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Rev. 2

INDEPENDENT DESIGN VERIFICATION

PIPE STRESS DESIGN REVIEW CRITERIA

FOR

COMANCHE PEAK STEAM ELECTRIC STATION

TEXAS UTILITIES SERVICES, INC.

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1.0 INTRODUCTION

The purpose of this document is to provide the criteria to be used for the review of the Piping Stress and Flued Head Analyses for Comanche Peak Steam Electric Station (CPSES). This Design Criteria shall be used in conjunction with Work Instruction 1, "Assessment Procedures," for details on the review methodology and documentation requirements.

2.0 SCOPE

The scope of the pipe stress and flued head review includes the following portions of the Residual Heat Removal/Safety Injection (RHR) system, Train B:

- Class 2 containment sump recirculation piping from containment penetration MS-2 to the suction of RHR pump TBX-RHAPRH-02 (Gibbs & Hill Stress Problem 1-069).

- Class 2 RHR piping from the discharge of the reference pump to the tubeside inlet of RHR heat exchanger TBX-RHAHRS-02 (Gibbs & Hill Stress Problem 1-070).

- Penetration MS-2, including the entire forging and the containment sleeve between the flued head and the containment wall.

3.0 CODES, STANDARDS AND REFERENCE DOCUMENTS

This section lists the industry standards and design basis that were applicable during the design period and should have been implemented. These codes, standards and references provide a criteria that the design can be evaluated against.

3.1 Piping

The design and stress analysis shall be reviewed for conformance with:

3.1.1 USNRC Standard Review Plan, Chapter 3 (NRC SRP).

3.1.2 ASME Boiler and Pressure Vessel Code Section III, 1974 Edition, including Summer 1974 addenda.

Note: Later editions of the ASME code may be used if the requirements of paragraph NA-1140 are met. If so, the analyses will be reviewed accordingly.

3.1.3 The following Gibbs and Hill, Inc. Project Design Specifications:

- 2323-MS-200 Revision 3. (ASME Section III, Code Class 2 and 3 piping), hereafter noted as Project Design Specification 2323-MS-200.

- 2323-MS-100 Rev 6 (Piping Erection), hereafter noted as Project Design Specification 2323-MS-100.

- 2323-MS-46A, Rev. 3 (Nuclear Safety Class Hangers and Supports), hereafter noted as Project Design Specification 2323-MS-46A.

3.1.4 CPSES Final Safety Analysis Report

3.2 Flued Head

The design and stress analyses shall be reviewed for conformance with:

3.2.1 ASME Boiler and Pressure Vessel Code Section III, 1974 Edition, including all addenda thru Summer 1976

3.2.2 Gibbs and Hill, Inc. Project Design Specification: 2323-MS-74 Section 3, including amendments 1 thru 5 (Mechanical Penetrations), hereafter noted as Project Design Specification 2323-MS-74.

4.0 DESIGN

4.1 General

All piping systems shall be reviewed for conformance with the requirements of the Code as stipulated in Subarticles NC-3600 for Nuclear Class 2 and NE-3000 for Nuclear Class MC components.

4.2 Classification of Piping Systems

4.2.1 Nuclear/Quality

Nuclear and quality system classifications are specified in Project Design Specification 2323-MS-200, Table 3.1-2.

4.3 Boundaries

4.3.1 Piping system boundaries are designated on the flow diagrams for Nuclear Class 1, 2 and 3 piping and are described in Project Design Specification 2323-MS-200. Piping/MC boundaries are shown in Project Design Specification 2323-MS-74.

4.3.2 The dimensional location of each piping boundary is shown on the Piping Isometric Drawings.

4.3.3 Piping Analyses may be decoupled when:

a. The ratio of the moments of inertia of the run and branch piping exceeds 10.0.

b. The restraint configuration and piping layout of the branch line is such that the effects of any large mass (e.g., valves) on the branch line will not significantly affect the run pipe.

4.3.4 Flued Heads and major equipment nozzles (RHR pump, heat exchanger) shall be considered as anchor points in the piping analyses.

4.3.5 Anchor points for flued head analysis are as described in Section 3.6.4.3 of Project Design Specification 2323-MS-74.

4.4 Design and Operating Conditions

Analysis data shall be reviewed for conformance with the following:

4.4.1 The design pressures and temperatures for each piping system tabulated in Project Design Specification 2323-MS-200, Appendix 3, and Project Design Specification 2323-MS-74, Table 3.6-1

4.4.2 The operating pressures and temperatures for the piping tabulated in Project Design Specification 2323-MS-200, Appendix 8, and Project Design Specification 2323-MS-74, Table 3.6-1.

4.5 Geometry and Computer Modeling

4.5.1 The piping geometry used as input data for computer analysis shall be reviewed for conformance with the latest revision of the Brown & Root "BRHL" isometric drawings.

Analysis isometrics shall be compared to the Brown & Root as-built isometric drawings (BRP as-built drawings) for conformance with the following tolerances:

- Maximum centerline deviation is 2" as per Project Design Specification 2323-MS-100, Section 4.9.

Geometries which do not conform to this tolerance shall be reviewed for impact upon the analytical results.

4.5.2 Restraint locations input for computer analysis shall be reviewed for conformance with the latest revision of the "BRHL" isometric drawings.

When compared to the pipe support as-built configuration, these locations should be within the tolerances of TUSI Verification Procedure CP-EI-4.5-1, Section 3.2.4, i.e., ± 2".

Restraint locations which do not conform to these tolerances shall be reviewed for impact upon the analytical results.

4.5.3 Pipe properties shall be reviewed for conformance with Project Design Specification 2323-MS-200, Appendix 3.

4.5.4 Material properties shall be reviewed for conformance with Project Design Specification 2323-MS-200, Appendix 3, the associated piping isometric drawings and ASME B&PV Code, Section III, Appendix I.

4.5.5 Poisson's ratio shall be taken as 0.3 for all metals at all temperatures.

4.5.6 Mass point spacing shall be reviewed for adequacy of representing the dynamic properties of the system up to 33 Hz for seismic analysis.

4.5.7 Valve modeling shall be reviewed for conformance with the following conventions:

a. Weights and centers of gravity shall be as specified on the applicable vendor supplied valve assembly drawings, except as amended in 2323-MS-200, Appendix 10.

b. For extended operator valves, modeling of the operator shall be such that the first frequency of the valve stem equals or exceeds 33 Hz.

4.5.8 Flange modeling shall be reviewed for conformance with the following conventions:

a. Flanges shall be considered as additional lumped weights.

b. Flange thickness shall be assumed as the same thickness of the pipe for purposes of modeling stiffness.

4.5.9 The penetration assembly (flued head) finite element modeling shall be reviewed for conformance with Fig. 74-1, Rev. A, of Project Design Specification 2323-MS-74 and the appropriate fabrication drawings.

4.6 Loading and Stress Requirements

Review to assure that each load case meets the general requirements as specified in the Code with emphasis placed upon the following particular items.

4.6.1 Stress intensification factors shall be reviewed for conformance with:

a. ASME B&PV Code, Section III subarticle NC-3670.

b. Applicable Bonney Forge Reports for weldolets.

4.6.2 Pressure Effect

The effect of internal pressure shall be considered in computing longitudinal stress per the Code.

4.6.3 Gravity Analysis

a. Review to assure that the weight of the pipe, fluid, insulation, fittings, flanges, valves (including actuators) and other in-line components have been considered.

4.6.4 Thermal Analysis

a. Review to assure that and all thermal modes have been considered.

b. Review to assure that the effects of thermal movements from equipment nozzles have been considered.

4.6.5 Seismic Analysis

a. Review to assure that 1/2 SSE and SSE spectra at appropriate damping values for all pertinent buildings at the proper elevations have been enveloped. Individual building response spectrum curves are provided in Appendix 5 of of Project Design Specification 2323-MS-200.

b. Review to assure that damping values are consistent with CPSES-FSAR Table 3.7 B-1 i.e.,

	Damping Ratio (Percentage)	
Pipe Size	OBE	SSE
Pipe diameter greater than 12 inches	2	3
Pipe diameter less than or equal to 12 inches	1	2

The damping ratio is assumed to be the same for all modes.

c. Review to assure that the method used for combining modal responses conforms to NRC Regulatory Guide 1.92 revision 1.

d. Review to assure that analysis cut-off frequency used was at least 33 Hz.

e. Review to assure that piping is designed and supported such that the acceleration of the active valves does not

exceed 3 g in any horizontal direction, 2 g in the vertical direction, or lower g values as required by the respective manufacturers.

f. Review to assure that at least 90% of the mass has been included in the computer calculation for dynamic analyses. If this criterion is not met, the results will be evaluated on a case by case basis to assure that the calculated loads and stresses are acceptable.

4.6.6 Seismic Anchor Movement (SAM) Analysis

Review to assure that seismic differential anchor movements have been considered. If piping passes between buildings, proper phasing should be taken into account. Movements are provided in Appendix 5 of Project Design Specification 2323-MS-200.

4.6.7 Restraint stiffness input shall be reviewed for conformance with Table 3.4-1 of Project Design Specification 2323-MS-200.

4.6.8 Flange design shall be reviewed for conformance with the stress requirements of the Code paragraph NC-3647.

4.6.9 Functional Capability

Review the maximum primary stress data to insure that the piping can deliver rated flow under all conditions as required in NRC SRP Section 3.9.3.

4.6.10 Flued Head Loading

Flued head applied loads shall be reviewed for conformance with Table 3.6-2 of Project Design Specification 2323-MS-74.

4.7 Loading Combinations

4.7.1 Load combinations for nuclear class 2 piping will be as specified in ASME Code Subarticle NC-3650 and in Table 5.2-1 of Project Design Specification 2323-MS-200. Load combinations for the Flued Head fitting will be as specified in ASME Code Subarticle NE-3100 and in Table 3.6-3 of Project Design Specification 2323-MS-74.

4.8 Stress Limits

4.8.1 Stress limits for the Class 2 piping shall be in accordance with the Code, except as modified in Table 5.2-1 of Project Design Specification 2323-MS-200 for essential piping. For the flued head fitting, Table 3.6-3 of Project Design Specification 2323-MS-74 shall apply.

4.9 Nozzle Load Check

4.9.1 Equipment nozzle loads shall be reviewed for conformance with the applicable data from Appendix 4 of Project Design Specification 2323-MS-200.

4.10 Sleeve Clearances

4.10.1 Sleeve clearances (piping passing thru floors or walls) shall be reviewed to insure no interference between the pipe and sleeve.

5.0 EXHIBITS

None