units for oxygen scavenging.

10 F3.3 Chemical Storage

10 F3.3.1 Storage Capacity

Chemical storage tanks for bulk chemicals will, in general, be sized to store a minimum of 1.5 times the normal bulk shipment. The minimum acceptable volume of the SCR aqueous ammonia storage tank will provide at least seven days storage.

Specialty chemicals used for makeup cycle water treatment, condensate and feedwater conditioning, circulating water, and miscellaneous uses, will be delivered in totes or specialized containers according to the chemical suppliers.

10 F3.3.2 Containment

Chemical storage tanks containing corrosive and hazardous fluids will be surrounded by curbing. Curbing and drain piping design will allow a full tank capacity spill without overflowing the curbing. For multiple tanks located within the same curbed area, the largest single tank will be used to size the curbing and drain piping.

Alternatively, where curbing is not possible, double-walled chemical tanks will be used for bulk chemicals that are corrosive and hazardous, in lieu of containment.

10 F3.3.3 Closed Drains

Waste piping for volatile liquids and wastes with offensive odors, will use closed drains to control noxious fumes and vapors.

10 F3.3.4 Coatings

Tanks, piping, and curbing for chemical storage applications will be provided with a protective coating system. Specific requirements for selection of an appropriate coating will be identified prior to equipment and construction contract procurements.

10 F3.4 Wastewater Treatment

Metal cleaning wastes from pre-operational and operational chemical cleaning of the boiler and preboiler systems of the HRSG will be collected, treated, and disposed offsite by the chemical cleaning contractor. Other maintenance chemical cleaning wastes from the combustion turbine off-line washes will be collected in sumps, tested for compliance with discharge limits, treated, and hauled off-site (if necessary) by a licensed contractor. Cooling tower blowdown will be discharged directly from the circulating water system to the City sanitary sewer system located in Central Expressway. RO brine, HRSG blowdown, filter backwash, and demineralizer wastes will be discharged directly to the cooling tower basin for use as makeup. Other plant process wastewaters such as floor drains, as well as miscellaneous waste water streams, will be collected in the plant wastewater collection system for the oil/water seperator. Discharge from the oil/water seperator will be supplied to the cooling tower basin. Plant effluent to be discharged off-site will meet all applicable criteria of federal, state, and local permits.

Sanitary wastewater will be collected and sent with the plant wastewater to the city sanitary sewer in Central Expressway.