

Updated Safety Analysis Report (USAR)
Page Markups

*[Word-processor mark-ups use "double underline"
or "~~strikeout~~" feature for "new" or "deleted" text respectively.]*

When Fort Calhoun Station was originally licensed, non-RCS safety-related piping was designed and constructed to meet the requirements of USAS B31.7, 1968 (DRAFT) Edition (i.e., the Code of Record for this piping).

Amendment No. XXX to Renewed Facility Operating License No. DPR-40 allows the design and/or analysis of non-RCS safety-related piping to be performed in accordance with ASME Section III, 1980 Edition (no Addenda) as an alternative to USAS B31.7, 1968 (DRAFT) Edition.

The following table lists the principal plant design and operating characteristics. Data relate to 100 percent rated power (1500 MWt) unless specifically stated otherwise.

Table 1.2-1 - Principal Plant Design and Operating Characteristics

Plant

Net Electrical Power Output, MWe	509.0
Gross Electrical Power Output, MWe	531.9
Electrical Power Output, MWe at 1500 MWt	533.7 Maximum

Reactor

Core Thermal Output, MWt	1500
Nominal Flow Rate, gpm	214,563
Maximum Core Inlet Temperature, °F (no uncertainties)	545
Maximum Core Outlet Temperature, °F (no uncertainties)	593
Maximum Operating Pressure, psia	2100
Design Pressure, psia	2500
Design Temperature, °F	650
Number of Fuel Assemblies	133
Number of Control Element Assemblies	49
Number of Loops	2
Number of Pumps	4

Steam Generators

Number of Units	2
Nominal Total Steam Flow, lb/hr	6.62x10 ⁶
Feedwater Temperature, Design °F	442.5
Steam Temperature, Design °F	522.6
Steam Quality, expressed as moisture content, max.	0.1
Shell Side Design Pressure, psia	1025
Shell Side Design Temperature, °F	560

FCS DESIGN CRITERIA*

CRITERION 9 - REACTOR COOLANT PRESSURE BOUNDARY

The reactor coolant pressure boundary shall be designed and constructed so as to have an exceedingly low probability of gross rupture or significant leakage throughout its design lifetime.

This criterion is met. Reactor coolant system components are designed for a pressure of 2500 psia and a temperature of 650°F. The nominal operating conditions of 2100 psia and an average reactor coolant system temperature of 572.5°F permit an adequate margin for normal load changes and operating transients. The components are designed and constructed in accordance with the ASME Boiler and Pressure Vessel Code, Section III. Codes and standards for components of the engineered safeguards systems are delineated in Criterion 1. Reactor coolant loop piping is designed in accordance with ANSI B 31.1 plus nuclear code cases. Other reactor coolant boundary piping is in accordance with the intent of ANSI Draft Code for Nuclear Piping B 31.7 of February 1968. Amendment No. XXX to Renewed Facility Operating License No. DPR-40 allows the design and/or analysis of non-RCS safety-related piping to be performed in accordance with ASME Section III, 1980 Edition (no Addenda) as an alternative to USAS B31.7, 1968 (DRAFT) Edition. Quality Control, inspection, and testing as required by these standards ensure the integrity of the reactor coolant system and are described in [Appendix A](#) and [Section 4.5](#) of the USAR.

In addition to the code requirements listed, the reactor coolant loop piping is designed to meet the cyclic loading requirements and transient conditions stated for the reactor pressure vessel in [Section 4.2.2](#) of the USAR. This piping is designed to withstand the dynamic seismic loadings for Class I structures under the rules listed in Section 2.0, [Appendix F](#), of the USAR.

Also, cf. Criteria 33 to 36.

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Fort Calhoun Station
R7

Classification of Structures and Equipment
and Seismic Criteria

Appendix F
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Table F-1 - "Loading Combinations and Primary Stress Limits"

Primary Stress Limits

<u>Loading Combinations</u>	<u>Vessels</u>	<u>Piping (e)</u>	<u>Supports (f)</u>
1. Design Loading + Design Earthquake	$P_M \leq S_M$ $P_B + P_L \leq 1.5S_M$	$P_M \leq 1.2S_h$ $P_B + P_M \leq 1.2S_h$	Working Stress Anchor Bolts F.S. ≥ 4.0 (d)
2. Normal Operating Loadings + Maximum Hypothetical Earthquake + (Fluid Transient Loadings (d))	$P_M \leq S_D$ $P_B \leq 1.5 \left[1 - \left(\frac{P_M}{S_D} \right)^2 \right] S_D$ <p style="text-align: center;">(b)</p>	$P_M \leq S_D$ $P_B \leq \frac{4}{\pi} S_D \cos \frac{\pi}{2} X \frac{P_M}{S_D}$ <p style="text-align: center;">(c)</p>	Within Yield Anchor Bolts F.S. ≥ 2.0 (d)
3. Normal Operating Loadings + Pipe Rupture + Maximum Hypothetical Earthquake	$P_M \leq S_L$ $P_B \leq 1.5 \left[1 - \left(\frac{P_M}{S_L} \right)^2 \right] S_L$ <p style="text-align: center;">(b)</p>	$P_M \leq S_L$ $P_B \leq \frac{4}{\pi} S_L \cos \frac{\pi}{2} X \frac{P_M}{S_L}$ <p style="text-align: center;">(a), (c)</p>	Deflection of supports limited to maintain supported equipment within limits shown

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Table F-1 (Continued)

NOTES:

- (a) These stress criteria are not applied to a piping run within which a pipe break is considered to have occurred.
- (b) Loading combinations 2 and 3, stress limits for vessels, are also used in evaluating the effects of local loads imposed on vessels and/or piping, with the symbol P_M changed to P_L .
- (c) The tabulated limits for piping are based on a minimum "shape factor". These limits are modified to incorporate the shape factor of the particular piping being analyzed.
- (d) These load cases and limits apply only to the Pressurizer relief valve piping and supports.
- (e) As an alternative to USAS B31.7, 1968, non-RCS, safety-related piping analysis may also be performed in accordance with ASME III, 1980 Edition (no Addenda). Material properties shall be from the original code of record (i.e., USAS B31.7, 1968). Associated stress limits shall be in accordance with ASME III, 1980 Edition (no Addenda) for Service Levels as shown below:

<u>Load Combination</u>
<u>Service Level A (Eqn. 8): Dead Weight</u>
<u>Service Level A (Eqn. 10): Thermal</u>
<u>Service Level A (Eqn. 11): Normal Loading: Dead Weight + Thermal</u>
<u>Service Level B: Normal + Design Earthquake</u>
<u>Service Level C: Normal + (Maximum Hypothetical Earthquake + Fluid Transient Loading)_{srss} (d)</u>
<u>Service Level D: Normal + (Maximum Hypothetical Earthquake + Pipe Rupture)_{srss}</u>

- (f) Support analysis will continue to be performed in accordance with the existing licensing basis (i.e., Seventh Edition, AISC, American Institute of Steel Construction).