No. TR-83102-1

FINAL REPORT

Piping Design Review
for
Perry Nuclear Power Plant - Unit 1

Prepared for

Cleveland Electric Illuminating Company
Perry Nuclear Power Plant
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February 27, 1984

CYGNA

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1.0 EXECUTIVE SUMMARY

1.1 Introduction

At the request of the Cleveland Electric Illuminating Company (CEI), Cygna Energy Services developed a program to perform a third-party review of three major piping systems within the Perry Nuclear Power Plant (PNPP). The objective of this review was to confirm that the design is in accordance with applicable design specifications, design criteria, licensing commitments and standard industry practice. This objective was achieved by performing an in-depth, multi-disciplined technical review of the engineering work done by Gilbert Associates, Incorporated (GAI).

Cygna's review activities were initiated on September 29, 1983.

1.2 Scope of Work

Based on discussions with Cygna and GAI, CEI designated the following systems for this review:

- 1-N22-G01 Main Steam Drain (Class 1)
- 1-E22-G04 High Pressure Core Spray System (Class 1)
- 1-B21-G08 SRV Discharge Line (excluding quencher) (Class 3)

These particular systems were selected because they are important to plant/reactor safety and because they represent a diversified cross-section of piping analyses with respect to ASME Code class, pipe size, fluid content and operating conditions. In addition, these systems involved a high level of interface between GAI and General Electric Company (GE) in the Mechanical discipline.

This technical review covered engineering activities in the mechanical systems (e.g., flow and pressure drop calculations), pipe stress and pipe support disciplines. Recognizing that the design process on PNPP is a dynamic activity, the review concentrated on the design documents as they stood on September 29, 1983. Changes to those baseline documents were considered only to resolve specific questions raised during the review. The baseline documents for each discipline encompassed the following time periods:

- Mechanical Systems 1975 to present
- Pipe Stress 1977 to present
- Pipe Support 1980 to present

1.3 Project Organization

Exhibit 1.1 depicts Cygna's project organization for this effort. The organization was divided into three functional tiers: the Project Team, the Review Board, and in-house consultants. The Project Team was composed of the Principal-in-Charge, Project Manager, Project Engineer, and Lead engineers in the Mechanical, Pipe Stress and Pipe Support disciplines. This team not only has considerable experience in the specific areas addressed, but several of its members performed similar functions during the implementation of independent design reviews for Grand Gulf Unit 1, Enrico Fermi 2 and Comanche Peak. This team, drawing upon the in-house consultants as necessary, was responsible for day-to-day work performance.

The Review Board was composed of a CEI engineer, the Cygna Project Manager and Cygna Group Leaders. The CEI engineer was an individual with previous piping experience who had just recently joined the Company and was not involved in any design work on PNPP. The function of the Review Board was to evaluate the accuracy and completeness of the observations and potential findings. Activities by both the Project Team and Review Board were coordinated with GAI through a structured communication process.

1.4 Methodology

The basic steps followed in the review and communication process are listed below:

Step 1: Collect Documents
Step 2: Develop Work Instructions/Criteria
Step 3: Develop Review Procedures
Step 4: Conduct Design Reviews
Step 5: Project Team Review
Step 6: Review Board Evaluation
Step 7: Report Results

In developing the review procedures (Step 3), detailed checklists were prepared. These checklists, which defined for the reviewer the items to be verified. formed the foundation for the review process. During the conduct of the review (Step 4), the reviewer evaluated each item on the checklist and noted any items which, in his judgement, did not conform to the checklists and acceptance criteria. Each of these items was then fully checked by members of the project team and discussed with GAI in order to determine its significance. Based upon the results of this check, either explanatory comments were noted on the checklists or more formal documentation (Observations) was prepared.

Each Observation received an additional level of review by a Review Board to once again confirm its validity and to also evaluate its potential impact on plant safety. If the Review Board determined that a potential impact on safety did exist, a Potential Finding Report (PFR) was written. Each PFR was discussed with CEI and GAI to reach resolution of the finding. If, in the judgement of the Review Board, all reasonable efforts had been made to resolve the PFR and a potential impact on safety still existed, this finding was submitted to GAI for processing using their form QAD 600 as a possible reportable event.

Exhibit 1.2 charts the review process from data collection to final report.

1.5 Results

The Observation Log (Exhibit 1.3) summarizes the final status of all observations identified during the course of this review. A total of thirty three (33) observations were identified. Of these, one (1) was an invalid observation and two were identified as potential findings.

A summary of the valid observations and PFRs, by discipline, is provided below:

Discipline	Valid Observations	PFR's	Possible Reportable Events
Pipe Stress	7	0	0
Pipe Supports	9	2	1
Mechanical Systems	16	0	0
Total	32	2	1

1.6 Conclusions

The third-party piping Design Review for PNPP achieved its major objective. The review was able to confirm the design adequacy of the three designated piping systems. Based upon the resolution of the two potential findings identified in the pipe support review, Cygna has been able to conclude that these three piping systems have been adequately designed to perform their intended safety function in accordance with PNPP project commitments, applicable code requirements and industry standards.

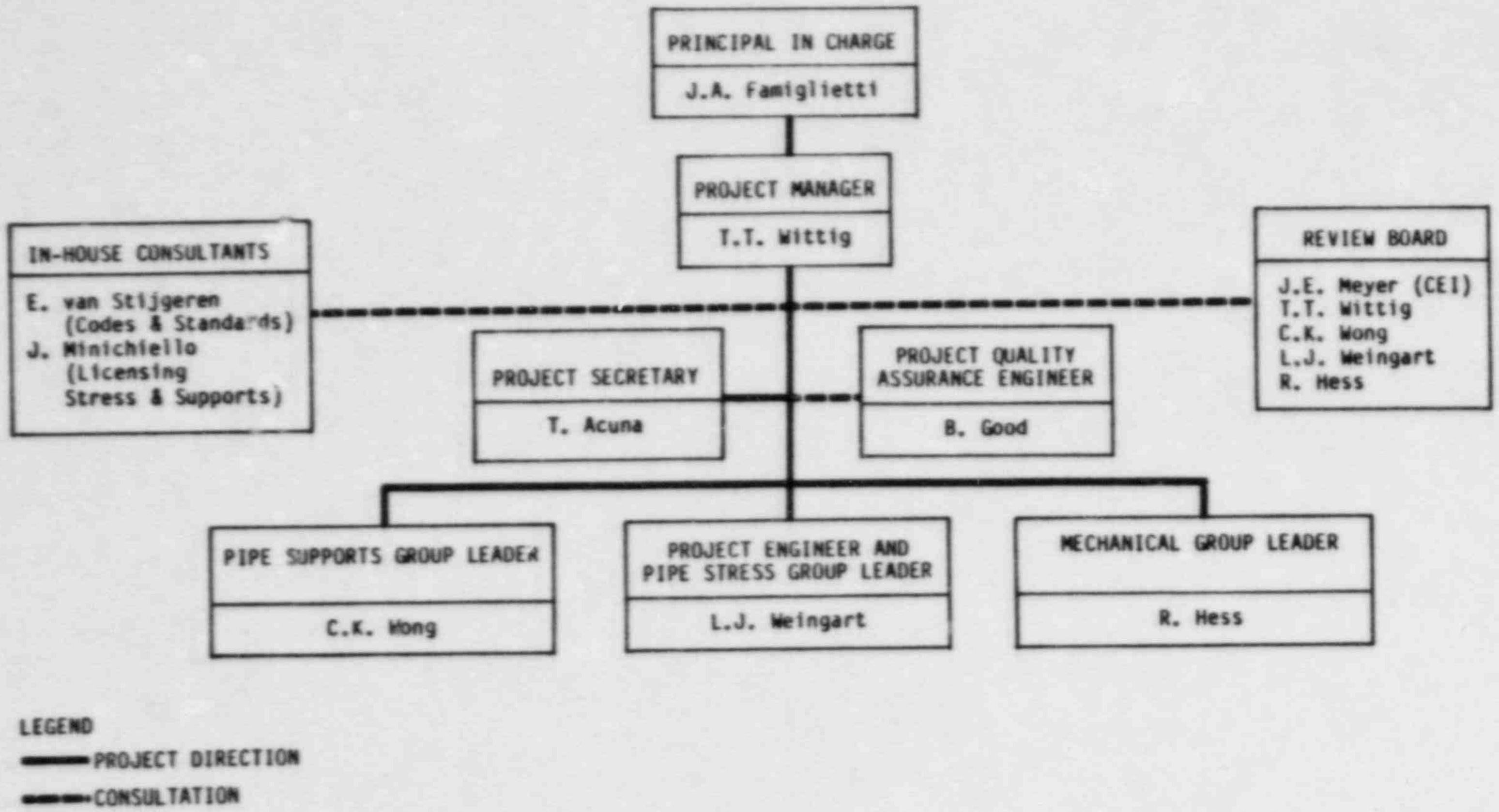


EXHIBIT 1.1

CYGNA PROJECT ORGANIZATION

EXHIBIT 1.2
METHODOLOGY NETWORK

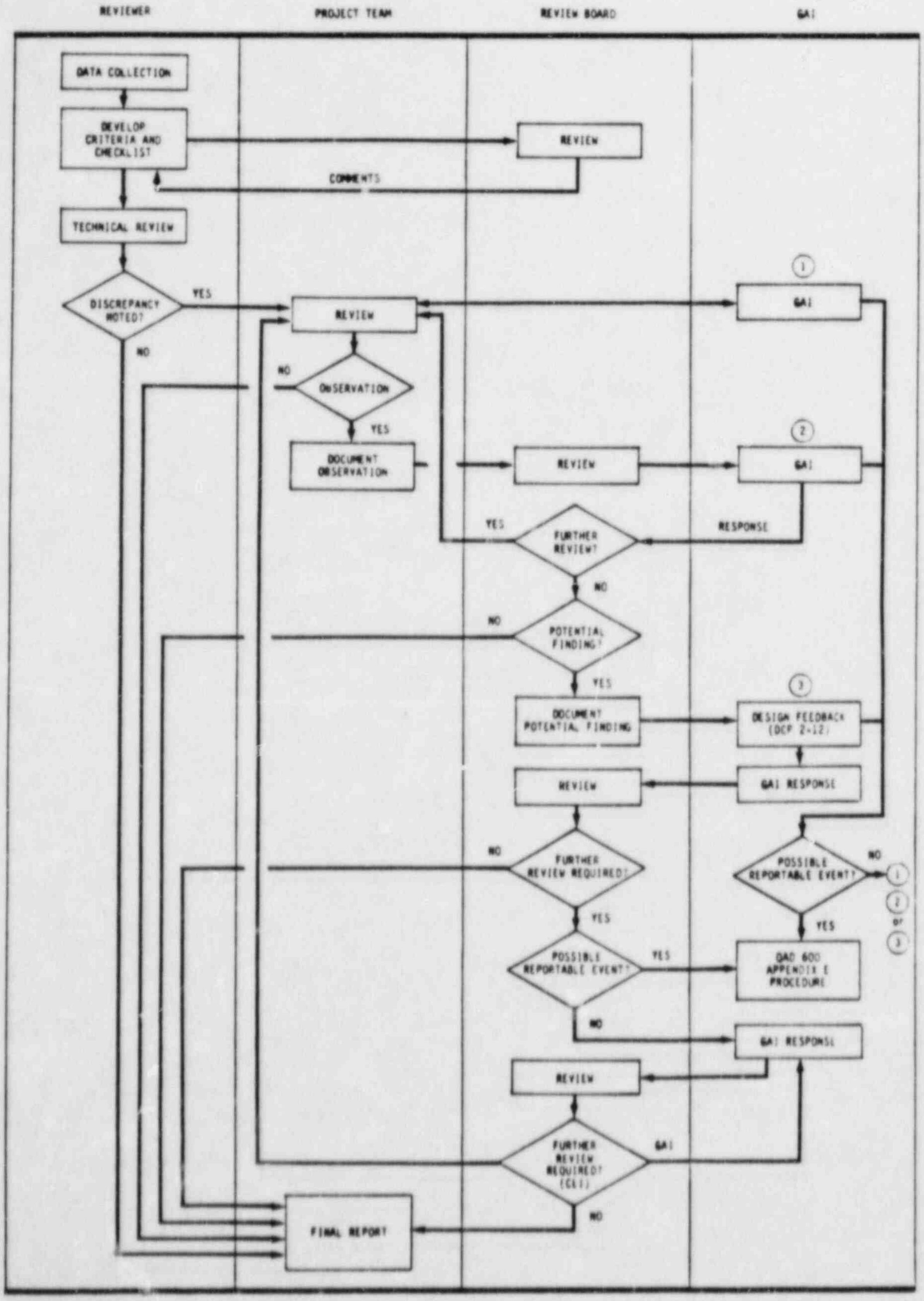


EXHIBIT 1.3

OBSERVATION LOG

Observation Numbering System:

- Pipe Stress
  PI-mm-xx where mm = 00 General Criteria
  01 (SRV System)
  02 (HPCS System)
  03 (MSD System)
  04 (HPCS Flued Head)

- Pipe Supports
  PS-mm-xx where mm = 00 General Criteria
  01 (SRV System)
  02 (HPCS System)
  03 (MSD System)

- Mechanical
  ME-mm-xx where mm = 00 General Criteria
  01 (SRV System)
  02 (HPCS System)
  03 (MSD System)

Where xx = Sequential Number of Observations

EXHIBIT 1.3

Observation Log

		Rev. No. 0 Date 2/9/84	Classification			
Observation No.	Description		Potential Finding		Closed	
			Y	N	Y	N
PI-00-01	Support flexibility is not considered in Class 2 or Class 3 piping analyses. Supports are input as rigid and then designed using a maximum deflection criterion of 0.1".			X	X	
PI-00-02	Minor inconsistencies noted during the review of the MSRV, HPCS and MSD piping analyses.			X	X	
PI-00-03	Items either lack documentation or utilize inconsistent data.			X	X	
PI-00-04	Analysis oversights are noted for Jet Impingement load calculations.			X	X	
PI-01-01	The stress intensification factors (SIFs) at points 2, F1, and F2 are not input properly.			X	X	
PI-01-02	MSRV seismic anchor movements (SAM) in the z-direction are applied in the x-direction at point J1.			X	X	
PI-02-01	The fatigue analysis did not consider the different thermal gradients (ΔT1 and ΔT2) for the sweepolet and socket welded boss. The piping thermal gradients were input as the default values and these were not overridden for the sweepolet and socket welded boss. The thermal transient analysis indicates that the only instances for which this happens to be non-conservative is for the sweepolet (Point C24) during the up transients. In addition, the thermal transient analyses considered the flow to be zero at these same points. While this may be conservative when determining the discontinuity stresses (T_A - T_B), it is non-conservative in the calculation of the thermal gradients through the thickness (ΔT1 and ΔT2).			X	X	

Observation Log

Rev. No. 0 Date 2/9/84

Observation No.	Description	Potential Finding Y	Potential Finding N	Closed Y	Closed N
PI-03-01	The thermal transient reanalysis (P-256, Rev. 0) did not consider the following discontinuities for evaluation of T_A-T_B: 1. Valve coupling to 2" pipe. 2. 3" x 3" x 2" tee to 3" pipe. 3. 3" x 3" x 2" tee to 2" pipe. 4. 3" pipe to 3" valve. 5. 3" pipe to penetration. This analysis was rerun due to errors in fluid properties. It should be noted that the original analysis did consider these discontinuities. In addition there is no documentation to indicate that the fatigue analysis is to be rerun using the later transient analysis data. Furthermore, the tee sections did not consider any additional thickness in the crotch area of the component.		X	X	
PI-03-02	Changed to PI-00-02(d).				
PI-03-03	Changed to PS-00-01(n).				
PS-00-01	Items either lack documentation or utilize inconsistent data.		X	X	

Observation Log

Observation No.	Description	Potential Finding Y	Potential Finding N	Closed Y	Closed N
	Rev. No. 0 Date 2/9/84				
PS-00-02	Items are not consistent with design commitments, requirements or criteria. a. The GAI method for combining dynamic inertial loads and dynamic displacement loads differs from the General Electric specification. b. GAI Design Specifications B21 and E22 do not include Faulted Load Case No. 8 as specified in Table 3.9-21 of the PNPP FSAR.		X	X	
PS-00-03	The signs of Jet Impingement load input for support load combinations in utilizing the computer program "M093" were not properly considered. (e.g., HPCS, E22G04(C), Rev. No. J484, dated 4/18/83). The dynamic Jet Impingement input loads are all positive.	X		X	
PS-00-04	Changed to PI-00-04.				
PS-00-05	Design oversights were noted.		X	X	
PS-00-06	The design of the supports does not consider the following items: a. Dead weight of the support itself. b. Inertial loads due to support self-weight excitation.		X	X	
PS-00-07	Items were noted in relation to the setting for springs and snubbers.		X	X	

Observation Log

Rev. No. 0 Date 2/9/84

Observation No.	Description	Potential Finding Y	Potential Finding N	Closed Y	Closed N
PS-01-01	For the design of Main Steam Safety Relief system pipe supports, there is no indication that the hydro test load is considered in the design.		X	X	
PS-02-01	The following design oversights were noted for support 1E22-H001:			X	
	a. Wrong section properties were used in shear and deflection calculations (Pg. 10.4).		X		
	b. Young's modulus "E" has not been adjusted for temperature effect in the stiffness calculation (Pgs. 10.1 and 10.2).		X		
	c. Welding between items D and F is overstressed.	X			
	d. Dimensions of some items on the support drawings are not clearly defined (e.g. length of item D, and length of weld between F and D).		X		
PS-02-02	The Jet loads on supports H001 and H002 are specified in the design specification, but were not included in the support design calculations.		X	X	
ME-01-01	Safety relief valve discharge line sizing (flow and pressure drop) calculations could not be located by GAI.		X	X	
ME-01-02	Vacuum breaker valves F037 and F038 are 6 inch valves with a maximum resistance coefficient of K = 1.6 as specified in GAI Specification SP-639-4549-00 Rev. 1. Per information supplied by the vendor, Anderson, Greenwood and Co., the actual K = 1.408 and the flow area is 0.201 $ft.^2$ This data results in an $A/\sqrt{K}$ factor equal to 0.17 $ft.^2$, rather than the General Electric specified minimum of 0.30 $ft.^2$ for each of these valves. In addition, no documented and verified calculations justifying the size of these valves could be located by GAI.		X	X	

Observation Log

Rev. No. 0	Date 2/9/84				
Observation No.	**Description**	**Classification: Potential Finding Y**	**Potential Finding N**	**Closed Y**	**Closed N**
ME-02-01	There are various inconsistencies between Table 1 of GAI Specification DSP-E22-1-4549-00 Rev. 1 and Rev. 2 and the General Electric Process Diagram 762A455.		X	X	
ME-02-02	In GAI Specification DSP-E22-1-4549-00 Table 1, the mode A pressure drop across valve F010 is given as 522 ft., and the drop across valve F011 is given as 116 ft. These drops are well above the General Electric stated minimum of 62 ft., indicating that the valves are not fully open in mode A. Also, these pressure drops (throttled position) were not used in the flow and orifice sizing calculation for the system.		X	X	
ME-02-03	The location and arrangement of some equipment and piping is inconsistent with General Electric and NRC Criteria. Specifically. a. The HPCS suppression pool suction strainer is not located outside the safety relief valve discharge zone. b. Valve F023 is located approximately 14 ft. from the containment penetration. It should be located as close as practical to the penetration. Normally a distance of 5 ft. or less is achievable. c. The length of straight pipe after a valve and prior to flow orifice N007 does not meet the 43 ft. requirement.		X	X	
ME-02-04	The vendor print (Rockwell) for valve F005 indicates this valve is a lift check valve with no stem (i.e., no stem leak-off connection) or external operator for remote testing. In addition the pressure and temperatures indicated on the drawing match a 600 lb. class valve. The General Electric data, CEI SAR and GAI P & ID all indicate this valve should be a remotely testable swign check valve with an air operator and stem leak-off connection. In addition, line specification D1-1 recommends valves of this size be 900 lb. class valves.		X	X	

Observation Log

		Rev. No. 0	Date 2/9/84	Classification			
				Potential Finding		Closed	
Observation No.	Description			Y	N	Y	N
ME-02-05	HPCS system check valve drawings for F002, F016, F024, and F007 do not show any provisions for checking free movement of the valve disc.				X	X	
ME-02-06	The sizing calculation for pump C-003 minimum flow bypass orifice, RO-D003, is based on a minimum flow of 10 GPM and an assumed head loss of 96 feet. The specification for the pump and its attached "Design Requirement Summary Sheet" list two different minimum flows (i.e., 10 GPM and 15 GPM) for this pump. No sizing or pressure drop calculation could be located for this pump so the 96 feet of head available for orifice sizing could not be verified.				X	X	
ME-02-07	It is not apparent from the P&ID or piping drawings how valves F001, F010, and F011 will be leak tested. There do not appear to be any drain valves located such that meaningful test results can be obtained.				X	X	
ME-02-08	Items either lack proper documentation or utilize inconsistent data.				X	X	
ME-02-09	Items summarize the inconsistencies and inaccuracies noted in GAI Calculation E22-A/J-cc, HPCS Line Losses.				X	X	
ME-03-01	Inconsistencies within Table 1 of DSP-B21-1-1-4549 and between Table 1 and the General Electric system data.				X	X	
ME-03-02	No sizing calculation could be located for restricting orifice RO-D001. Therefore, no documented basis exists for the specified orifice size.				X	X	

Observation Log

Observation No.	Description	Potential Finding Y	Potential Finding N	Closed Y	Closed N
	Rev. No. 0 Date 2/9/84				
ME-03-03	Calculation N22-3 page 13 is for sizing the 1st MSIV before seat drain line. This calculation does not match the physical piping arrangement and does not include all modes of operation.		X	X	
ME-03-04	Valves F034 and F035 are 3/4" Y pattern globe valves arranged in series with approximately 125 feet of 3/4" pipe attached to the outlet of valve F035. The flowrate specified for this drain is 50 GPM of 125°F water with a pressure upstream of valve F034 of 100 PSIA.		X	X	
	The 3/4" drain size will restrict will restrict the drain flowrate to less than 50 GPM and increase the time required to drain the flooded main steam lines.		X	X	
ME-03-05	The closing speed specified for valves F016 and F019 in GAI Specification 521-02-4549-00 and bill of material RNU-202 is "Vendor Standard." The Borg-Warner vendor drawing 81180 states that the valve closing time is 20 seconds maximum. This closing time corresponds to a minimum closing speed of approximately 9 inches per minute for a 3 inch valve. The GE Nuclear Boiler Design Specification Data Sheet 22A4522AR Section 3.1.17.1 states that valves F016 and F019 shall have a closing speed of at least 12 inches per minute.		X	X	

2.0 PROGRAM REVIEW SCOPE

This section describes the scope of work for the Design Review for the Perry Nuclear Power Plant. It covers the following areas:

- Program Objectives
- System Selection
- Design Review Scope

2.1 Program Objectives

The objective of this review was to evaluate the design adequacy of three typical piping systems important to plant/reactor safety. In order to accomplish this objective, Cygna reviewed the system requirements, system design, piping analysis/design and pipe support design.

The design adequacy of these engineering activities was measured against appropriate licensing commitments and codes, project requirements and standard industry practices.

This review focussed strictly on the technical aspects of the design. The review did not evalute the adequacy or implementation of project quality assurance programs.

2.2 System Selection

Based on discussions with Cygna and GAI, CEI selected the following systems for this review:

- 1-N22-G01 Main Steam Drain (Class 1)
- 1-E22-G04 High Pressure Core Spray System (Class 1)
- 1-B21-G08 SRV Discharge Line (excluding quencher) (Class 3)

These particular systems were selected in order to provide a diversified cross-section of piping analyses with respect to ASME Code class, pipe size, fluid content and operating conditions. Each of these subsystems also performs a function important to plant/reactor safety. Exhibits 2.1, 2.2 and 2.3 define the extent of each subsystem.

2.3 Design Review Scope

The Design Review activity, as illustrated by the flow diagram in Exhibit 2.4, was composed of an in-depth, multi-disciplined technical review to confirm that the design was in accordance with applicable specifications, design criteria, licensing commitments and industry practices.

The review activities were conducted in three major design areas: Mechanical Systems, Pipe Stress and Pipe Supports. Each of these areas is described below.

2.3.1 Mechanical

The Mechanical Systems review focused on ensuring that the GAI design satisfied the basic system design and functional requirements. Cygna developed a review criteria document containing these basic requirements, and then evaluated the following items:

- Verification that all design basis, codes, Regulatory Guides, NUREGS, FSAR and SER requirements had been implemented as related to system function and design.

- Verification that the GE design documents had been correctly incorporated.

* Verification that the GAI-supplied system equipment and piping are adequate to meet all process and interface requirements. An integral part of this activity was to review the system flow and pressure drop calculations.

* Verification that the system functional requirements, including redundant components and flow paths, are adequate.

2.3.2 Pipe Stress

The technical review of the pipe stress analysis activities concentrated on the following key elements:

* Input data check
* Piping model check
* Review of stress-related calculations
* Review of stress reports

Each of these areas is discussed in detail below.

<u>Input Data Check</u>

This task was performed to ensure that piping geometry and loading conditions were correctly incorporated in the piping analyses. The input data which was provided by GE (NSSS) and Gilbert Associates, Inc. (A/E), was reviewed by the Project Team for general conformity to industry standards. Any discrepancies noticed in design specifications during this phase of the review were evaluated before proceeding to the check of the input data. As part of the input data check, Cygna reviewers ensured that all appropriate load cases had been included and proper loading conditions had been selected. As a minimum, the following input data were considered:

- Internal piping pressure
- Thermal load cases
- System operating modes
- Specified anchor movements
- Application of given seismic spectra
- Application of hydrodynamic loadings

Piping Model Check

The Project Team accomplished this task by first obtaining the applicable piping isometrics (latest revisions) and then performing a detailed check of the piping models developed for the stress analyses. The appropriateness of the computer model used for the analysis was evaluated by the Review Team using the criteria and input data. During these activities the Review Team paid particular attention to the following items, as a minimum:

- Piping geometry
- Piping section properties
- Support, restraint types and location
- Fittings, nozzles and valves
- Operating conditions
- System boundaries and classification
- Mass point spacing and support stiffness
- Penetration type
- Analysis cut-off criteria

Review of Stress-Related Calculations

Various stress-related calculations performed during the stress analysis effort were subjected to a detailed review by the Project Team. Some of these calculations are listed below:

- Seismic anchor movements for anchor and equipment
- Thermal anchor movements for equipment
- Valve dynamic response characteristics
- Support, restraint, penetration and nozzle load summaries
- Flued head reports
- Local stress calculations for integral welded attachments (e.g., lugs, stanchions)

Review of Stress Reports

Upon completion of the reviews in the above-mentioned areas, the Project Team then performed a detailed review of the results and conclusions made by the original designers. The basis for this evaluation was a careful study of the design reports issued to-date. As a minimum, particular attention was paid to the following items:

- Load cases considered in the analysis
- Summary of load combinations
- Nozzle reactions and valve acceleration check
- Pipe displacements
- Dynamic frequencies and mode shapes of the piping system
- Mass participation and zero period acceleration
- Stresses in piping and fittings

The analysis output was reviewed to ensure that the allowables defined in Design Criteria document 83102-DC-1 were satisfied. This included the allowables defined in ASME Section III, licensing commitment documents and equipment specifications (nozzle allowables).

Class 1 Stress Reports

The Nuclear Class 1 piping stress reports for the HPCS and Main Steam Drain systems, GAI Document Nos. P-1001, Rev. 0, and P-1010, Rev. 0, respectively, were reviewed in detail to assure compliance with project criteria and Code requirements for Class 1 piping analyses. This review placed particular emphasis on the following areas of these Class 1 analyses:

- Interpretation of pressure/temperature load histogram for use in thermal transient and fatigue analysis
- Piping discontinuity evaluation
- Calculation and use of stress indices
- Material parameters specific to Class 1 analyses
- ASME Code Class 1 acceptability check
- Analysis of welded attachments

Flued Head Analysis

The Nuclear Class 1 Stress Report for the HPCS Drywell Flued Head prepared by Nutech was reviewed in detail to assure compliance with project criteria and Code requirements for Class 1 analyses. This review placed particular emphasis on the following areas:

- Interpretation of pressure/temperature load histogram for use in thermal transient and fatigue analysis

- Application of loads due to attached piping

- Application of pipe failure loads

- Application of Nutech's proprietary finite element computer program

- Conformance to ASME Code Class 1 requirements

2.3.3 Pipe Supports

The technical review of the design of selected pipe supports and restraints was concentrated in the following areas:

- Review of input data and load combinations
- Review of design calculations
- Review of issued drawings

This review was confined to supports and restraints on the primary flow path. Each of the above mentioned pipe support activities is described in detail below:

<u>Review of Input Data</u>

The Project Team performed a thorough review of the support guidance generated by the stress group for the pipe support group. The key elements included in this review were:

- Support stiffness
- Support type and locations
- Piping deflections for all essential load cases
- Load directions and magnitudes

Review of Design Calculations

Based upon the criteria and support guidance established above, the Project Team reviewed the calculations performed by the pipe support designers. The calculations for those supports and restraints on the primary flow path were reviewed in detail ensuring that the following key elements were considered:

- ASME design requirements
- Support stiffness
- Weld calculations
- Stress allowables
- Vendor allowables for catalog allowables
- Proper modeling for computerized calculations
- Anchor bolt allowables and baseplate flexibility effects

The Review Team also checked whether the stiffness of the support was consistent with the piping analysis.

Review of Drawings Issued

The Review Team made a thorough comparison of the analytical results of the overall piping design process with the support drawings produced to ensure that correct drawings were forwarded to the site. They achieved that by checking the following key elements, as a minimum:

- Correct type, orientation, location and piping system
- Appropriate clearances specified
- Sufficient structural and weld data
- Correct component sizes

During the review of the design calculations, any assumptions not in accordance with the FSAR and/or similar documents were evaluated by the Project Team based on standard industry practice. Particular attention was given to the basic assumptions utilized by GAI throughout this review process to 1) ensure their reasonableness, and 2) confirm that the final design was consistent with these assumptions.

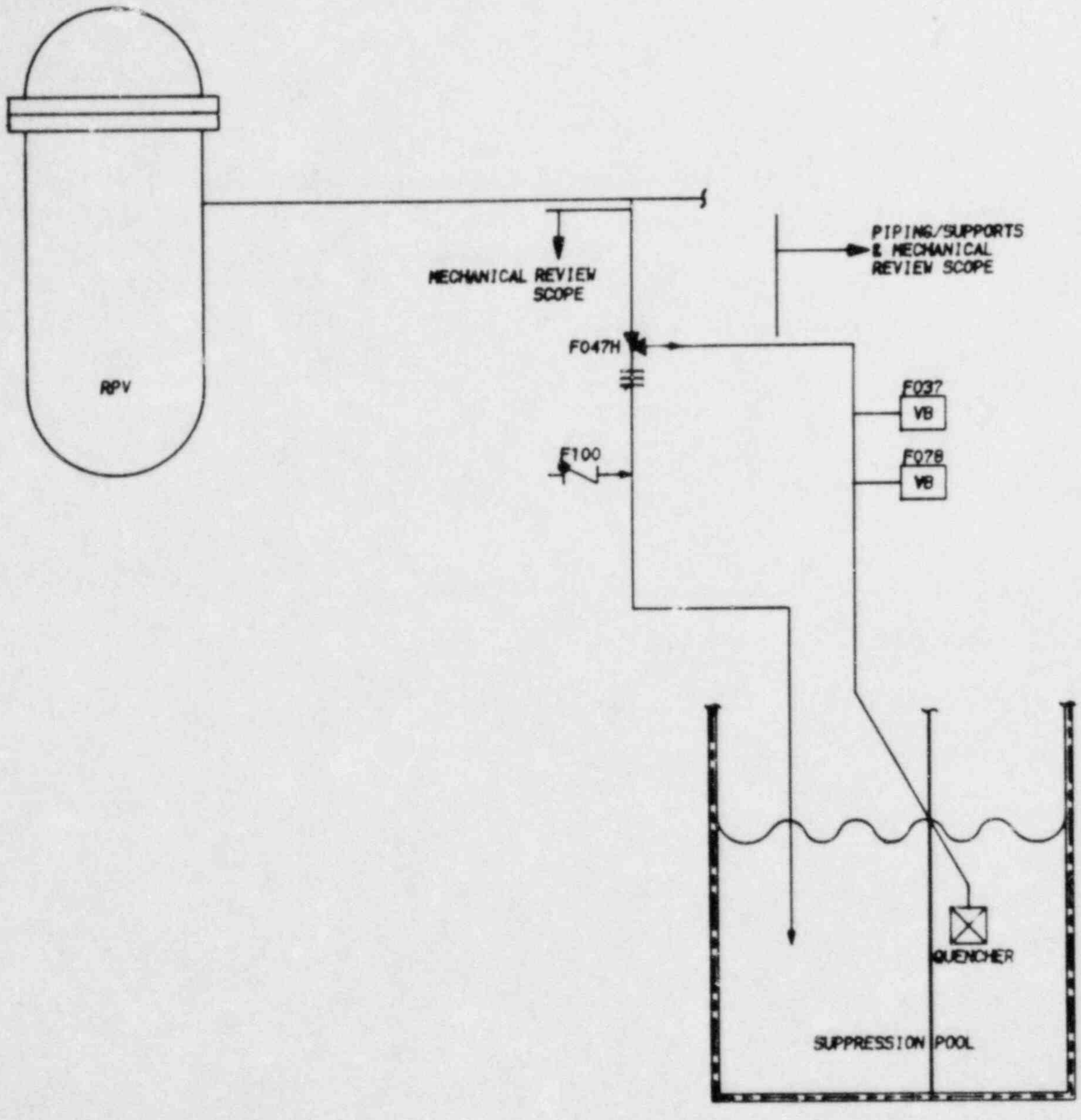
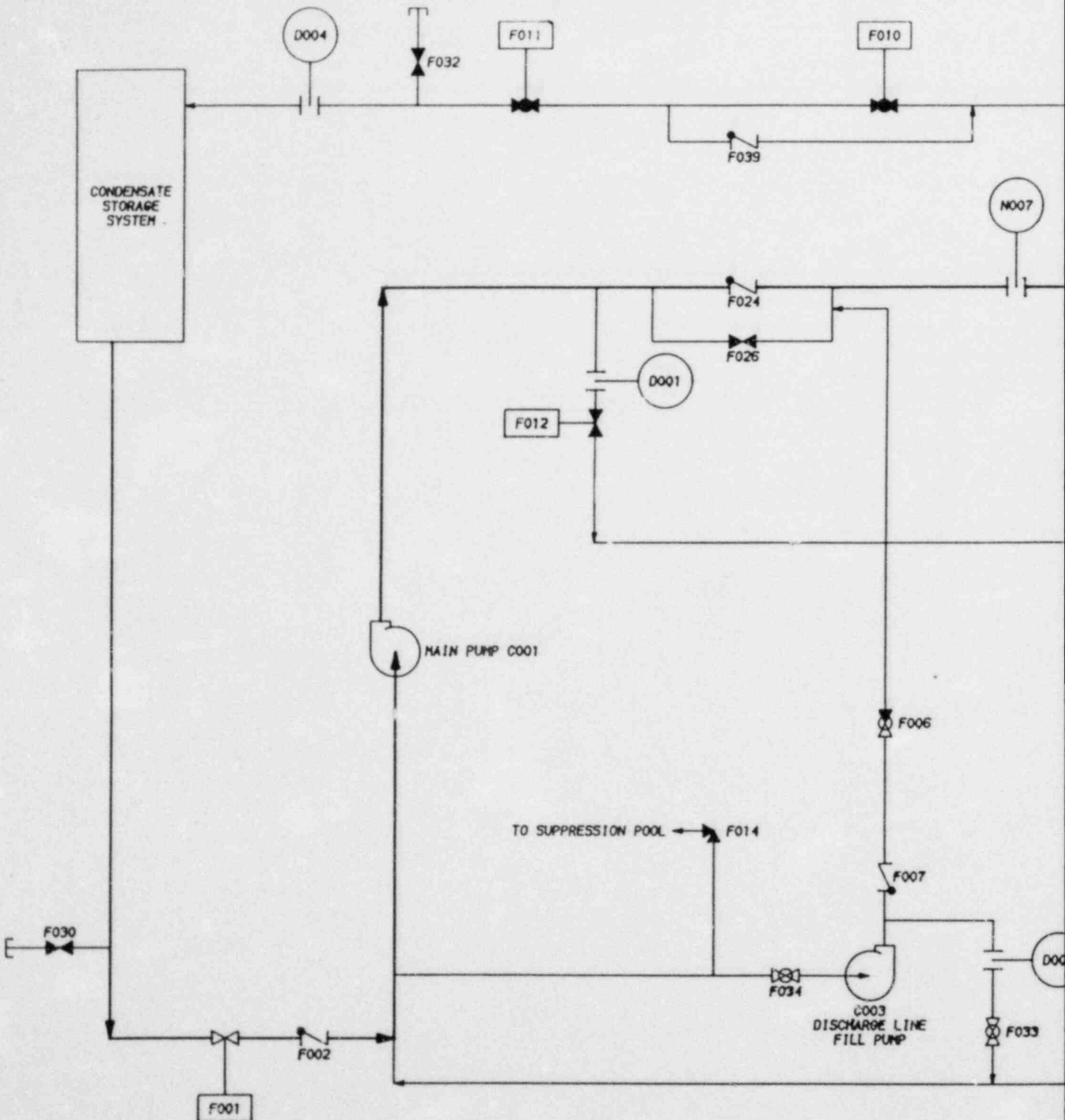


EXHIBIT 2.1
MAIN STEAM RELIEF VALVE DISCHARGE SYSTEM
PIPING AND EQUIPMENT DIAGRAM



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HIGH PRESSURE C
PIPING AND EQU

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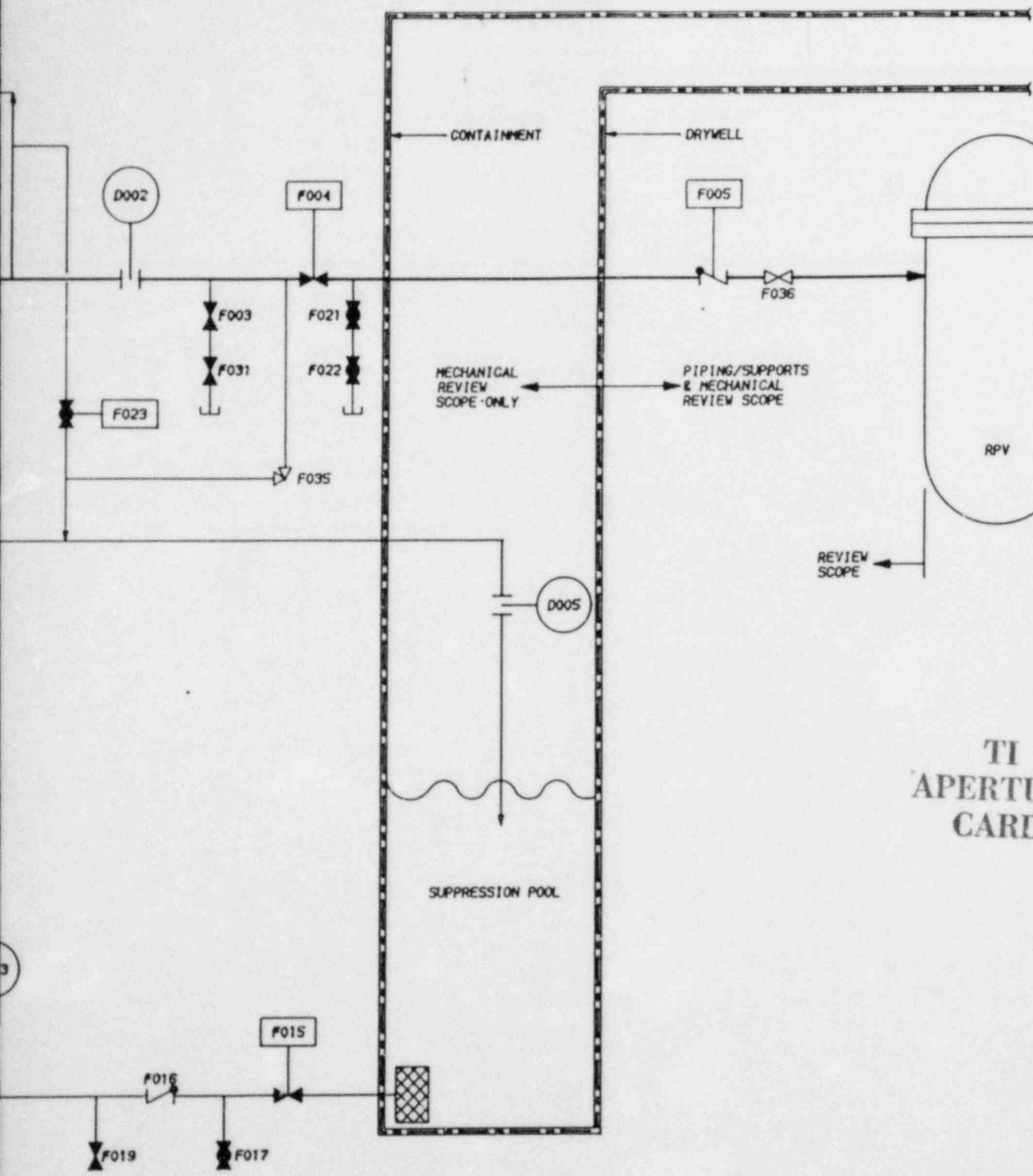
Aperture Card



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IT 2.2
ORE SPRAY SYSTEM
IPMENT DIAGRAM

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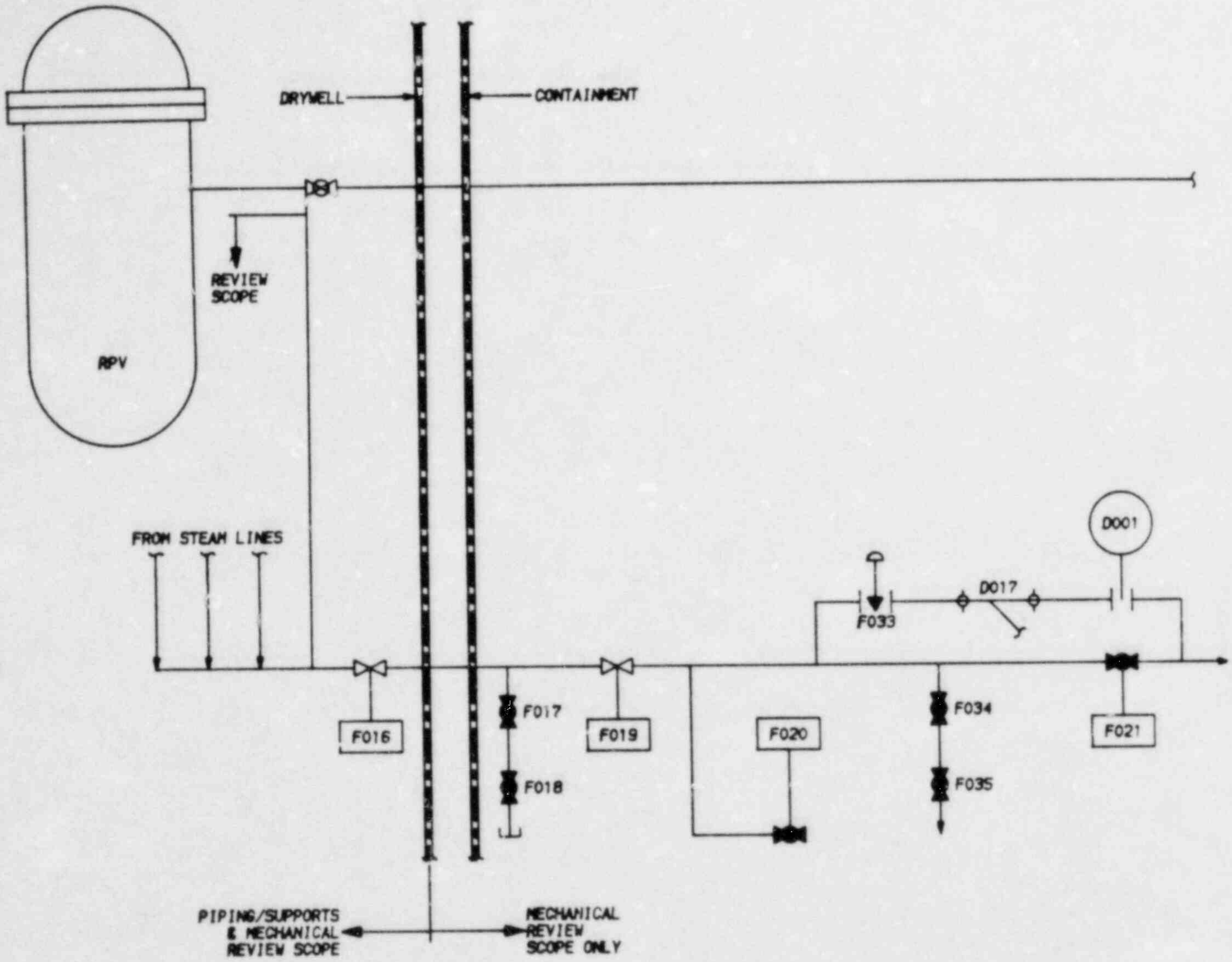

EXHIBIT 2.3
MAIN STEAM DRAIN SYSTEM
PIPING AND EQUIPMENT DIAGRAM

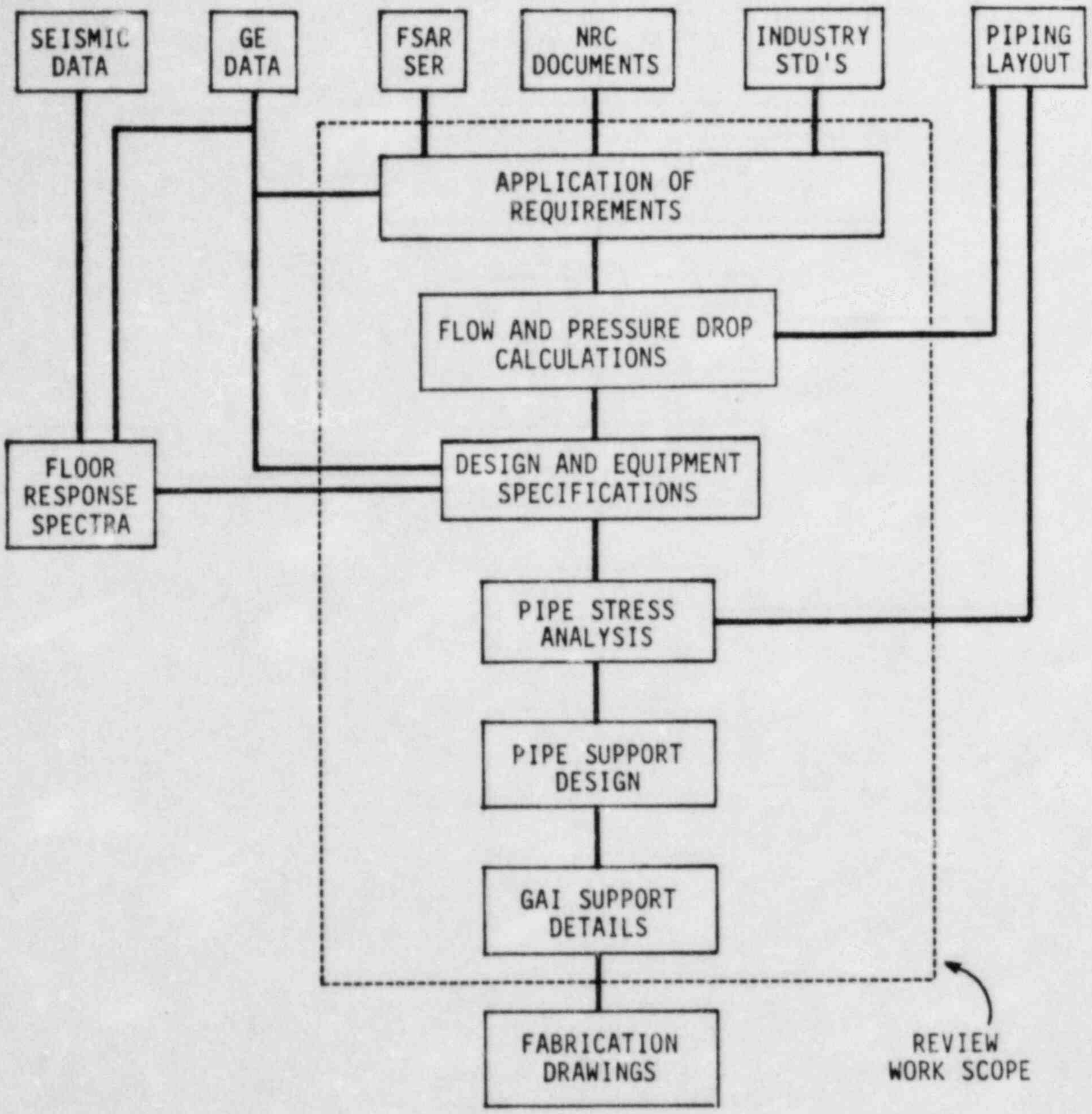

EXHIBIT 2.4
REVIEW SCOPE

3.0 METHODOLOGY

This section describes the methodology and procedures used to conduct the Design Review for PNPP Unit 1. It describes how the review process was organized and identifies the sequence of events and requirements for documentation throughout the course of the review. In addition, it defines the basic steps involved in completing the review activities for the scope of work presented in Section 2.0.

Exhibit 3.1 provides an overview of the review process from the initial collection of documents to the final report. In particular, the exhibit illustrates the interaction and participation by both the Project Team and Review Board during the review.

The Design Review was accomplished through a three-tiered evaluation process consisting of a Project Team, Review Board and in-house consultants.

- The Project Team was responsible for reviewing the three systems mentioned above, completing checklists, documenting any observations, and preparing the final report.

- The Review Board was composed of a CEI engineer, the Cygna Project Manager and Cygna Group Leaders. The CEI engineer was an individual with previous piping experience who had just recently joined the Company and was not involved in any design work on PNPP. This team evaluated the accuracy and completeness of the observations and potential findings. All activities by the Review Board were coordinated with GAI.

- Cygna in-house consultants provided specialized expertise on an as-needed basis.

Appendix A provides a listing of the specific terminology used during this review, part of which was established with the NRC during previous Independent Design Reviews conducted by Cygna.

The key elements and activities in the review process are listed below:

1. Collect Documents
2. Develop Work Instructions/Criteria
3. Review Procedures
   - Checklists
   - Observation Records
   - Potential Finding Reports
   - Interaction with GAI
   - Action Items
4. Conduct Design Review
5. Project Team
6. Review Board

As indicated on the flowchart, throughout this process items identified as having a possible impact on plant safety were given immediate, high priority attention. This was to ensure that both GAI and CEI would receive timely notification of any items which could have a definite potential impact on safety. Each of the basic activities in the DR process are described in the following subsections.

3.1 Document Collection

Documents were collected and reviewed in two stages. During the first stage, the reviewer identified those central documents which guided the design process, such as the SAR, project procedures, design criteria, system descriptions and drawings. Reviewing these central documents provided an understanding of how the work process had been structured and directed on Perry.

During the second stage of document and data collection, the reviewer identified and gathered those documents needed to complete the review. The prime contacts in GAI and CEI are listed in Exhibit 3.2. Documentation was collected through these contacts, and all requests were tracked using the Action Items form. Documents utilized during the course of the review were recorded and are listed in Appendix B.

3.2 Work Instructions/Design Review Criteria

Key activities during the initial stages of the DR centered on the development of work instructions and Design Review criteria to direct the review activities and to measure the adequacy of the design process on the Perry project. Work Instructions were written for each project group to describe how they were to function in performing assigned activities, to define the applicable technical criteria documents and to delineate any unique documentation requirements. The Design Review criteria are a composite of licensing commitments, project design requirements and appropriate standard industry practice. The three sets of Design Criteria generated for this DR are included in Appendix C.

3.3 Review Procedures

The Design Review criteria discussed above provided a means for measuring the design adequacy of the system elements selected as the scope of work. In addition to these standards, each reviewer was guided by checklists prepared by the discipline Group Leaders prior to the actual review. These checklists identified key elements to be evaluated during the technical reviews. If a reviewer determined that a line item on the checklist was inadequately addressed, the discrepancy was noted on the checklist. If, after review by the Project Team and discussions with GAI, a discrepancy was judged to have potential impact upon design, or if uncertainty remained regarding either design impact or the time required for resolution of the discrepancy, an

"Observation Record" was prepared. All observations were then reviewed by the Project Team to determine their potential impact on plant safety. For those determined to have potential safety impact, a "Potential Finding Report" (PFR) was prepared.

Checklists, Observation Records, PFR's and the interactive process with GAI are described in further detail below.

3.3.1 Checklists

Checklists provided the reviewers with a listing of key design elements to be considered. Appendix D to this report contains all the completed checklists used for the Design Reviews. As a reviewer checked each line item on a checklist, its adequacy was evaluated against the review criteria. If the requirements were met, the "satisfactory" column was checked "yes." Whenever significant conservatisms were identified, they were noted in the "comments" column. If the reviewer was not fully satisfied that the requirements had been met, the "no" column was checked. The discrepancies were then reviewed by the Project Team to assess whether there was any potential for design impact. If this was determined to be the case, the issue was discussed with cognizant GAI engineers. Based upon these discussions, either explanatory comments were noted on the checklist or the discrepancy was submitted to the Review Board as a prospective Observation. Observation Record numbers were recorded in the comments column of the checklist.

During the course of the reviews, the reviewers added line items to the checklists, as needed, with the approval of the Project Engineer. This provided each reviewer with a mechanism to expand the checklists during the course of the review if the results indicated further design information or documents were needed to perform a meaningful review.

Each completed technical review checklist was reviewed and approved by a checker assigned by the Project Engineer. Each checklist was assigned a unique identifier, in accordance with the following guidelines:

- Pipe Stress

PI-mm	where	mm =	00 General Criteria
			01 (SRV System)
			02 (HPCS System)
			03 (MSD System)
			04 (HPCS Flued Head)

- Pipe Supports

PS-mm-nn	where	mm =	00 General Criteria
			01 (SRV System)
			02 (HPCS System)
			03 (MSD System)
		nn =	Pipe support number

- Mechanical

ME-mm	where	mm =	00 General Criteria
			01 (SRV System)
			02 (HPCS System)
			03 (MSD System)

3.3.2 Observation Records

Whenever the reviewed work failed to conform to the applicable standards spelled out on the checklists and this nonconformance was also determined to have a potential impact upon design, an Observation Record was prepared. A unique observation number was sequentially assigned to each observation by the Project Engineer. Note that the Observation Record specifies the number of the corresponding checklist for traceability.

Each Observation Record was prepared by the originator of the observation and then reviewed by a qualified person assigned by the Project Engineer. Based on this review, interaction with the project Group Leaders, consultation with Cygna specialists and discussions with the designer, the Review Board prepared an Observation Review Record. Each review record summarizes the validity, potential design impact, and potential safety impact of each observation.

In the event that a particular observation was concluded to have a potential impact on plant safety, it was recorded in a Potential Finding Report. There is a detailed description of potential finding reports in the following subsection. The disposition of all observations, including those that have been invalidated, is summarized on the Observation Log. This log is included as Exhibit 1.3. All completed Observation Records for this DR are contained in Appendix E.

3.3.3 Potential Finding Report

Those observations that were concluded to have a potential impact on plant safety were recorded on a Potential Finding Report (PFR). Each PFR was identified by a sequential number assigned by the Project Engineer. The Potential Finding Report number was also noted on the corresponding Observation Log entry in the remarks column. Note that the corresponding Observation number is recorded on this form for traceability. On this form, the cognizant Group Leader recorded a description of the observation, an assessment as to the extent of the observation, plus an evaluation of the design and safety impact. The PFR was then reviewed by the Review Board to assure completeness and accuracy.

All potential finding reports were submitted to GAI for their final comments. These comments were evaluated to determine whether or not further review would be required. If no further review was required, the final report was prepared by the Project Team.

If the Review Board had concluded that the observation did indeed have a potential impact on plant safety, the finding would have been reported to GAI and CEI by the Project Manager.

3.3.4 Interaction with GAI

When the preliminary observation records were completed, informal discussions were held between Cygna, GAI and CEI, during which Cygna informed GAI of the nature and intent of the observations. The purpose of these discussions was to provide a means to identify and eliminate any invalid observations, which could be due either to oversights by the reviewer or the possibility of some existing documents related to the Design Reviews not being provided to the Project Team at the time of the reviews. Preliminary observation records were then transmitted to GAI as Rev. A so that their engineers would have an opportunity to review them in detail. Responses to these observations were transmitted to Cygna by GAI in a timely manner agreed upon by both parties.

The GAI responses fell into, but were not limited to, one of the following categories:

- A resolution to the observation.
- Additional information or documentation for further review by Cygna.
- The observation was invalid based on supporting documents or explanations furnished by GAI.

The Cygna/CEI Review Board reviewed each response from GAI to determine the adequacy and acceptability of the response. When the response or resolution was accepted by Cygna, the observation record was finalized and documented. If changes in the observation itself were required at this point, the observation was reissued as Rev. B, C, etc. If the response from GAI did not adequately resolve all pertinent issues, Cygna tried to resolve any open items by means of question and answer sessions with GAI. These sessions were preceeded by a transmittal to GAI of

Cygna's questions and/or requests. In this manner all parties were better prepared for a more productive working session.

This process was repeated until a satisfactory conclusion was reached. At this time the formal Observation Record and Observation Record Review were issued as Rev. 0.

3.3.5 Action Items

In order to assure timely progress of the review process, all requests to GAI were tracked from initiation to closeout. As an integral part of this monitoring system, action items were recorded using Exhibit 3.3. As a minimum the following actions were tracked on this form:

- Requests for documentation
- Requests for information
- Requests which affect the start or completion of an activity

Significant actions required by both Cygna and others were identified and tracked to closure.

A description of each column on the form is provided below:

- Description: Identify the action to be performed, e.g., "Provide copies of the GAI design specification for containment penetrations (Doc. # P-900)."

- Reference: Briefly identify how and when the action item was initiated, e.g., "Telecon w/ J.E Meyer 9/24/83."

- By: The person to whom the action is owed.

- To: The person who must perform the action.

- Date Due: The date when the action is due, as agreed by the person who must perform the action.

- Date Close-Out: The date when the action was completed.

- Notes: This column shall identify closures, e.g., a letter number, telecon/person, conference report, transmittal number. General remarks may also be included in this column to describe the status of an action or to provide clarification.

At the close of each week an action item list was submitted to the Project Engineer by the Group Leaders.

3.4 Design Review

The following disciplines were reviewed in the DR on the Perry Nuclear Power Plant:

- Pipe Stress
- Pipe Support
- Mechanical Systems Design

Each discipline was reviewed by an individual or a group of individuals capable of both performing and reviewing the work. The Cygna Review Team consisted of eight individuals with a combined experience totaling 81 years. The work was guided by the design criteria and checklist described in the previous subsections, as well as the project Work Instructions.

3.5 Project Team

During the Design Review, all discrepancies recorded by the reviewer were reviewed by at least two members of the Project Team. The Project Team, which consisted of the Project Manager, Group Leaders and the reviewers, evaluated each discrepancy against the following conditions:

- The discrepancy is complete and accurate
- There is potential design impact

If both of these conditions were not satisfied, then either more review was performed or the discrepancy was closed by a note on the checklist.

If these conditions were satisfied, the discrepancy was recorded as an observation.

Each observation was sequentially numbered using the checklist identifier. For example, the second observation on checklist PS-01 would be numbered PS-01-02. This observation number was noted on the checklist in the comments column.

The Project Team also performed the following functions:

- Reviewed all completed checklists to verify their completeness and accuracy

- Identified a probable root cause of each observation

- Evaluated the collective design impact of observations and discrepancies that individually have insignificant design impact

- Prepared the final report

3.6 Review Board

Any observations recorded during the Design Reviews were evaluated by at least two members of the Review Board, and these observations were submitted to GAI for their comments.

After considering the GAI comments, the Review Board (which included a CEI representative) determined whether more evaluation was required by either GAI or the Project Team. If no further review was required, each observation was assessed to determine its potential impact on plant safety. A detailed explanation of the process and procedures for the generation and resolution of Observation Records is described in subsection 3.3.2. Observations which were concluded to have potential impact on plant safety were recorded on a Potential Finding Report (PFR).

The Review Board also performed the functions listed below:

- Evaluated the collective safety impact of observations and discrepancies that are individually concluded to have insignificant safety consequences

- Coordinated observations and potential findings with GAI

- Reviewed the final report

During the entire review process, those potential findings which were identified as having potential safety impact received immediate and first priority attention. If the Review Board had concluded that any observation or PFR did have a definite potential impact on plant safety, the finding would have been reported immediately to GAI and CEI.

EXHIBIT 3.1
METHODOLOGY NETWORK

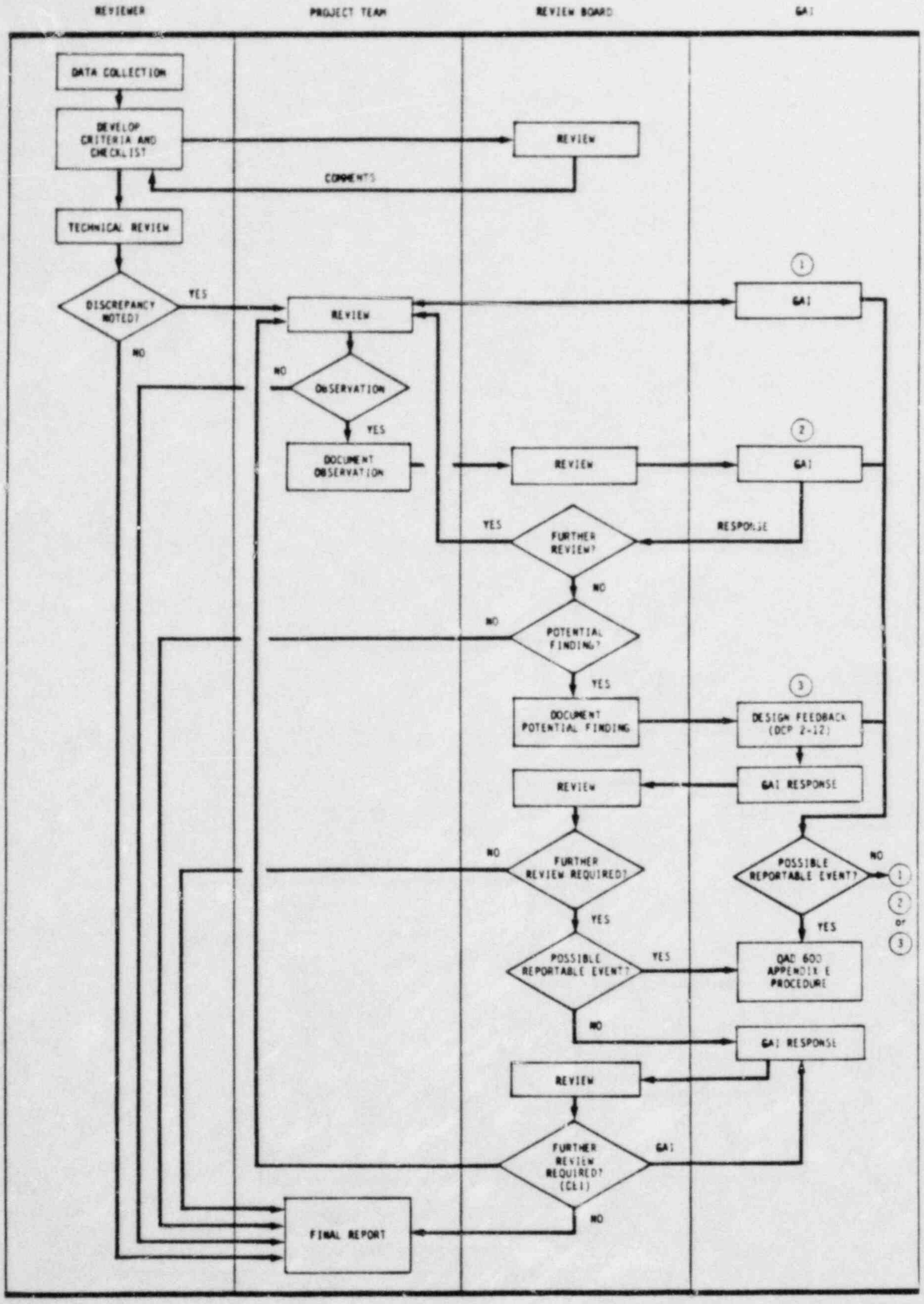

EXHIBIT 3.2

LIST OF PRIME CONTACTS

CLEVELAND ELECTRIC ILLUMINATING COMPANY

Jack Bellack	General Supervising Engineer	(216) 259-3737
Earle Mead	Sr. Project Engineer	(216) 259-3737
Hank Putre	Lead Sr. Engineer	(216) 259-3737 ext. 5240
Jim Meyer	Engineer	(216) 259-3737 ext. 5242

GILBERT ASSOCIATES, INC.

Paul Gudikunst	Project Manager	(215) 775-2600 ext. 2936
Jay Leininger	Project Manager	(215) 775-2600 ext. 2791
Pat Patton	Project Control Engineer	(215) 775-2600 ext. 2580
Ted Manning	Manager of Corporate QA Programs	(215) 775-2600 ext. 7751
Camice Paschal	Manager of Quality Management	(215) 775-2600 ext. 2269

Pipe Stress/Support

Chuck Whitehead	Project Engineer	(215) 776-2600 ext. 2055
Joe Zalewski	Project Piping Support Analyst	(215) 775-2600 ext. 3269
Paul Schmitzer	Piping Engineer	(215) 775-2600 ext. 2024
Tim Hatch	Lead Piping Stress Analyst	(215) 775-2600 ext. 2347
Bob Stevens	Project Piping Support Designer	(215) 775-2600 ext. 3343

Mechanical Group

Bob Sheldon	Project Engineer	(215) 775-2600 ext. 3272
Joe Kadingo	Lead Engineer	(215) 775-2600 ext. 2952
Terry Daugherty	Engineering Specialist	(215) 775-2600 ext. 2029
Harvey Goldstein	Engineer	(215) 775-2600 ext. 3281
Joe Hickson	Engineer	(215) 775-2600 ext. 3730
Jack Metzger	Piping Engineer	(215) 775-2600 ext. 3262

CYGNA

EXHBIT 3.3

Action Items

Prepared By   Date

Description	Reference	By	To	Date		Notes
				Due	Close-out	

4.0 REVIEW RESULTS AND CONCLUSIONS

4.1 Introduction

Following the preparation of the review criteria and checklists as described in the previous sections, the Cygna Project Team and Review Board completed the technical review of the defined scope. Appendix B contains a list of the documents reviewed by Cygna.

This section describes the results of the reviews in the three technical disciplines and draws a final conclusion concerning the design of the three systems within the scope of this review. The reviews in the pipe stress, pipe support and mechanical systems areas are discussed in detail in the following paragraphs. Also included are brief descriptions of the Observations noted during the review and their resolution. All completed Observations are contained in Appendix E.

As a result of this review, Cygna identified a total of 33 Observations. Of these, one was determined to be invalid upon further review. The remaining 32 Observations were divided as follows:

- Pipe Stress - 7
- Pipe Supports - 9
- Mechanical Systems - 16

In the pipe stress and pipe support areas there were general Observations written addressing documentation and design oversights. Within these Observations there was a variety of independent items denoted as a, b, c, etc. Based on further review, several of these items were determined to be invalid. These particular items were marked as "deleted" on both the Observation Record and Observation Record Review forms.

Each of the 32 valid Observations, except for PS-00-03 and PS-02-01, was closed out based on discussions with GAI and/or additional calculations (to determine design impact). For the two noted exceptions, Potential Finding Reports (PFR-01 and PFR-02, respectively) were prepared. These PFRs are included in Appendix F and are described in detail in Section 4.3 of this report.

4.2 Technical Review

4.2.1 Pipe Stress Review

As a result of the pipe stress Design Review, Cygna identified a total of eight Observations. One of the Observations (PI-01-02) was determined to be invalid after performing further review. The remaining valid Observations were divided among the three systems within the scope of the review as follows:

- General (i.e., pertaining to all systems) - 4
- Main Steam Relief Valve Discharge - 1
- High Pressure Core Spray - 1
- Main Steam Drain - 1

The reviews from which these Observations resulted were based on the scope of work as described in Section 2.0. Observations were closed out only after a determination had been made regarding the potential design and safety impact for the three systems within the scope of this review.

Two general Observations (PI-00-02 and PI-00-03) dealt with minor inconsistencies, lack of documentation and/or utilization of inconsistent data identified during the reviews of all three systems. Initially, these items were not considered to have any impact on design individually. In addition, further review revealed that there were no cumulative effects associated with these Observations due to the small number of discrepant items per system.

Observation PI-00-01 dealt with GAI's practice of not including support stiffness in the analysis of Nuclear Class 2 and 3 piping. Cygna performed further review of the one system within the review scope for which support stiffness was not considered (MSRV) and determined that the supports were designed much stiffer than required by the GAI design specification. Thus, there was no impact on design for this system.

Observation PI-00-04 pertained to analytical oversights within the jet impingement analyses for the MSRV and HPCS systems. Further review revealed that the oversight associated with the MSRV system had been considered insignificant and noted as such by the verifier. Cygna concurs with the verifier's conclusion. GAI reran the HPCS analysis and found no significant change in results.

Observation PI-01-01 was associated with a computer input error which resulted in the use of incorrect Class 3 stress intensification factors (SIFs) in the piping analysis. Further review showed that use of the correct SIFs did not impact design due to the large margin to the Code allowable stress at the points of concern.

Observation PI-01-02 identified an apparent error in the direction of the displacement input for a seismic anchor movement analysis. Further review indicated that the input used a local coordinate system and was indeed correct. This Observation was invalidated.

Observations PI-02-01 and PI-03-01 both were related to the thermal transient and fatigue analyses associated with the Class 1 piping systems. In both cases, Cygna identified Observations related to the treatment of branch connection components. Discussions with GAI regarding Observation PI-02-01 revealed that due to the component in question being overstressed in their original 1-D thermal analysis, a 2-D analysis was already being performed. As part of this reanalysis GAI would also consider the concerns raised by Cygna. In response to

Observation PI-03-01, GAI performed a 1-D thermal analysis incorporating a 50% increase in thickness to account for the reinforcement found in the crotch area of tees. Although there was a substantial increase in stress, this was more than offset by the large margins associated with the tees on the Main Steam Drain system.

The review of the HPCS flued head Class 1 analysis and stress report did not result in any Observations. Cygna found the analysis to be well documented and the report to be clearly written. However, the analysis did not consider the hydrodynamic loads associated with BWRs (NLAE) and is scheduled for a major near-term revision. This reanalysis effort had previously been scheduled by GAI.

As a general overview, Cygna found that the GAI stress analyses closely conformed to the applicable design specifications and procedures, and in general the calculations were well documented and easy to follow. In particular, Cygna found the GAI Design Verification Record, the accompanying checklists and comments section to be an excellent method for ensuring that all open items have been properly addressed as data becomes available.

4.2.2 Pipe Support Review

As a result of the Pipe Support review, Cygna identified a total of nine Observations. These Observations were divided among the three systems within the scope of the review as follows:

- General (i.e., pertaining to all systems) - 6 Observations
- Main Steam Relief Valve Discharge - 1 Observation
- High Pressure Core Spray - 2 Observations
- Main Steam Drain - 0 Observations

The reviews from which these Observations resulted were based on the scope of work as described in Section 2.0. Observations were closed out only after a determination had been made regarding the potential safety impact for the three systems within the scope of this review. After further review, it was determined that two of the Observations, PS-00-03 and PS-02-01, could indeed potentially have an impact on safety. Observation PS-00-03 was written questioning the correctness of the input of jet impingement loads to the GAI load combination computer program. As a result of GAI's investigation of the Observation, a bug was discovered in the program. Consequently, potential finding PFR-01 was written. Observation PS-02-01 noted several design oversights in the calculation for one of the supports on the HPCS system. One of the noted oversights resulted in the detection of an overstressed weld. In order to properly address this issue, potential finding PFR-02 was written. Both of these Potential Findings are discussed in more detail in Section 4.3 of this report.

The seven remaining Observations were determined not to have any potential impact on safety and are briefly discussed in the following paragraphs.

Two general Observations (PS-00-01 and PS-00-05) dealt with minor inconsistencies, lack of documentation and/or utilization of inconsistent data identified during the reviews of all three systems. Initially, these various items within each Observation were not considered to have any impact on design individually. In addition, based on further review and discussions with GAI, Cygna concluded that the cumulative effect of these items were not a concern with respect to the three systems reviewed.

Observation PS-00-02 noted two instances in which GAI procedures were not consistent with design commitments or GE criteria. The first instance was a situation in which a load combination technique was employed by GAI which differed from that which was specified in the GE requirements.

Further review by Cygna determined that the GAI method was conservative. The second item noted in this Observation dealt with GAI's design specification not including one of the load combinations required by the PNPP FSAR. Cygna's examination of all of the supports for the three systems within the scope of this review revealed that there was no significant increase in design loads as a result of considering the neglected load case.

Observation PS-00-06 was associated with GAI's standard design practice with regard to consideration of dead weight and self-weight excitation for supports. In order to resolve Cygna's concern, GAI performed additional analysis for two of the supports among the three systems which are most susceptable to these loadings. In both cases GAI's calculations showed the supports were indeed adequate to withstand the additional loading. However, for one of the supports (1N22-H132) GAI has decided to modify the support to provide additional out-of-plane stability.

General Observation PS-00-07 noted various items regarding the settings for springs and snubbers. Further review indicated that the items associated with individual supports were of minor consequence and that any deviations would be corrected as part of GAI's as-built program prior to fuel load. One general item concerned GAI's consideration of dynamic movements at spring hangers. GAI's standard practice is to allow a minimum of 1/2" margin on each end to prevent bottoming out. This was determined to be adequate based on GAI's additional practice of placing springs only in regions where excessive dynamic displacements would result in inducing high stresses on nozzles and equipment connections. Thus, the pipe stress allowables would inherently place a limitation on dynamic movements in the areas of concern.

Observation PS-01-01 concerned the lack of consideration of hydro test loads in the design of the MSRV supports. This issue was resolved based upon 1) higher design loads for other conditions, 2) inherent additional capacity of spring components, and 3) Cygna's review of support structural steel.

Observation PS-02-02 was written due to jet loads required in the HPCS design specification not being included in the support design calculations. Further review and discussions with GAI revealed that jet shields are still being added and that the supports in question are now being shielded.

Based on the support design calculations of the three sub-systems reviewed by Cygna, it can be concluded that the designs were based on generally accepted engineering practice and that the GAI support design group had shown conscientious effort in adhering to the project criteria and project instructions.

It is also important to note that several support Observations related to snubber settings, minor dimension changes, spring settings/allowable movements, and flexibility of the as-built support were resolved by relying on the as-built (IE Bulletin 79-14) verification program. Therefore, it will be important to ensure that these items are adequately reviewed during the course of the PNPP as-built program.

4.2.3 Mechanical Systems Review

As a result of the Mechanical Systems Design Review, Cygna identified a total of sixteen Observations. These Observations were divided among the three systems within the scope of the review as follows:

- Main Steam Safety Relief Subsystem - 2 Observations
- High Pressure Core Spray System - 9 Observations
- Main Steam Drain Subsystem - 5 Observations

The reviews from which these Observations resulted were based upon the following types of documents:

- GAI design specifications
- GAI piping and equipment sizing calculations
- GAI piping and instrumentation diagrams
- GAI process flow diagrams
- GAI piping and equipment arrangement drawings
- GE design requirement documents

Cygna reviewed the above documents and used them as a basis for determining whether the GAI design satisfied the NRC and GE system design and functional requirements. The resulting Observations fell into three general catagories: 1) missing or inconsistent calculations; 2) inconsistencies between GE requirements and GAI design; and 3) inconsistencies between and within GAI design documents. It should be noted that some of the Observations are multifaceted and were classified in more than one of these categories. The following paragraphs provide a brief summary of the Observations for each system, and detail their extent within the three catagories mentioned above.

Main Steam Safety Relief Subsystem

The mechanical review of the the main steam safety relief subsystem resulted in two Observations. Both of these concerned missing calculations and one also involved an apparent inconsistency between GE requirements and the GAI design. Subsequent review by Cygna and additional data supplied by GAI resulted in verification of the acceptability of the GAI design.

Observation ME-01-01 pertained to line sizing calculations for the safety relief valve discharge line which could not be located by GAI. Subsequently, a calculation was produced which, although its original purpose was not to serve as a line sizing calculation, did confirm that the GE and FSAR requirements for this piping had been met.

Observation ME-01-02 was associated with the flow coefficient requirements for the vacuum breaker valves which, individually, do not meet the GE minimum specification and lack of any justifying calculations. Subsequent communications between GAI and GE verified the acceptability of using the combined flow coefficient of both valves on each discharge line to meet this requirement.

This additional calculation and GE clarification resulted in Cygna determining that these two Observations had no significant effect on the design and safety of this subsystem.

High Pressure Core Spray

Review of the High Pressure Core Spray system resulted in nine Observations. Five of these Observations involved inconsistencies between the GE requirements and the GAI design documents. Inconsistencies between and within GAI design documents resulted in five of the Observations, and three of these five also involved calculations. After additional discussions with GE, all inconsistencies between the GE requirements and the GAI design were determined to be either acceptable to GE or to result in a conservative design.

For the instances in which calculations were missing GAI subsequently located them. All inconsistencies were resolved by either a revision to the calculations or GAI's verification which ensured that all piping and components were sized to meet system functional requirements. The inconsistencies between and within various GAI design and licensing documents were either determined to result in a conservative design or are being changed in accordance with GAI procedures.

Specifically, Observations ME-02-01 and ME-02-02 pertained to inconsistencies between the tabulated design values from the GAI specification and the GE process diagram requirements. GAI has committed to a limited revision of their design specification for items other than those determined to be conservative for piping and pipe support design.

Observation ME-02-03 concerned the location and arrangement of some equipment and piping which was not consistent with GE and NRC general design criteria. Further review and subsequent communications with GE determined that the specific inconsistencies were still acceptable for system function and safety.

In Observation ME-02-04, ME-02-05 and ME-02-07, inconsistencies were noted between valve drawings and system requirements for operation and/or testing. For Observations ME-02-04 and ME-02-05 further review revealed that requirements were either met by alternate testing procedures or by auxiliary testing systems still in preliminary design. Additionally, in Observation ME-02-04 documentation was provided by the vendor confirming that the valve in question would indeed meet the pressure and temperature rating requirements of the GAI specification. Observation ME-02-07 was closed due to the fact that the test method for the valves in question is currently under review and will be finalized by the CEI/NTS (Nuclear Test Section) group.

Observation ME-02-06 regards an inconsistency between the sizing calculation for a flow orifice, its associated pump and the GAI specification. The preliminary pump design calculation was subsequently located and showed that the pump and orifice are adequate for their intended purpose. In addition, the orifice size will be verified by GAI in system preoperational tests.

Observation ME-02-08 is associated with various items in the HPCS system design documents which showed either lack of proper documentation or utilization of inconsistent data. The individual items within this Observation have been closed based on either GAI commitments to revise specifications and the FSAR, or independent calculations by GAI which verify the adequacy of the original design.

Observation ME-02-09 pertains to inconsistencies and inaccuracies noted in the HPCS system flow and head loss calculations. This Observation was resolved by GAI performing a reanalysis which showed that the system meets or exceeds requirements for all modes of operation. In addition, these conclusions will be verified by system performance and pre-operational testing.

The resolutions cited above resulted in Cygna determining that all of the above Observations had no significant effect on the design and safety of the HPCS system.

Main Steam Drain

The review of this subsystem resulted in five Observations. Three of the Observations concerned inconsistencies between GE requirements and GAI design documents and two of these also involved inconsistencies within GAI documents. Two of the Observations involved missing and inconsistent calculations and one of these also concerned inconsistencies between GAI documents.

Specifically, Observation ME-03-01 involved inconsistencies within the GAI design specification and between it and the GE system data. In addition to GAI's commitment to update their design specification, GAI has subsequently received concurrance from GE on a modified method of system operation to eliminate the inconsistencies between the GE requirements and the GAI design.

Observation ME-03-02 pertained to a sizing calculation for a restricting orifice which could not be located. GAI generated a new calculation which verified the adequacy of the existing orifice.

Observation ME-03-03 was written due to the identification of a pipe sizing calculation for which the input neither matched the physical piping arrangement nor included all modes of operation. GAI subsequently revised the calculation. This revised calculation, when combined with existing calculations, confirmed that the components were adequately sized to meet the intended design function.

Observation ME-03-04 relates to a piping and valve arrangement which is inconsistent with the GE specified drain flowrate. This issue was discussed between GE and GAI. GE has concurred that alternate paths would enable the required flowrate to be achieved without compromising the intended system function.

Observation ME-03-05 is associated with a valve drawing which indicates that the GE requirement regarding the closing speed of this valve is not met. Subsequent discussions with GE have confirmed their acceptance of the actual closing speed. In addition, GAI is initiating a change to the FSAR which will reflect the actual closing time.

At the conclusion of the review, Cygna determined that none of the sixteen Observations in and of themselves had any significant impact on design or safety. Two of the Observations have been closed by Cygna based on additional design and analysis work to be done by GAI. These two Observations (ME-01-04 and ME-02-07) involve the test system and methods for several valves in the HPCS system and the reanalysis of valve F005 by the vendor for certification at a higher pressure/temperature rating. In addition, two of the Observations (ME-03-01 and ME-03-04) on the MSD system resulted from changes in the system operating modes or flowpaths which are being approved by GE. These additional efforts by

GAI will result in system designs which meet present NRC and GE requirements.

The review of flow and equipment sizing calculations for the three systems resulted in several Observations associated with missing calculations or inconsistencies found in calculations and GAI design data. Other Observations dealt with GE requirements and/or data being misinterpreted or misapplied by GAI. Cygna evaluated the impact of each of these Observations, both individually and collectively, and concluded the following:

- The calculations provide a conservative basis for piping and pipe support design.
- GE has concurred that there will be no detrimental impact on the system's function.

Based on this review, it is concluded that the subject systems are adequately designed to perform their intended functions.

4.3 Potential Finding Reports

During the course of the Design Review, Cygna identified a total of thirty-two valid observations, including two which were considered to be potential findings. As described in Section 3.0, Methodology, an "Observation" is any nonconformance to the review criteria having potential design impact and a "Potential Finding" is an observation considered to have a significant potential impact on plant safety. After further review, one of the potential findings, PFR-02, was determined to have no definite impact on plant safety and was closed. PFR-01 has been closed by Cygna based on activities by GAI that are currently underway. Appendix F contains more detailed documentation for each potential finding.

PFR-01

A bug has been discovered in the GAI computer program which is used for performing load combinations to produce support design loads. The problem is isolated to emergency load combinations, such as those with jet impingement loadings. These combinations could be underestimated due to this bug and could potentially result in support stresses exceeding Code allowables. This, in turn, could lead to failure of the support.

Further review of PFR-01 by Cygna revealed that additional investigations needed to be performed in order to confirm or discount the potential for safety impact. In accordance with the options specified in the piping review progam methodology, CEI assigned resolution of this PFR to GAI. GAI then began processing this potential safety issue per their quality assurance program by issuing their form QAD 600. Based on the fact that Cygna has notified CEI/GAI and that GAI has initiated the proper action, PFR-01 has been closed.

PFR-02

The weld between two items of a pipe suppport on the HPCS system is overstressed. This could potentially lead to a failure of the support.

As a resolution to this finding, GAI is preparing an ECN which, when incorporated, will serve to reduce the moment loading at the overstressed connection. Based upon this commitment to a modification, this PFR has been closed.

4.4 Conclusion

In summary, Cygna has concluded the following regarding the design of the systems reviewed:

- Pipe Stress - The GAI stress analysis closely conformed to the applicable design specifications and procedures. No Observations were identified which were determined to have any significant impact on design or safety.

- Pipe Supports - The designs provided by the GAI pipe support group evidenced a conscientious effort in adhering to the project criteria and instructions. Resolution of the two PFR's assures that there will not be any adverse impact on design or safety as a result of those findings.

- Mechanical - GAI's mechanical system design calculations provide a conservative basis for the piping and pipe support design. All Observations were satisfactorily resolved such that Cygna can conclude that the three systems are adequately designed to perform the intended functions.

Overall, the review of the designs generated by the three disciplines shows that all three systems will perform their intended safety functions in accordance with PNPP project commitments, applicable Code requirements and industry standards.

APPENDIX A

Definitions

Review Criteria	A compilation of acceptable procedures and criteria. The adequacy of the design process is measured against these standards.
Checklist	A listing of key items to be checked during the design review. The checklist provides a guide to the reviewer; it is neither all-inclusive nor limiting.
Observation	Identification of an item in nonconformance with the project standards.
Invalid Observation	Any observation which is judged to be inaccurate as a result of further review.
Valid Observation	An accurate and complete observation as judged by the project team and review board.
Potential Finding	A valid observation having a potential impact on plant safety as judged by the project review team.
Discrepancy	Identification of an item in apparent nonconformance with the review criteria.

Nomenclature

ALARA	As Low As Reasonably Achievable
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
BWR	Boiling Water Reactor
CEI	Cleveland Electic Illuminating Company
C_V	Valve Flow Coefficient
DC	Design Criteria
DCC	Design Control Change Sheet
DR	Design Review
ECN	Engineering Change Notice
GAI	Gilbert Associates, Inc.
GE	General Electric Company
GPM	Gallons Per Minute
HPCS	High Pressure Core Spray
H_f	Head Loss In Feet Due to Friction
Hs	Head Loss In Feet Due to Elevation
MSD	Main Steam Drain
MSIV	Main Steam Isolation Valve
MSRV (or MSSRV)	Main Steam Safety Relief Valve
NLAE	New Loads Adequacy Evaluation
NQAM	Nuclear Quality Assurance Manual
NRC	Nuclear Regulatory Commission
PFD	Process Flow Diagram
PFR	Potential Finding Report
P&ID	Piping and Instrumentation Diagram
PNPP	Perry Nuclear Power Plant
PPM	Project Procedures Manual
PQAP	ProjectQuality Assurance Procedures
PSIA	Pounds Per Square Inch Absolute
PSID	Pounds Per Square Inch Difference

Nomenclature (continued)

PSIG	Pounds Per Square Inch Gauge
QA	Quality Assurance
QAP	Quality Assurance Procedures
RAP	Redesigned Attachment for Piping Engineering
RPV	Reactor Pressure Vessel
SAM	Seismic Anchor Movement
SAR	Safety Analysis Report (Preliminary or Final)
SRP	Standard Review Plan
ZPA	Zero Period Acceleration

APPENDIX B

DOCUMENTS REVIEWED

NO.	DESCRIPTION
1.	GAI - Document No. DSP-E22-1-4549-00, Rev. 1, March 26, 1982 - Design Specification High Pressure Core Spray Systems Piping and Pipe Supports
2.	GAI - Document No. DSP-B21-1-4549-00, Rev. 1, April 30, 1982 - Design Specification Nuclear Boiler System Piping and Pipe Supports.
3.	GAI - Document No. DSP-B21-4549-00, dated Jan. 15, 1980 - Design Specification Nuclear Boiler System Piping and Pipe Supports.
4.	GAI - Document No. SP-51-4549-00, Rev. 1, November 16,1978 - Specification - Installation of Insulation and Lagging Group II.
5.	GAI - Doc. No. P-900 Specification, Rev. 1, June 17,1983 - Class MC Piping Containment Penetration Assemblies for Class 2 Process Piping.
6.	GAI - Attachment Specification, Document No. SP-750-4549-00, Rev. 2, Seismic Analysis, Testing and Documentation (August 30, 1973).
7.	GAI - Document SP-527-4549-00, Rev. II, March 21, 1977 - Conformed Specification - Fabrication and Delivery of Safety Class Piping.
8.	GAI - Document SP-44-4549-00, Rev. III, March 13, 1981 - Conformed Specification - Installation of Safety Class Piping, and Safety Class and Non-Safety Class Equipment.
9.	GAI - Document SP-506-4549-00, Rev. VI, November 18, 1981 - Conformed Specification - Fabrication and Delivery of Waterleg Pumps.
10.	GAI - Project Pipe Stress Analysis Instructions Manual No. 27 (Gilbert), dated April 23, 1982.
11.	GAI - Project Pipe Support Design Instructions Manual No. 99, Revision December 14, 1982.
12.	GAI - PNPP Class I Analysis Guide No. 04, Rev. 0.
13.	GAI - Evaluation of Functional Capability of Piping Components (July 29, 1982).

NO.	DESCRIPTION
14.	GAI - Document No. PY-NTC/GAI-032, Rev. 4 - Design Specification for Class I Piping Penetration Assemblies PNNP Units 1&2.
15.	GAI - Document 04-4549s-322-002, Rev. C - Dimensions and Tolerances (Sh. 1-31).
16.	GAI - Document 04-4549S-322-004, Rev. C - Erection Standards (Sh. 1-21).
17.	GAI - Piping Eng'g. Standards (DS-5 Rev. 1, November 3, 1980) - Piping Stresses at Shear Lug Attachment.
18.	GAI - Program Certification Record - (TPIPE) "TPIPE Piping Analysis" (March 21, 1983).
19.	GAI - Specification DSP-E22-1-4549-00, Rev. 2, March 15, 1983 - High Pressure Core Spray System Piping & Pipe Supports.
20.	GAI Specification SP-529-4549-00, Rev. 1, October 5, 1976 - Suction Line Strainers for Core Cooling Systems.
21.	GAI - Specification DSP-B21-1-4549-00, Rev. 2, May 31, 1983 - Nuclear Boiler System Piping & Pipe Support.
22.	GAI - Specification SP-50-4549-00, Rev. 1, November 10, 1978 - Installation of Insulation & Lagging Inside Containment.
23.	GAI - Specification SP-353-4549-00, Rev. 1, November 13, 1978 - Fabricate & Deliver Insulation and Lagging Inside Containment.
24.	GAI - Specification SP-354-4549-00, Rev. 1, November 20, 1978 - Fabrication & Delivery of Insulation and Lagging Group II.
25.	GAI - Specification SP-51-4549-00, Rev. I, November 16, 1978 - Installation of Insulation and Lagging Group II.
26.	GE - Document No. 22A3131, Rev. 5 - Design Specification High Pressure Core Spray System.
27.	GE - Document No. 22A313AS, Rev. 2 - Design Specification Data Sheet High Pressure Core Spray System.
28.	GE - Document No. 22A4622, Rev. 5 - Design Specification Nuclear Boiler System.
29.	GE - Document No. 22A4622AR, Rev. 2 - Data Sht. Nuclear Boiler System.

NO.	DESCRIPTION
30.	GE - Document No. 22A5454, Rev. 1 - Design Specification Main Steam Piping Design.
31.	GE - Document No. 22A5454AA, Rev. 0 - Design Specification Data Sheet Piping, Main Steam.
32.	GE - Operation & Maintenance Manual Section I - Instructions for the High Pressure Core Spray System).
33.	GE - document - Division of Design Responsibility (Bet. G.E. & Purchaser with respect to the scope and detail design of the nuclear system and other plant systems and equipment).
34.	GE - Document No. 22A6547, Rev. 0 - Design Specification Emergency Core Cooling System Piping Systems.
35.	GE - Document No. 213A5452BD, Rev. 2 - (ICD) Interface Control Document - Reactor.
36.	GE - Document No. 283X237CA - Parts List High Pressure Core Spray System, Rev. 15.
37.	GE - Document No. 22A5495 - Appendix II - Steam Condensate, Rev. 1.
38.	GE - Document No. 283x219CA - Parts List Nuclear Boiler System, Rev. 26.
39.	GE - System Description - High Pressure Core Spray System (C.3) 22A1483R3.
40.	GE - Document No. 21A1913, Rev. 2 - Purchase Specification Pumps, Auxiliary, for Boiling Water Reactors.
41.	GE - Document No. 21A1913AJ, Rev. 4 - Purchase Specification High Pressure Core Spray Pump.
42.	GE - Document No. 22A3731, Rev. 5 - Design Specification - System Design Pressures.
43.	GE - Document No. 21A9505BV, Rev. 1 - Purchase Specification Flow Orifice Assembly, HPCS.
44.	GE - Document No. 21A9506, Rev. 5 - Purchase Specification Valve, Main Steam Isolation.
45.	GE - Document No. 22A3743, Rev. 2 - Design Specification - Emergency Core Cooling System Network.

NO.	DESCRIPTION
46.	GE - Document No. 22A6926, Rev. 0 - BWR Requirements Specification - BWR Equipment Environmental Interface Data.
47.	GE - Document 105D4935AE, Rev. 3 - Nuclear Boiler System Purchase Part (Data Control - Isolation Valve).
48.	GE - Document No. 11A6926AA, Rev. 1 - BWR Requirements Data Sheet - BWR Equipment Environmental Interface Data.
49.	GE - Document 105D4935AE, Rev. 3 (Rev. Status Sheet) - Purchase Part (Data Control) - Isolation Valve.
50.	GAI Memorandum - Document No. PY-STR-1427, Rev. 4 - Ref. Index of Seismic-AP & NLAE Design Documents for PNPP.
51.	GAI Memorandum - Document No. PY-STR-1121 dated August 27, 1979 - Seismic Displacements for Structures.
52.	GAI Memorandum dated July 6, 1982, J.W. Mitchell to R.L. Lawit - Temperature Profiles along the Insulated Regions of the LPCS, HPCS, RHR & RCIC Pipes for Normal Power Operation with Check Valve Leakage.
53.	GAI Memorandum dated January 7, 1982 - R.W. Alley (R.J. Schmehl to C.W. Whitehead) Document PY-STR-1404 - Diesel Gen. Bldg. Radwaste Bldg. & Control Complex OBE Displacements.
54.	GAI Memorandum November 19, 1982 J.W. Mitchell - (Final) Temperature Profiles Along the Insulated Regions of the LPCS, HPCS, RHR, & RCIC Pipes for Normal Power Operation w/ Check Valve Leakage.
55.	GAI Memorandum dated January 10, 1983 from T. Hatch, J. Zalewski) - Weir & Suppression Pool Hydrodynamic Loads.
56.	GAI Memorandum July 8, 1983 - Document PY-STR-1668 - Containment Vessel & Shield Building SRV Displacements.
57.	GAI Memorandum dated February 8, 1983 from P.H. Schnitzer - Final SRV Cycle & Stress Level Definition.
58.	GAI Memorandum dated December 2, 1983 - ME-03-05: FSAR Amendment Containment Isol. Valves B21-F016 and F019.
59.	GAI Memorandum dated January 5, 1984 - ME-02-08.
60.	GAI Memorandum PY-DIOR-088 (PI-00-04), Rev. 6.
61.	Telecon dated December 22, 1983 - GAI/GEN (ME-02-05) - GE Design Specification 22A3131, Rev. 5, Item 4.5.1.4/E-22 (Gilbert).

NO.	DESCRIPTION
62.	CEI Letter to Mr. R. L. Tedesco of NRC - Response to Request for Additional Information, Reactor Systems.
63.	NRC Letter to Dr. W. Cooper/Teledyne dated July 5, 1983 re IDVP Meeting w/ PG&E Diablo Canyon Project on June 14, 1983.
64.	G.E. Letter dated May 18, 1983 re ECCS Testable & Check Valves (Responses to PY-GAI/GEN-2656).
65.	GAI letter dated December 7, 1983, PY-GAI/GEN-2931 - E22 High Pressure Core Spray System Flow Element FE-N007 Installation.
66.	GAI letter PY-GAI/GEN-2964, dated January 3, 1984 - ME-03-01, B21/B22 Main Steam Isolation Valve Drains; ME-03-05, Required Closing Speed of Valves B21-F-016 and F-019; and ME-01-02, Main Steam Safety Relief Valve Discharge Line Vacuum Breaker Sizing Criteria.
67.	GAI letter dated December 27, 1983 - PY-GAI/CEI-15132 - ME-02-04.
68.	GAI-SER for PNPP - Section 3 - Design Criteria for Structures Systems, and Components.
69.	GAI-SER for PNPP - Section 3.6 - Protection Against Dynamic Effects Associated with the Postulated Rupture of Piping.
70.	GAI-SER for PNPP - Section 3.8.4 - Other Category I Structures.
71.	GAI-SER for PNPP - Section 5.3.2 - Pressure-Temperature Limits.
72.	GAI-SER for PNPP - Section 5.3.3 - Reactor Vessel Integrity.
73.	GAI-SER for PNPP - Section 6.3 - Emergency Core Cooling System.
74.	GAI-Perry SSER 2 - Section 3 - Design Criteria for Structures, Systems, and Components.
75.	GAI-Perry SSER 1 - Section 3.8.4 - Other Category I Structure.
76.	GAI-Perry SSER 3 - Section 6 - Engineered Safety Features.
77.	Perry FSAR, Amendment 12 - Section 3.2 - Classification of Structures, Components and Systems.
78.	Perry FSAR, Amendment 12 - Section 3.6 - Protection Against Dynamic Effects Associated with the Postulated Rupture of Piping.
79.	Perry FSAR, Amendment 12 - Section 3.7 - Seismic Design.

NO.	DESCRIPTION
80.	Perry FSAR, Amendment 12 - Section 3.8.1 - Concrete Containment for Safety Class Structures.
81.	Perry FSAR, Amendment 12 - Section 3.9 - Mechanical Systems and Components.
82.	Perry FSAR, Amendment 12 - Section 5.2.2 - Overpressurization Protection.
83.	Perry FSAR, Amendment 12 - Section 5.4.13 - Safety and Relief Valves.
84.	Perry FSAR, Amendment 12 - Section 6.3 - Emergency Core Cooling Systems.
85.	Perry FSAR, Amendment 12 - Section 10.3 - Main Steam Supply System.
86.	Perry FSAR, Amendment 12 - Section 15.5 - Increase in Reactor Coolant Inventory.
87.	Perry FSAR, Amendment 12 - Section 15.6 - Increase in Reactor Coolant Inventory.
88.	Perry FSAR, Amendment 12 - Appendix 3A - Hydrodynamic Loads for PNPP.
89.	Perry FSAR, Amendment 12 - Appendix 3B (AM.11 2-15-83) - Containment Loads.
90.	Perry FSAR, Amendment 12 - Tables 3.9-1.
91.	GAI - Design Input for Analysis Calc. 1B21G08A, Rev. 2, November 4, 1982.
92.	GAI - Design Verif. Record (P203), Rev. 0, Thermal Hydraulic Transient Force on the Main Steam SRV Discharge Piping.
93.	GAI - Design Input for Analysis Calculation, E22G04A, Rev. 2.
94.	GAI - Piping Analysis Calculation 1E22G04C, Rev. 3 (HPCS System).
95.	GAI - Design Input for Analysis Calculation 1N22G01A, Rev. 2.
96.	GAI - Piping Stress Analysis Calculation - 1N22G01C, Rev. 3 - Fatigue Evaluation.
97.	GAI Calculation - Design Verif. Record (P-256) - Thermal Transient Analysis, Rev. 0.

NO.	DESCRIPTION
98.	GAI - Piping Analysis Calc. 1B21G08A, Rev. 2, dated February 4, 1983 - Main Steam Safety Relief Valve.
99.	GAI - PNPP Unit 1 - ASME Class 1 Stress Report P-1001, Rev. 0.
100.	GAI - PNPP Unit 1 - ASME Class 1 Stress Report P-1010, Rev. 0.
101.	GAI Calculation 1E22G04C, Rev. 4, Jet Load Input Calculation (PI-00-04).
102.	GAI - Pipe Support Design Calculation set for MSD, No. 1N22-G01B, Rev. 1.
103.	GAI - Pipe Support Design Calculation set for HPCS System, No. 1E22-G04B, Rev. 1.
104.	GAI - Pipe Support Design Calculation set for MSRV, No. 1B21-G08 B, Rev. 0.
105.	GAI documents - RAP, DCC, ECN for 1N22-G01.
106.	GAI documents - RAP, DCC, ECN for 1E22-G04.
107.	GAI documents - RAP, DCC, ECN for 1B21-G08. Hanger Detail for 1B21-G08.
108.	GAI - Stress Program Verification Calculation (Shear Lug Analysis Verif., Rev. 0).
109.	GAI - Pipe Support drawings - 04-4549S-322-605 for Main Steam Relief (1B21G08) system.
110.	Load Capacity Data Sheets of Class 1 Component Supports, Document No. P-2010, Rev. 0 (Gilbert Comm.).
111.	Load Capacity Data Sheets of Class 1 Component Supports, Document No. P-2001, Rev. 0 (Gilbert Comm.).
112.	Suction Strainer - Pressure Drop Calculations, August 3, 1976 (Sandusky Mac-Iron).
113.	GAI - Calculation (E22-4) E22 High Pressure Core Spray Overpressure Protection, Rev. 0.
114.	GAI - Design Verif. Record (E22-1) HPCS System NPSH Calculations, Rev. 0.

NO.	DESCRIPTION
115.	GAI - Calculation (Attachment #1-E22A-J,CC) HPCS Restricting Orifices (February 8, 1979).
116.	GAI - Calculation HPCS - Line Losses (E22 A/J-CC, Rev. 1, February 16, 1979).
117.	GAI - Design Verif. Record (Calc. N-22-1) Main Steam Drains Penetrations Temp. & Pressure Transients, Rev. 0.
118.	GAI - Calculation (N22-2) - Steam Drain Flow Rates, Rev. 0.
119.	GAI - Calculation (N22-3) - N22-Line Sizing, Rev. 0.
120.	GAI Calculation (N22-4) N22 System Orifice Sizing, Rev. 0.
121.	GAI - Calculation (N22-5) 2nd MSIV B.S.D. - Line Sizing, Rev. 0.
122.	GAI - Design Verif. Record (N22-6) Orifice Sizing - Water (Rev. 0 - April 12, 1982).
123.	GAI - Design Verif. Record (N22-7) Orifice Sizing, Rev. 0.
124.	GAI - Calculation (N22-8) Orifice Sizing for Drain System, Rev. 0.
125.	GAI Calculation N22-9 (ME-03-02) Steam Flow through Orifice, 1/2 B21-D001.
126.	GAI Calculation P203, Rev. 0 (ME-01-01) Thermal-Hydraulic Transient Analysis of the Main Steam Safety Relief Discharge Piping (B21 Substem G01-G19).
127.	GAI Calculation E22-3 with Design Input and Design Verification Records.
128.	GAI Calculation E22-4 with Design Input and Design Verification Records.
129.	GAI Calculation E22-5 with Design Input and Design Verification Records.
130.	GAI Calculation E22-6 with Design Input and Design Verification Records.
131.	GAI Calculation E22-8 with Design Input and Design Verification Records.
132.	GAI Calculation E22-7 (ME-02-06).

NO.	DESCRIPTION
133.	GAI Calculation N22-3-A (ME-03-03).
134.	GAI TPIPE Computer Output for Calculation 1B21G08, Rev. 2, Vol. 1 of 2 - Static, Dynamic & Time History, Run No. JOHNVXW, DW2; Run. No. JOHNVXX; Adj. Quencher Water Jet Impingement, Run No. JOHNVYU; Vol. 2 of 2 - 1B21G08, Rev. 2 (pages 1-260), Post Processor, Run No. JOHNVSR.
135.	GAI - TPIPE Computer Output - 1E22G04C, GEOMETRY, Rev. 2, Vol. 1 of 1 (Run Nos. AOXZHYO, AOXZIGM, AOXZGCL, AOXZIIQ, SEISMIC RUN 4, (83/03/24), AOXZGLP & CURVE ENVELOP RUN J72).
136.	GAI - TPIPE Computer Output - 1E22G04C, Rev. 3, Vol. 1 of 3 - Fatigue Analysis, Run No. AOXZIHD, Vol. 2 of 3 - Fatigue Analysis, Run No. AOXZIHD Vol. 3 of 3 - Thermal Transient and Additional Thermal Expansion Output Run Nos. AOXZBWD, AOXZEPQ AOXZJXU, AOXZLNM AOXZLNF, AOXZGVK AOXZGMK, AOXZGLX AOXZGIW, AOXZLOV AOXZLQO, AOXZCGD AOXZJKS, AOXZCEZ AOXZIXR, AOXZKUA AOXZJGU, AOXZCPA AOXZCOP, AOXZCTO AOXZAWA, AOXZCWI AOXZCZT, AOXZDDY AOXZFHL, AOXZAAV AOXZFHX, & AOXZBJI
137.	GAI - M093 COMPUTER OUTPUT RUN No. J301 (02/23/83), Load Combination for 1B21-G08.
138.	GAI - TPIPE Computer Outputs - 1N22G01C - Main Steam Drain Book 1 of 2, Rev. 2 (Run Nos. AOQZEQA & AOQZHFL) Book 2 of 2, Rev. 2 (Run Nos. AOQZGFM, AOQZAMI & AOQZGIE).
139.	GAI - TPIPE 1N22G01 Computer Output (P256), Rev. 0, Thermal Transient, Run No. AOQZAPN, AOQZAPW, AOQZAQD, AOQZBFJ, AOQZDIM, AOQZBQD, AOQZDJN, 11/15/83.
140.	GAI - TPIPE Computer Output, 1N22G01C, Rev. 0, Thermal Transient, Book 1 of 2, Run Nos. AOQZBFY, AOQZBNC, AOQZBNE, AOQZBKM, AOQZCBB, AOZBGX, AOQZEXI Indv. Fatigue Eval., Book 2 of 2, Run No. AOQZENE

NO.	DESCRIPTION
141.	GAI-1N22G01C Computer Output - MSD Geometry and Frequency Run No. AOQZAOL (82/12/04).
142.	Perry - Waterleg Pumps - Characteristic: Curve Sheet (E22-C003) Bingham.
143.	Byron Jackson - Doc. No. PC-741-S-1414 - Performance Curve, Rev. A (Reviewed by G.E.).
144.	(Gilbert) Bill of Material (E22 F0039) for Valves Check - Code Class 2 per ASME III.
145.	TPIPE - User Manual (Gilbert Commonwealth), Rev. B.
146.	Power Piping Load Capacity Table.
147.	Chapter II-II - Gen. requirement for Fluid Metering: Installation (ASME).
148.	Design Handbook - for Continuous condensate "Removal from Steam Systems with the Flexitallic Orifice System" (Bulletin 474, 1979 1st Edition) by Flexitallic Gasket Co., Inc.
149.	The New Mac-Iron Microfinished Orifice Plates (Mack Iron Works Co.) Catalog data.

NO.	DESCRIPTION

Drawings Reviewed

150. 762E455, Sheet No. 1/2, Rev. 6, GE - Process Diagram - HPCS.

151. 794E707, Sheet No. 1 & 2, Rev. 1, GE - Design Bases - Class 1 Piping Cycles - HPCS.

152. 795E873, Sheet No. 1&2, Rev. 1, GE - P&ID - HPCS System.

153. 105D5076, Rev. 3, GE Drawing Interface Control - Pump Motor.

154. D-302-701, Rev. G, GAI-HPCS System, Piping System Diagram (GE Dwg. No. 105D5025AA Rev. 1).

155. D-304-701, Rev. M, GAI - Piping System Diagram - HPCS (Plan and Sections).

156. D-304-702, Rev. L, GAI - HPCS, Piping Systems (Sections).

157. D-304-703, Rev. G, GAI - HPCS, Piping Systems (Reactor Bldg. El. 520'6" etc.).

158. D-320-701, Rev. C, GAI - HPCS System Piping Design Spec. E22 (GE Dwg. No. 105D5025, Rev. 6).

159. D-314-701, Sheet No. 4, Rev. 12 & 13, GAI - HPCS to Reactor & Suppression Pool (Inside Containment).

160. 1-E22-G-HPC-50-RB, Sheet No. F-1895, Rev. 2
Sheet No. F-1895-A, Rev. 1
F-1896, Rev. 1
F-1897, Rev. 1
Pullman-Kellogg - E22 - H.P. Core Spray

161. B-301-734, Rev. J, GAI - Quencher Arrangement Design Envelope.

162. 767E676, Sheet No. 1/2, Rev. 1, Sheet 2/2, Rev. 1
GE - Interface Control - Discharge Quencher, Nuclear Boiler System.

163. D-302-605, Rev. C, GAI - Nuclear Boiler System Piping System Diagram.

164. D-302-606, Rev. C, GAI - Nuclear Boiler System, Piping System Diagram.

165. D-320-605, Rev. B, GAI - Nuclear Boiler System, Piping Design Specification System B21.

166. D-320-606, Rev. A, GAI - Nuclear Boiler System Piping Design Specification System B21.

NO.	DESCRIPTION
167.	769E305CA, Sheet Nos. 1-6, GE - P&ID Nuclear Boiler System.
168.	105D5575, Sheet No. 1, Rev. 0, GE - Process Diagram - Nuclear Boiler System.
169.	131C7911C, Sheet No. 1, Rev. 5, GE - Process Data - Nuclear Boiler System.
170.	D-314-701, GAI - Piping System Analysis Diagram HPCS System: Sheet No. 1, Rev. 11, Suction & Discharge Sheet No. 2, Rev. 9, Test to Suppression Pool Sheet No. 3, Rev. 11, Min. Flow to Suppression Pool Sheet No. 4, Rev. 14, To Reactor & Suppression Pool (inside containment). Sheet No. 5, Rev. 3, Discharge. Sheet No. 6, Rev. 3, Standby and HPCS Diesel Gen. Exhaust and Intake.
171.	D-314-315, Sheet No. 1, Rev. 3, GAI - Piping System Analysis Diagram Condensate Transfer to RCIC and HPCS.
172.	D-304-007, Rev. C, GAI - Main Steam Safety Relief Valve Vent Line (Reactor Bldg. Plan El. 620'-6" - West).
173.	D-304-008, GAI - Main Steam Safety Relief Valve Vent Line (Reactor Bldg. Plan El. 620'-6" - East).
174.	D-304-009, Rev. D, GAI - Main Steam Safety Relief Vent Lines (Reactor Building Plan El. 599'-9" - West).
175.	D-304-010, Rev. E, GAI - Main Steam Safety Relief Vent Lines El. 699'-9" - East).
176.	D-304-011, Rev. P, GAI - Piping, Main Steam - Steam Tunnel.
177.	D-304-025, Rev. K, GAI - Main Steam Safety Relief Piping Inside Reactor Bldg. (El. 620'-6" - West).
178.	D-304-026, Rev. H, GAI - Main Steam Safety Relief Piping Inside Reactor Building (El. 699'-9" and El. 574'-10" - West).
179.	D-304-027, Rev. M, GAI - Main Steam Safety Relief Piping Inside Reactor Building (E. 620'-0" - East).
180.	D-304-028, Rev. E, GAI - Main Steam Safety Relief Piping Inside Reactor Building (El. 699'-9" & 574'-10" - East).
181.	D-304-501 - Rev. E, Main Reheat Extraction & Miscellaneous Drains.

NO.	DESCRIPTION
182.	D-314-011, Sheet No. 44, Rev. 5, GAI - Piping System Analysis Diagram, Main Steam - Drains.
183.	794E709, Sheet Nos. 1&2, Rev. 0, GE - Design Bases - Class 1 Piping Cycles - Main Steam.
184.	D-314-011 (1B21G08), Sheet No. 42, Rev. 5, Main Steam Safety Relief Valves (F047H) Discharge to Supp. Pool.
185.	D82-24401-18, Sheet Nos. 1/3, Rev. C, Rockwell International Testable Piston Check Valve w/Indicator.
186.	81030-1, Sheet No. 1/1, Rev. B, Borg-Warner Corp. - Valve Assembly, Gaye 12", 1500 lb. C.S. Gear Operated.
187.	81180, Sheet No. 1/1, Rev. H, Borg-Warner Corp. - Valve Assembly, Gate 3", 1500 C.S. Motor Operated.
188.	N04-2217-530, Sheet No. 1/1, Rev. D, Anderson Greenwood & Co., CVIB SPCL VAC BRKR VALVE. Assembly, 6"-300 ANSI.
189.	112D1130, Sheet No. 1/1, Rev. 4, GE - Interface Control - Valve, Safety Relief.
190.	105D5228, Sheet Nos. 1&2, Rev. 9, GE - Interface Control - Isolation Valve.
191.	1X2REH-C-5, Sheet No. 1/1, Rev. E, Target Rock Corp. - 1"x2" 150 lb. Relief Valve Assembly.
192.	1 1/2X2REH-S-3, Sheet No. 1/2, Rev. G, Sheet No. 2/2, Rev. G, Target Rock Corp. -1 1/2 x 2 900 lb. Relief Valve with and without Blowdown Ring.
193.	21140, Sheet No. 10/20, Rev. A, Sheet No. 12/20, Rev. A, TRW Duo-Check Valve Installation Dims. and Part List.
194.	81510, Sheet No. 1/1, Rev. E, Borg-Warner Corp. - Valve Assembly - 16 inch, 900 lb. Swing Check, C.S.
195.	D-9955, Rev. A, Kerotest - 3/4 Series 1500 - Y-Type Globe Valve.

NO.	DESCRIPTION
196.	1NC087: (4549-41-620-2-4), Sheet No. 2, Rev. 8 (4549-41-620-2A-3), Sheet No. 2A, Rev. 5 (4549-41-620-2B-4), Sheet No. 2B, Rev. 5 (4549-41-620-2BA-3), Sheet No. 2BA, Rev. 3 (4549-41-620-2BB-0), Sheet No. 2BB, Rev. 0 (4549-41-620-2C-4), Sheet No. 2C, Rev. 4 (4549-41-620-2D-3), Sheet No. 2D, Rev. 4 (4549-41-620-2E-4), Sheet No. 2E, Rev. 4 (4549-41-620-2F-6), Sheet No. 2F, Rev. 4 (4549-41-620-2G-2), Sheet No. 2G, Rev. 2 GAI - Index & Individual Valve Listing and Nameplate Data
197.	0-108 562E, Rev. 5, Eugen Seitz AG (GE) - Control Valve for Safety Discharge Steam Valve.
198.	P-7837151.S, Valves by Sys. for Gilbert as of 8/18/83 (pg. 3, 7, 11, 285 & 287) as of 9/15/83 (pp. 1-11 & pp. 288-292) (see Project File 7.0, Drawings)
199.	D-314-011, Sheet No. 44, Rev. 3, GAI - Piping System Analysis Diagram, Main Steam Drains (1N22-G01).
200.	D-314-011, Sheet No. 45, Rev. 4, GAI - Main Steam Drains (1N22-G02).
201.	40-445-2 (G-471-6/125.04.03), Rev. 06, G. Dikkers & Co. - Safety Relief Valve with Air Operated Actuator.
202.	105D5229, Rev. 4, GE - Interface Control - Safety/Relief Valve.
203.	35A0155, Rev. B, Fisher Controls - 1" Body, 40 Actuator, 657-DBO Diaphragm Actuated Control Valve.
204.	PD-156324, Sheet No. 1/2, Rev. B, Rockwell International - Edward Globe Stop Valve.
205.	PD-156324, Sheet No. 2/2, Rev. A, Rockwell International - Size 3, Class 1500, Globe Weld End Detail.
206.	PP-D-9955(2), Rev. B, Kerotest - 3/4" Series 1500# Y-Type Globe Valve.
207.	D-304-725, Rev. E, GAI - Piping System P21, P22 (Two Bed and Mixed Dimineralized Dist. System Control Complex Plans).
208.	D-304-961, Rev. E, GAI - Piping System B21, E31 - Leak Detection System and Reactor Head Vent Drain Reactor Building Plan and Sections.

NO.	DESCRIPTION
209.	PY-DIDR-030, Sheet Nos. 1-6, Rev. 12, Drawing List (See Project File: 7.0 Drawings).
210.	D-411-170, Rev. K, Reactor Building - Drywell Wall - Concrete Outline.
211.	D-411-174, Rev. B, Reactor Building - Drywell Wall - Concrete Outline.
212.	3-258-2-C, Ladish Company Reducing Butt Welding Tee.
213.	B-312-646, Rev. E, GAI - Drywell Penetration Detail Type "Z".
214.	D-511-173, Rev. K, GAI - Reactor Building-Steel Framing Drywell Wall Liner Details Sections & Details.
215.	E-17409X (FD-1A015/22), Rev. 5, Bingham-Willamette Co. Water Leg Pump.
216.	B-312-656, Rev. B, GAI - Containment Vessel Penetration Detail Type J.
217.	D-304-122, Rev. G, GAI - M.R.E. and Miscellaneous Drains.
218.	D-304-121, Rev. E, GAI - M.R.E. and Miscellaneous Drains.
219.	D-304-129, Rev. D, GAI - M.R.E. and Miscellaneous Drains.
220.	E-303-002, Rev. U, GAI - Yard Piping Plan, Northeast Main Plant Area.
221.	E-303-016, Rev. H, GAI - Yard Piping, Sections and Details.
222.	E-303-017, Rev. N, GAI - Yard Piping, Auxiliary Plans - Sections and Details.
223.	E-303-018, Rev. F, GAI - Yard Piping, Plan and Details - Miscellaneous Nuclear Safety Related Piping.
224.	D-304-315, Rev. E, GAI - Piping, Condensate Transfer and Storage Auxiliary Building.
225.	D-304-316, Rev F, GAI - Piping, Condensate Transfer and Storage - Auxiliary Building Plan Above El. 574'-10".
226.	D-304-317, Rev. K, GAI - Piping, CNDS. Transfer and Storage - Auxiliary Building Plan El. 599'-0" and Sections.
227.	D-533-062, Rev. dtd. 11/2/83, GAI - Jet Shields - Residual Head Removal System, Erection Plan-West.

Job No. 83102
Doc. No. DC-1
Rev. 1

PIPE STRESS DESIGN REVIEW CRITERIA

FOR

PERRY NUCLEAR POWER PLANT - UNIT 1

CLEVELAND ELECTRIC ILLUMINATING COMPANY

Prepared by L. J. Weingart 12/6/83 Date

Independent Review by T. Nguyen 12/7/83 Date

Approved by J. Minichiello 12/13/83 Date

CYGNA ENERGY SERVICES
150 N. Wacker Drive, Suite 2450
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December, 1983

CYGNA

TABLE OF CONTENTS

1.0 INTRODUCTION

The purpose of this document is to provide the criteria to be used for the review of the Piping Stress Analyses for Perry Nuclear Power Plant - Unit 1. This Design Criteria shall be used in conjunction with Work Instruction 1.

Wherever a Gilbert Associates, Inc. (GAI) Specification or Criteria is referenced, the applicable sections have been reviewed and accepted by Cygna. [....] indicates statements extracted from GAI Criteria, unless noted otherwise.

2.0 SCOPE

The piping systems included in this review are:

- Nuclear Class 1 High Pressure Core Spray System Piping (HPCS) from the drywell wall penetration anchor to the RPV nozzle (GAI Analysis 1E22-G04).

- Nuclear Class 3 Main Steam Safety Relief Valve (MSRV) F047H discharge piping from anchor H061R-0 to the anchored quencher located in the suppression pool (GAI Analysis 1B21-G08).

- Nuclear Class 1 Main Steam Drain piping (MSD) from the taps located at the inlet ends of inboard main steam isolation valves to the containment penetration anchor (GAI Analysis 1N22-G01).

3.0 CODES, STANDARDS AND REFERENCE DOCUMENTS

3.1 Piping

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

3.1.1 ASME Boiler and Pressure Vessel Code Section III, 1974 Edition, including addenda through Winter 1975.

3.1.2 Applicable criteria contained in the following GAI Project Design Specifications which have been reviewed and approved by Cygna. Specific input values, such as pressure and temperatures, will be further evaluated during the course of the design review.

- DSP-E22-1-4549-00, Rev. 1 - HPCS
- DSP-B21-1-4549-00, Rev. 1 - Nuclear Boiler System

The referenced revision of design documents are the baseline documents. Later revisions may be used, as applicable, to verify the adequacy of evolving designs.

3.1.3 Perry Nuclear Power Plant - Unit 1 Final Safety Analysis Report (PNPP FSAR), Amendment 12.

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 addenda through Winter 1975.

3.2.2 GAI Project Design Specification:

- SP-PY-NTC/GAI-032, Rev.4 - "Design Specification for Class 1 Piping Penetration Assemblies for PNPP - Units 1 and 2"

4.0 DESIGN

4.1 General

All piping systems shall be reviewed for conformance with the requirements of the Code as stipulated in Subarticle NB-3200 and NB-3600 for Nuclear Class 1 and ND-3600 for Nuclear Class 3.

4.2 Classification of Piping Systems

4.2.1 Nuclear

Nuclear system classification is specified in GAI Drawings D-320-605, Rev. B (MSRV and MSD) and D-320-701, Rev. C (HPCS).

4.2.2 Seismic

Seismic system classification of the piping systems is specified in GAI Drawings:

- D-304-025, Rev.K (MSRV)
- D-304-501, Rev.E (MSD)
- D-304-703, Rev.G (HPCS)

4.3 Boundaries

4.3.1 Piping system boundaries are designated on the P&IDs for Nuclear Class 1, 2 and 3 piping and are described in GAI Project Design Specifications DSP-E22-1-4549-00, Rev. 1 and DSP-B21-1-4549-00, Rev. 1.

4.3.2 The dimensional location of each such boundary is shown on the piping isometric drawings listed in 4.7.1.

4.3.3 Piping Analyses may be dynamically decoupled when:

a. The ratio of the moments of inertia of the run and branch piping exceeds 25.

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 shall be considered as anchor points in the analyses.

4.3.5 The drain taps on the Main Steam Isolation Valves shall be considered as anchor points in the MSD analysis.

4.4 Loading Combinations

4.4.1 Load cases will be combined as specified in Code Subarticles NB-3650 and ND-3650 for Nuclear Class 1 and 3 piping respectively, PNPP FSAR Table 3.9-21 and GE design specifications 22A5454A, Rev. 1 (MSRV and MSD) and 22A6457, Rev. 0 (HPCS).

4.5 Stress Limits

4.5.1 Stress limits for the Class 1 piping shall be in accordance with the Code. Elastic or inelastic methods are acceptable.

4.5.2 Stress limits for the Class 3 piping shall be in accordance with the Code.

4.5.3 Functional capability criteria shall be in accordance with Interim Technical Position, "Functional Capability of Passive Piping Components", Mechanical Engineering Branch, Division of Systems Safety. Where additional criteria are required to evaluate functional capability, applicable criteria in GE Topical Report NEDO-21985, dated September 1978, may be used.

Note: For specific loading combinations and their associated stress limits, see Exhibits 1 and 2 for Class 1 and Class 3 piping, respectively.

4.6 Design and Operating Conditions

Analysis data shall be reviewed for conformance with the following:

4.6.1 The design pressures and temperatures, and operating pressures, temperatures, and flows for the piping systems as tabulated in GAI Project Design Specifications DSP-E22-1-4549-00, Rev. 1 (HPCS) and DSP-B21-1-4549-00, Rev. 1 (MSRV and MSD) (as verified by Cygna's mechanical systems review).

4.6.2 For Class 1 piping, the pressure, temperature and flow transients, including cycles, duration and description of subsystem boundaries are provided by the following General Electric Documents:

MSD	-	105D5575	Rev.0
		131C7911C	Rev.5
		794E709	Rev.0
HPCS	-	762E455	Rev.6
		794E707	Rev.1

4.7 Geometry and Computer Modeling

4.7.1 Piping geometry and restraint locations shall be reviewed for conformance with the latest revision of the following GAI isometric drawings:

- D-314-011 SHT 42, Rev. 5 (MSRV)

- D-314-011 SHT 44, Rev. 5 (MSD)
- D-314-701 SHT 4, Rev. 13 (HPCS)

4.7.2 Pipe properties shall be reviewed for conformance with GE Design Specifications 22A5454, Rev. 1 (MSRV and MSD) and 22A6547, Rev. 0 (HPCS).

4.7.3 Material properties shall be reviewed for conformance with GE Design Specifications 22A5454, Rev. 1 (MSRV and MSD) and 22A6547, Rev. 0 (HPCS), the associated piping isometric drawings and ASME B&PV Code, Section III, Appendix I.

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

4.7.5 Mass point spacing shall be sufficient to adequately represent the dynamic properties of the system up to 33 HZ for seismic analysis and 60 Hz (or higher depending on the individual response spectra) for hydrodynamic analysis. This spacing shall be calculated based upon the pipe properties (including contents) and the characteristics of a simply supported beam.

4.7.6 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.

b. For motor operated valves, modeling of the operator shall be such that the first frequency of the valve stem equals the natural frequency of the valve as presented in the vendor valve stress reports.

c. If the actual properties of the valve are not available to be used in the modeling of the valve body, the valve body element shall be modeled such that [the inside diameter matches that of the mating pipe with a wall thickness equal to 1.1 t_m], where t_m is obtained from ASME B&PV Code Sect. III, Table NB-3542-1. Another acceptable method is to model the body element in a manner such that the stiffness of that element is appreciably larger than that of the mating pipe. This may be accomplished, for example, by doubling the wall thickness.

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

a. Flanges shall be considered as additional lumped weights.

b. Section properties shall be calculated as described in 4.7.7(c).

4.8 Loading

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

4.8.1 Stress intensification factors and stress indices shall be reviewed for conformance with:

a. ASME B&PV Code, Section III subarticles NB-3680 and ND-3670.

b. For weldolets, latrolets and sweepolets refer to the appropriate Bonney Forge publications.

4.8.2 Pressure Effect

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

4.8.3 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.

4.8.4 Thermal Analysis

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

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

4.8.5 Seismic Analysis

a. Review to assure that OBE and SSE spectra at appropriate damping values for all pertinent buildings and the Reactor Pressure Vessel (if applicable) at the proper elevations have been enveloped. Individual building response spectrum curves are per GAI Doc. Nos. PY-STR-1360, Rev.2, PY-STR-1529, DTD 9/15/82 and GE Doc. No. 22A7144, Rev.0.

b. Review to assure that damping values are consistent with NRC Regulatory Guide 1.61, Oct. 1973, i.e.,

	Damping Ratio Percentage	
Pipe Size	OBE	SSE
Pipe diameter greater than 12 inches	2.0	3.0
Pipe diameter less than or equal to 12 inches	1.0	2.0

If the piping system is composed of pipe sizes in both of the above ranges, the envelop spectra of both dampings shall be used.

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, Rev. 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 valves does not exceed [3 g in any horizontal direction, 3 g in the vertical direction], or lower g values as required by the respective manufacturers. Assure that containment isolation valves and safety class motor operated valves have been individually documented for qualification.

f. All dynamic analyses shall be reviewed to assure that sufficient mass has been included in the computer calculation such that inclusion of additional modes shall not result in an increase in responses of more than 10 percent. This shall be accomplished by assuring that the effects of the modes not included are added (by SRSS method) to the dynamic response as one term, using the acceleration at the cut-off frequency as an additional mode. If this criterion is not met, the results will be evaluated on a case by case basis to assure that the loads and stresses are acceptable.

4.8.6 Seismic Anchor Movement (SAM) Analysis

Review to assure that seismic differential anchor movements have been considered. If piping passes between buildings or is connected to different structures, proper phasing should be taken into account. Movements are per GAI Document No. PY-STR-1121, DTD 8/27/79.

4.8.7 Hydrodynamic Analysis (NLAE)

4.8.7.1 Review to assure that the following hydrodynamic load cases have been considered (refer to GE design specifications 22A5454, Rev. 1 and 22A6547, Rev. 0 for a detailed explanation of each load case):

- Safety relief valve pressure wave loads - RVO (MSRV only)
- Safety relief valve loads due to air clearing - SRV
- Vent clearing loads (poolswell) - PS
- Condensation oscillation - CO
- Annulus pressurization - AP
- Chugging - CHUG
- Weir Wall - WEIR

The requirements of 4.8.5 apply with the following exceptions:

a. Individual building response spectrum curves are per documents as noted in GAI document No. PY-STR-1427, Rev.4.

b. The analysis cut-off frequency shall be at least 60 Hz or higher depending upon the individual response spectra curves input.

4.8.7.2 Review to assure that the differential movements due to SRV loadings have been considered. If piping is connected to different structures proper phasing should be taken into account. Movements are per documents as noted in GAI Document No. PY-STR-1427, Rev.4.

4.8.7.3 Review to assure that impact and drag loads due to PS and SRV have been considered. These shall be accounted for by static analyses.

4.8.8 Jet Impingement Analysis

Review to assure that jet impingement loadings from adjacent piping systems or vessels has been considered. Jet loads are as specified in Table 7 of GAI Design Specifications DSP-E22-1-4549-00; Rev.1, DSP-B21-1-4549-00, Rev.1 and PY-DIDR-030.

Static analyses shall be performed, following the requirements of PNPP FSAR Section 3.6.2.3.1, i.e.,

- A dynamic load factor of 2.0 should be used when considering initial impact. Snubbers are to be included in this analysis.

- A dynamic load factor of 1.0 should be used when considering steady state impact. Snubbers are not to be included in this analysis.

4.8.9 Restraint stiffness input shall be reviewed for conformance with the detail drawings and Cygna Pipe Support Design Review Criteria, 83102-DC-2, Rev. 0, Exhibit 4.1-1.

4.8.10 Flange design shall be reviewed for conformance with the requirements of NB-3647.

4.8.11 Impact and Drag Loads

The analysis of pipe shall be in accordance with the PPSAI:

[a. Load on the Pipe

Loads are given on Table 2.11-1 in lb/in^2 for different elevations. This load is converted to the more useful form of pounds per foot of pipe using:

$$\text{Load (lb/ft)} = \text{O.D. Pipe (in)} \times 12 \left(\frac{\text{in}}{\text{ft}}\right) \times \text{Load (lb/in}^2)$$

b. Application of the Load to the Pipe

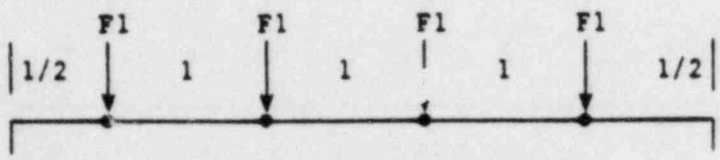
The load may be applied to the pipe by either of the two following methods, but the first method is preferred.

1. Uniform Load (Pipdyn)

The load (lb/ft) is input as "weight per foot" for the cross section of the pipe being affected - all other cross sections have no weight input. The gravitational vector must be defined in the direction of the force acting on the pipe.

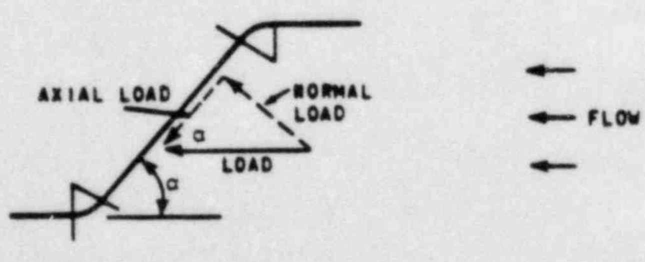
2. Concentrated Loads (Pipdyn, T-Pipe)

The load may be applied to the pipe by inputing concentrated loads at evenly spaced nodes, where the load at a node is equal to Load (lb/ft) times length between nodes (ft). For example:



3. Special Applications
   a. Load for pipe members skewed to direction of flow

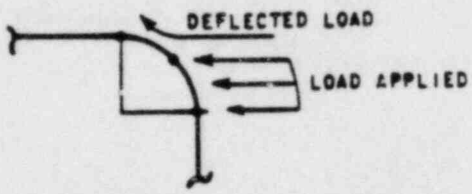
      The method for determining loads for skewed members is explained using:



The load (lb/ft) is broken into its normal and axial components. The axial load may be ignored, since it is due to skin friction and is negligible. The normal load is input as the load on the pipe in the normal direction.

b. Load on Elbows

The force on an elbow is input along the curved surface until most of the water is deflected. For a 90° Elbow this is taken to be halfway. For example:



An equally acceptable, and more conservative, method is to apply the force over the complete length of the elbow.

c. Miscellaneous Loads - Pipe Ends, Flanges, Valves and Supports

For each case, the area over which the load is applied must be calculated and multiplied by the lb/in^2 from the load chart. Care must be taken to use the correct load; for flat or cylindrical surfaces, whichever applies.

d. For pipe skewed in the vertical direction the project piping analyst should be consulted for necessary load cases.]

5.0 EXHIBITS

None.

Job No. 83102
Doc. No. DC-2
Rev. 1

INDEPENDENT DESIGN REVIEW

PIPE SUPPORT DESIGN REVIEW CRITERIA

FOR

PERRY NUCLEAR POWER PLANT - UNIT 1

CLEVELAND ELECTRIC ILLUMINATING COMPANY

Prepared by Wong Chun Kau 1-16-84
C. Wong Date

Independent Review by RAVI BALIGA 1-17-84
R. Baliga Date

Approved by J. Minichiello 1-17-84
J. Minichiello Date

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January, 1984

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TABLE OF CONTENTS

1.0 INTRODUCTION

This design criteria document establishes the general guidelines for the independent design reivew of pipe support components, hangers, restraints and shock suppressors for the Perry Nuclear Power Plant. The scope of work is identified in the next section.

The purpose of this review is to ensure that the pipe supports are capable of supporting the piping system safely during all conditions of operation by transmitting the loads from the pipe to supporting structural elements in the building.

2.0 SCOPE

The pipe supports associated with the piping systems to be performed in this review are as follows:

- Nuclear Class 1 High Pressure Core Spray System Piping (HPCS) from the drywell wall penetration anchor to the RPV nozzle.
- Nuclear Class 3 Main Steam Safety Relief Valve (MSRV) FO47H discharge piping from anchor HO61R-0 to the anchored quencher located in the suppression pool.
- Nuclear Class 1 Main Steam Drain piping (MSD) from the taps located at the inlet ends of inboard main steam isolation valves to the containment penetration anchor.

In this design review, the pipe support structural elements up to the support attachment/connection point (e.g., anchor bolts, base plate, etc.) are considered to be within Cygna's scope of work, whereas structural supporting member, steel liner plate, embedded plate, concrete wall/member, etc. are considered to be out of Cygna's scope of work.

3.0 CODES, STANDARDS AND REFERENCE DOCUMENTS

The following codes, standards and reference documents shall be used for the design review of pipe supports.

3.1 Codes and General Reference

3.1.1 ASME Boiler and Pressure Vessel Code, Section III, Subsection NF, 1974 Edition, including addenda through winter of 1975.

3.1.2 ANSI B31.1, Power Piping Code, 1973 Edition, including 1973 addenda.

3.1.3 American Institute of Steel Construction, Inc., AISC Steel Construction Manual, 7th Edition.

3.1.4 American Welding Society, Structural Welding Code, AWS D1.1, 1979.

3.1.5 GE Document 22A5454, Rev.1, Design Specification - Main Steam Piping Design.

3.1.6 GE Document 22A6547, Rev. 0, Design Specification - Emergency Core Cooling System Piping Systems.

3.1.7 Kwik-Bolt Testing Summary Report - File No. H2189-S1, Report No. 8783R by ABBOT A. HANKS, INC. Testing Laboratories.

3.1.8 Perry Nuclear Power Plant - Unit 1, Final Safety Analysis Report, Amendment 12.

3.2 Specifications

Applicable criteria contained in the following Gilbert Associate design specifications have been reviewed and approved by Cygna. Specific input values, such as temperature, jet impingement loads, etc, will be verified during the course of the design review.

3.2.1 Design Specification, Gilbert Associates, Inc. Nuclear Boiler System Piping and Pipe Supports ASME III, Division 1.

Document No. DSP-B21-1-4549-00, Revision 1, April 30, 1982.

3.2.2 Design Specification, Gilbert Associates, Inc. High Pressure Core Spray System Piping and Pipe Supports ASME III, Division 1.

Document No. DSP-E22-1-4549-00, Revision 1 March 26, 1982.

Note: The referenced revision of design documents are the baseline documents. Later revisions may be used, as applicable, to verify the adequacy of evolving designs.

4.0 DESIGN

4.1 Physical Requirements

4.1.1 Stiffness

The estimated stiffness of a pipe support in the pipe's restrained direction shall meet the typical stiffnesses shown in Exhibit 4.1-1 according to the nominal size of restrained pipe, unless actual computed stiffness is used. The stiffness calculation shall consider the combined effects of the support frame and mechanical components (except springs). The flexibility of the building structure shall not be included in the stiffness calculation.

Alternatively, the following stiffness criteria developed by Gilbert Associates, Inc. (GAI)* may also be employed:

Class 1 system rigid supports, which have not yet been designed, shall meet the following stiffness requirements:

PIPE SIZE	MINIMUM SUPPORT STIFFNESS
< 2" NPS	> 100,000 LB/IN
3" to 4" NPS	> 500,000 LB/IN
> 4" to 12" NPS	> 1,000,000 LB/IN
> 12" NPS	> 10,000,000 LB/IN

* NOTE: The above stiffness values are taken from GAI Project Pipe Support Design Instruction Manual, Rev. 12-14-82, for Perry Nuclear Power Plant. These values have been reviewed and accepted by Cygna.

4.1.2 Gaps

A gap shall be provided to accommodate radial expansion and construction tolerances. The maximum total gap allowed in the restrained direction is 1/8". In non-restrained directions, the support design shall allow clearance for the most severe thermal plus dynamic movements of the pipe. Proper installation tolerances shall be provided where thermal movement cannot be accommodated within the specified gap minus 1/16".

4.1.3 Spring Supports

Spring supports shall be capable of exerting a supporting force equal to the load, as determined by weight-balance calculations, plus the weight of all hanger parts, such as clamps and rods, that will be supported by the spring. The design shall be such as to prevent complete release of the component load in the event of spring failure or misalignment. Any variability of a supporting spring force resulting from movement of the component shall be considered in the loadings used in the stress analysis of the component. The spring's available travel shall be checked against all the thermal and dynamic movements. Spring support shall also be designed for a maximum variation in supporting effort of 25 percent due to the total travel resulting from thermal movement of the pipe.

4.1.4 Hanger Rods

Hanger rods shall be subjected to tensile loading only unless specific gapping instructions are indicated on the drawings. Rod hanger assemblies shall be designed to allow anticipated thermal horizontal movement without subjecting the pipe to extraneous loads. The maximum swing angle due to horizontal pipe movement shall be less than 4° and/or the total movement shall be less than two inches. If the above conditions are not met, then the hanger shall be offset two-thirds of the thermal movement towards the direction of movement. Hanger rod for piping more than 2-1/2 inches should not be less than 1/2 inch diameter.

4.1.5 Snubbers

The snubber assembly shall be offset two-thirds of the thermal movement in the cold position if the swing angle exceeds 5° and/or the total movement of the point of attachment on the pipe is in excess of two inches. The midpoint of thermal travel for snubber strokes shall be set at the midpoint of the total travel with hot and cold settings established accordingly. The maximum travel range of the snubber must be checked under maximum thermal movements.

4.1.6 Sway Struts

Sway Struts are used to restrain movement of piping in one direction while providing for thermal movement in the unrestrained direction. Functionally, the rigid sway struts are similar to snubbers except that the sway strut does not allow free thermal movement in the restrained direction. In other words, the sway strut takes up static and dynamic loading. The maximum swing angle due to misalignment or thermal movement should be less than 5°.

4.1.7 Base Plates and Anchor Bolts

Base plate stiffness and prying effect shall be considered in the design review of the pipe supports. The Teledyne method, a finite element analysis, or any rational analysis may be used to check the adequacy of the base plate and anchor bolts.

4.1.8 Structural details shall conform to the requirements of the AISC Manual of Steel Construction.

4.1.9 All seismic supports shall be plus and minus restraints. Regardless of other imposed loads, the pipe must be physically restrained in each direction along the restraining axis.

4.2 Loads

The loadings that shall be taken into account in the design load combinations include, but are not limited to, the following:

- Deadweight loads (DW)
- Thermal Loads (TE)
- Earthquake Loads (OBE_I) - Operating Basis Earthquake, Inertial

	(OBE_D)	- Operating Basis Earthquake, Displacement
	(SSE_I)	- Safe Shutdown Earthquake, Inertial
	(SSE_D)	- Safe Shutdown Earthquake, Displacement

- Jet Loadings (JI)
- Annulus Pressurization loads (AP)
- Pool Swell Loads (PS) - Pool swell loads include inertial (PS_I), displacements (PS_D), drag (PS_{Drag}) and impact (PS_{Impact})
- Safety/Relief Valve Loads (RVO) - Acoustic Wave Loads
- Safety/Relief Valve Loads (SRV) - Include inertial (SRV_I) displacement (SRV_D) and drag (SRV_{DRAG}).
  SRV^{SV} - Single valve.
  SRV^{ALL} - All valves.
  SRV^{ADS} - Automatic Depressurization System.

- Chugging Loads (CHUG) - Includes inertial ($CHUG_I$) and displacement loads ($CHUG_D$).

- Condensation Oscillation Loads (CO) - Includes inertial (CO_I) and displacement (CO_D)

- Weir Swell Loads (Weir) - Weir swell causes impact ($Weir_{Impact}$), drag ($Weir_{Drag}$) and inertial loads ($Weir_I$) on piping and components.

- Friction Loads (FL)

For more detailed definition of these loads, refer to references 3.1.5 and 3.1.6 in Section 3.1 of this criteria.

4.3 Load Combinations

The following load combinations shall be used in the design review of Class 1, 2 and 3 pipe supports.

LOAD COMBINATION	ASME CODE SERVICE LIMITS		LOAD COMBINATION
Design:	1	A	$DW + OBE_I$
Normal:	2	A	$DW + TE$
Upset:	3	B	$DW + TE + [\ (OBE_I + OBE_D)^2 + (RVO)^2\ ]^{1/2}$
	4	B	$DW + TE + [\ (OBE_I + OBE_D)^2 + (SRV_I^{ALL} + SRV_D^{ALL})^2\ ]^{1/2} + SRV_{DRAG}$
	5	B	$DW + TE + [\ (OBE_I + OBE_D)^2 + (SRV_I^{SV} + SRV_D^{SV})^2\ ]^{1/2} + SRV_{DRAG}$
Emergency:	6	C	$DW + TE + \begin{bmatrix} (CHUG_I + CHUG_D)^2 + (RVO)^2 \\ \text{or} \\ (CO_I + CO_D)^2 \end{bmatrix}^{1/2}$
	7	C	$DW + TE + \begin{bmatrix} (CHUG_I + CHUG_D)^2 + (SRV_I^{ADS} + SRV_D^{ADS})^2 \\ \text{or} \\ (CO_I + CO_D)^2 \end{bmatrix}^{1/2} + \begin{bmatrix} SRV_{DRAG} \\ JI \end{bmatrix}$
	8	C	$DW + TE + \begin{bmatrix} (CHUG_I + CHUG_D)^2 + (SRV_I^{SV/ALL} + SRV_D^{SV/ALL})^2 \\ \text{or} \\ (CO_I + CO_D)^2 \end{bmatrix}^{1/2} + \begin{bmatrix} SRV_{DRAG} \\ JI \end{bmatrix}$

LOAD COMBINATION	ASME CODE SERVICE LIMITS	LOAD COMBINATION
Faulted: 9	D	$DW + TE + \left[\begin{matrix}(SSE_I + SSE_D)^2 \\ \text{or} \\ (OBE_I + OBE_D)^2\end{matrix} + (SRV_I^{ADS} + SRV_D^{ADS})^2 + \begin{matrix}(CHUG_I + CHUG_D)^2 \\ \text{or} \\ (CO_I + CO_D)^2\end{matrix} \right]^{1/2} + \begin{bmatrix} SRV_{DRAG} \\ JI \end{bmatrix}$
10	D	$DW + TE + \left[\begin{matrix}(SSE_I + SSE_D)^2 \\ \text{or} \\ (OBE_I + OBE_D)^2\end{matrix} + (SRV_I^{SV/ALL} + SRV_D^{SV/ALL})^2 \right]^{1/2} + \begin{bmatrix} SRV_{DRAG} \\ JI \end{bmatrix}$
11	D	$DW + TE + \left[\begin{matrix}(SSE_I + SSE_D)^2 \\ \text{or} \\ (OBE_I + OBE_D)^2\end{matrix} + (RVO)^2 + (CHUG_I + CHUG_D)^2 \right]^{1/2} + [JI]$
12	D	$DW + TE + [\, (SSE_I + SSE_D)^2 + (PS_I + PS_D)^2 \,]^{1/2} + \begin{bmatrix} JI \\ PS_{DRAG} \\ PS_{IMPACT} \end{bmatrix}$

LOAD COMBINATION	ASME CODE SERVICE LIMITS	LOAD COMBINATION
13	D	$DW + TE + [(SSE_I + SSE_D)^2 + (AP_I + AP_D)^2]^{1/2}$
14	D	$DW + TE + [(SSE_I + SSE_D)^2 + (SRV_I + SRV_D)^2 + (WEIR_I)^2]^{1/2} + SRV_{DRAG} + \begin{bmatrix} WEIR_{IMPACT} \\ WEIR_{DRAG} \end{bmatrix}$

NOTES:

- Any other sustained loads and/or occasional loads, if not included above, shall be added to the load combinations as applicable.
- The effect due to Turbine Stop Valve Closure (TSVC) on the main steam drain line pipe supports for the Upset condition shall be included unless it can be shown to be negligible.

- TE and Displacement loads may be excluded for the Emergency and Faulted conditions as per ASME Section III NF.

- $JI_{DYNAMIC}$, PS_{IMPACT} and $WEIR_{IMPACT}$ can be combined with inertia loadings by SRSS.

- For the Faulted condition and Pipe Rupture condition, if code service limit C is used for the piping, the linear support and standard component support shall be designed to level C limits (Emergency Limits).

Frictional load, where applicable, shall also be included. A minimum coefficient of friction of 0.3 shall be used for steel on steel. Its magnitude shall be the friction coefficient times the algebraic sum of the pipe deadload and the normal thermal load, but shall not be less than the pipe deadload times the coefficient of friction.

4.4 Allowable Stresses

Pipe supports shall satisfy the ASME code stress limits as defined in Exhibit 4.4-1. For details of load combinations, refer to section 4.3 of this criteria.

The allowable stresses shall take into account the effect of ambient design temperature.

For the Faulted load conditions in Exhibit 4.4.-1 if code service limit C is used for the pipe, the linear support and standard component support shall be designed to level C limits (Emergency Limits).

4.5 Anchor Bolt Design

4.5.1 Applications

4.5.1.1 When embeded plates or cast-in-place inserts are not available or not feasible for support attachment, expansion anchor bolts may be used for attachment connections. For this criteria, Hilti Kwik-Bolt is assumed to be used and the following requirements shall be met.

4.5.1.2 Anchors must be at least 1/2" diameter when used for structural connections or for anchorage of pipes greater than 2" diameter.

4.5.1.3 Embedded length of anchor shall be exclusive of thickness of grout pad or other overlay.

4.5.1.4 Minimum anchor spacing shall be ten (10) bolt diameters.

4.5.1.5 Minimum spacing to a free edge of concrete shall be five (5) bolt diameters for tension and 17.5 bolt diameters for shear loads directed to the free edge.

4.5.1.6 Minimum anchor embedment shall be four and one half (4 1/2) bolt diameters.

If the above requirements are not met, the support attachment shall be evaluated on a case-by-case basis to determine the resulting design impact.

4.5.2 Allowable Loads

4.5.2.1 Allowable loads for concrete expansion anchors shall be equal to the average ultimate loads shown in Exhibit 4.5-1 with a minimum factor of safety of four (4) applied for the appropriate concrete strength. Effect of prying force shall be included.

4.5.2.2 For concrete strength between those shown in Exhibit 4.5-1, straight line interpolation may be used to obtain the allowable load.

4.5.2.3 If the center-to-center spacing of anchors is less than ten diameters or the distance from the edge of concrete to the center of anchor is less than five diameters, linear interpolation may be used to reduce the allowable load, but in no case a reduction of more than 50% is allowed.

4.5.2.4 For anchors subjected to pullout and shear forces simultaneously, the straight line interaction equation based on pure shear and pure tension must be satisfied.

$$\frac{P_D}{P_A} + \frac{S_D}{S_A} \leq 1.0$$

Where:

P_D = Design pullout load
S_D = Design shear load
P_A = Allowable pullout load
S_A = Allowable shear load

5.0 AS-BUILT REVIEW AND VERIFICATION

The final as-built dimensions and configurations of the pipe support shall conform to the final design dimensions and configurations within allowable tolerances. If the as-built support has significant deviations from the final design, the as-built support shall be reviewed in detail and/or re-analyzed to ensure its adequacy and acceptability.

6.0 EXHIBITS

Exhibit 4.1-1	Minimum Pipe Support Stiffness
Exhibit 4.4-1	Stress Limits - Pipe Support Design Review
Exhibit 4.5-1	Kwik-Bolt, Average Ultimate Tensile and Shear Loads

EXHIBIT 4.1-1

MINIMUM PIPE SUPPORT STIFFNESS

1) Rigid Restraints

Nominal Pipe Size (in.)	Translational Stiffness Kt (lb./in.)	Rotational Stiffness Kr (in.-lb./rad.)
Under 6	2×10^5	1×10^7
6 to 14	1×10^6	1×10^8
Over 14	5×10^6	1×10^9

2) Mechanical Shock Arrestor

Nominal Pipe Size (in.)	Rated Load (lbs.)	Stiffness K (lbs./in.)
Under 2	1,000	1×10^5
2 to 6	3,000	2×10^5
8, 10, 12	10,000	3×10^5
Over 12	35,000	1.35×10^6

NOTE: The stiffnesses shown here are obtained from Cygna's Pipe Support Design Review Criteria, Job. No. 83090, DC-2, Rev. 0, Exhibit 4.1-1

EXHIBIT 4.4-1

PIPE SUPPORT DESIGN REVIEW

STRESS LIMITS

Load Condition	ASME Code Service Limit	Plate & Shell Supports	Linear Supports
Normal	A	ASME III, subsection NF (NF-3220/NF-3320 as applicable)	ASME III, subsection NF and NA Appendix XVII-2000
Upset	B		
Emergency	C	ASME III, subsection NF (NF-3321)	ASME III, subsection NF and NA (1.33 x normal allowables)
Faulted	D	ASME III, subsection NF (NF-3321) and Appendix F	ASME III, subsection NF and F-1370 of Appendix F

Note: For standard component, the catalog values of the catalog item shall be used for the normal and upset conditions. 1.33 x catalog value shall be used for the emergency condition and 1.5 x catalog value shall be used for faulted condition.

EXHIBIT 4.5-1

KWIK-BOLT
AVERAGE ULTIMATE TENSILE & SHEAR LOADS*

CONCRETE STRENGTH		2000 PSI		4000 PSI		6000 PSI	
Diameter	Embedment	Tension	Shear	Tension	Shear	Tension	Shear
1/4"	1 1/8"	975	1653	1455	2612	1755	2389
	1-1/2"	1875	1653	2225	2612	2935	2389
	1-3/4"	2275	1653	2700	2612	3300	2389
	2"	2525	1653	3125	2612	3350	2389
	2-1/4"	2680	1653	3310	2612	3350	2389
	2-1/2"	2800	1653	3350	2612	3350	2389
3/8"	1- 5/8"	2245	3748	2355	5107	2810	6266
	2"	2725	3748	3025	5107	3650	6266
	2-1/2"	3075	3748	3900	5107	4450	6266
	3"	3300	3792	4300	5419	5000	6266
	3-1/2"	3425	3792	4600	5419	5275	6266
	4"	3520	3792	4750	5419	5375	6266
	4-1/2"	3580	3792	4800	5419	5400	6266
1/2"	2-1/4"	4545	7444	5510	8316	6845	9341
	2 3/4"	5800	7444	7200	8316	9800	9341
	3-1/2"	7000	7444	9450	8316	13200	9341
	4-1/2"	7275	8897	11225	10232	14550	11522
	5-1/2"	8250	8897	12050	10232	15150	11522
	6"	9000	8897	12300	10232	15300	11522

EXHIBIT 4.5-1
(Continued)

KWIK-BOLT
AVERAGE ULTIMATE TENSILE & SHEAR LOADS*

CONCRETE STRENGTH		2000 PSI		4000 PSI		6000 PSI	
Diameter	Embedment	Tension	Shear	Tension	Shear	Tension	Shear
5/8"	2-3/4"	5410	11198	6600	11562	7700	13500
	3-1/2"	6250	11198	9100	11562	9560	13500
	4-1/2"	7000	11198	12000	11562	14500	13500
	5-1/2"	7550	13378	14300	15437	20300	15437
	6-1/2"	8025	13378	16000	15437	21000	15437
	7-1/2"	9000	13378	17000	15437	21000	15437
3/4"	3-1/4"	8155	13257	10150	17133	10860	18102
	4"	9700	13257	13400	17133	13700	18102
	5"	11700	13257	16500	17133	17600	18102
	6"	13800	15195	18000	18466	22500	21009
	7"	15800	15195	21000	18466	23600	21009
	8"	16000	15195	23000	18466	23600	21009
	9"	16000	15195	23500	18466	23600	21009
1"	4-1/2"	14000	27355	16000	26879	20500	32112
	5"	15500	27355	18900	26879	23441	32112
	6"	17600	27355	23441	26879	23441	32112
	7"	18200	27355	23441	26879	23441	32112
	8"	18200	27355	23441	34491	23441	36394
	9"	18200	27355	23441	34491	23441	36394
	10"	18200	27355	23441	34491	23441	36394

EXHIBIT 4.5-1
(Continued)

KWIK-BOLT
AVERAGE ULTIMATE TENSILE & SHEAR LOADS*

CONCRETE STRENGTH		2000 PSI		4000 PSI		6000 PSI	
Diameter	Embedment	Tension	Shear	Tension	Shear	Tension	Shear
1-1/4"	5-1/2"	19000	36750	23000	35680	31200	45195
	6-1/2"	21600	36750	27100	35680	36500	45195
	7-1/2"	23600	36750	31100	35680	42000	45195
	8-1/2"	25100	39843	34600	35680	44400	47098
	9-1/2"	26200	39843	37800	35680	44400	47098
	10-1/2"	26800	39843	40900	35680	44400	49596

NOTES:

Actual Concrete Strengths

2178 psi 4027 psi 6119 psi

*Tension values obtained from best fit curve through mean values of test data. Curves and test data contained in A.A. Hanks Report No. 8784 (HILTI No. TR-111A).

Shear values are minimum mean values at each embedment based on failure across threaded section of the anchor.

The maximum working loads should not exceed 1/4 of the average ultimate values listed. Actual factor of safety to be used depends on the application.

Also see reference No. 10 in section 3.0 of this criteria.

All loads are in lbs.

Job No. 83102
Doc. No. DC-3
Rev. 1

MECHANICAL DESIGN REVIEW CRITERIA

FOR

PERRY NUCLEAR POWER PLANT - UNIT 1

CLEVELAND ELECTRIC ILLUMINATING COMPANY

Prepared by R. W. Hess 9/30/83
R. Hess Date

Independent Review by D. Gardner 9/30/83
D. Gardner Date

Approved by Larry Kammerzell 9/30/83
L. L. Kammerzell Date

Cygna Energy Services
150 North Wacker Drive, Suite 2450
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September, 1983

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TABLE OF CONTENTS

1.0 INTRODUCTION

The purpose of this document is to provide the criteria to be used for the review of the mechanical system design of Perry Unit 1. Section 3.0 lists the references which form the basis for this criteria document.

2.0 SCOPE

The mechanical systems included in the review are the following portions of the High Pressure Core Spray System (HPCS), Safety/Relief Subsystem (SRS), and Main Steam Line Drain Subsystem (MSDS).

- HPCS flowpaths from the condensate storage tank and suppression pool to the reactor vessel, condensate tank and suppression pool.

- SRS flowpath from one safety/relief valve (SRV) discharge to the quencher in the supression pool.

- MSDS flowpath from one main steam isolation valve inside containment to the parallel restricting orifice and drain valve outside containment.

3.0 CODES, STANDARDS AND REFERENCES

3.1 NRC Regulatory Guides

a. 1.1 Net Positive Suction Head for Emergency Core Cooling and Containment Heat Removal System pumps. 11/70

b. 1.141 Containment Isolation Provisions for Fluid Systems. 4/79

3.2 10CFR50 Appendix A - General Design Criteria for Nuclear Power Plants - Aug. 1980

a. Criterion 35 - Emergency Core Cooling

b. Criterion 36 - Inspection of Emergency Core Cooling System.

c. Criterion 37 - Testing of Emergency Core Cooling System

d. Criterion 54 - Systems Penetrating Containment

e. Criterion 55 - Reactor Coolant Pressure Boundary Penetrating Containment

f. Criterion 57 - Closed System Isolation Valves

3.3 NUREG 0800 Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants

a. S.R.P. No. 6.3, Rev. 1 - July 1981 Emergency Core Cooling System

b. S.R.P. No. 9.2.6, Rev. 2 - July 1981 Condensate Storage Facilities

3.4 General Electric Data

a. 769E305CA, Rev. 1 Nuclear Boiler System P&ID

b. 105D5575, Rev. 0 Nuclear Boiler Process Diagram

c. 131C7911C, Rev 5 Nuclear Boiler Process Data Sheet

d. 22A4622, Rev. 5 Nuclear Boiler System Design Specification

e. 22A4622AR, Rev. 2 Nuclear Boiler System Design Specification Data Sheet

f. 795E873, Rev. 1 HPCS System P&ID

g. 762E455, Rev. 6 HPCS Process Diagram

h. 22A3131, Rev. 5 HPCS System Design Specification

i. 22A3131AS, Rev. 2 HPCS System Design Specification Data Sheet

j. 283X219CA, Rev. 26 Nuclear Boiler Parts List

k. 283X237CA, Rev. 15 HPCS Parts List

<u>3.5</u> <u>Mechanical Codes and Industrial Standards</u>

a. Standards of the Hydraulic Institute.

<u>3.6</u> <u>Final Safety Analysis Report and Amendments #1 thru #12</u>

a. Section 3.2 - Classification of Structures, Components and Systems

b. Section 5.2.2 - Overpressure Protection

c. Section 5.4.13 - Safety and Relief Valves

d. Section 6.3 - Emergency Core Cooling Systems

3.7 Safety Evaluation Report

a. Section 3 - Design Criteria for Structures, Systems and Components

b. Section 5.3.2 - Pressure Temperature Limits

c. Section 6.3 - Emergency Core Cooling System

3.8 Supplementary Safety Evaluation Report #1 thru #3

a. Section 3 - Design Criteria for Structures, Systems and Components

b. Section 6 - Engineered Safety Features

4.0 DESIGN

4.1 High Pressure Core Spray System

4.1.1 Equipment arrangement shall be in accordance with G.E. and N.R.C. requirements listed in Section 3.0, e.g.:

- HPCS pump C001 suction below minimum water level in condensate tank and suppression pool.

- Location of check valve F005 as close as possible to RV nozzle.

- Location of injection valve F004 as closed as possible to containment penetration.

- Suppression pool suction valve F015 located as close to containment as practical.

- One automatic isolation valve inside and one automatic isolation valve outside containment. A simple check valve may not be used as the automatic isolation valve outside containment.

4.1.2 ECCS water source and volume shall be in accordance with N.R.C. and G.E. requirements given in specification 22A3131 and data sheet 22A3131A5, e.g.:

- 150,000 gallon capacity of condensate storage tank dedicated to HPCS.

- HPCS dedicated supply protected from seismic, tornado and flood.

- Suction capability from suppression pool.

4.1.3 The system design shall provide for functional test and inspection requirements of the N.R.C., as stated in criterion 36 and 37 of 10CFR50 Appendix A, e.g.:

- Operability and performance of the active system components

- System operability during normal plant operation and shutdown.

- Inspectability of piping and components on a periodic basis.

4.1.4 The system piping arrangement and flow calculations shall be such as to insure that HPCS pump NPSH requirement is achieved for all operating modes, as required by R.G. 1.1 and G.E. process diagram 762E455, e.g.:

- Adequate NPSH available with 212°F water and 14.7 psia containment pressure.

- Adequate NPSH available from suppression pool with suction strainer 50% plugged.

4.1.5 HPCS fill pump performance shall comply with G.E. requirements for insuring that the system discharge line is maintained full of water, e.g.:

- Pump designed for continuous operation.

- Pump bypass piping designed to dissipate pump heat.

4.1.6 System flow and pressure drop calculations shall meet G.E. and N.R.C. requirements for all modes of operation given in process diagram 762E455 and data sheet 22A3131AS, e.g.:

- 517 GPM to the reactor vessel (R.V.) with an R.V. pressure 1177 psi above source suction pressure.

- 1550 GPM to the reactor vessel with the R.V. pressure 1147 psi above source suction pressure.

- 6110 GPM to the reactor vessel with the R.V. pressure 200 psi above source suction pressure.

4.1.7 Valve sizing and type shall be in accordance with GE and system functional requirements and criterion 37, 54 and 55 of 10CFR50 Appendix A, e.g.:

- Testable check valves.

- Motor operated isolation valves.

- Valves sized in accordance with system flow requirements.

4.1.8 System orifices and relief valves shall be correctly sized to meet G.E. requirements in specification 22A3131 and process diagram 762E455, e.g.:

- Limit flow to R.V. and condensate tank at pump runout.

- Thermal relief protection of piping.

- Protection of low pressure portion of piping from high pressure.

4.1.9 Suppression pool suction line strainer shall meet G.E. flow and particle size requirements of specification data sheet 22A3131AS, e.g.:

- Designed to prevent passage of particles larger than 0.094 inch.
- Shall not become more than 50% plugged after 100 days of post LOCA operation.

4.2 Main Steam Line Drain Subsystem

4.2.1 Piping Arrangement shall comply with G.E. functional requirements given in specification 22A4622 and data sheet 22A4622AR, e.g.:

- Inside containment MSIV drains headered to a common drain line.
- Automatic isolation valve located inside and outside containment.
- Low flow and high flow drain paths provided.

4.2.2 Restricting orifice D001 sizing shall meet G.E. requirements given in data sheet 22A4622AR and 131C7911C, e.g.:

- Pressure drop greater than 600 psi with flow of $2x10^3$ lb/hr of saturated steam at 1000 psia.

4.2.3 Valve sizing and type shall be in accordance with G.E. and system functional requirements and criterion 54 and 55 of 10CFR50 Appendix A, e.g.:

- Flow throttling capability.

- Motor operated isolation valves.

4.2.4 System pipe sizing shall meet the requirements of the system flow and pressure drop criteria for all modes of operation as given in data sheet 22A4622AR and process diagrams 105D5575 and 131C6911C, e.g.:

- Drain rate for maintenance shall be 50 G.P.M.

- Low power operation flow rate shall be $2x10^3$ lb/hr of saturated steam at 1000 psia.

4.3 Main Steam Safety Relief System

4.3.1 Piping arrangement shall comply with G.E. functional requirements as listed in Section 3.0, e.g.:

- Two vacuum breakers on discharge line located in drywell adjacent to pipe anchor.

- SRV body drains piped to SRV discharge line.

- SRV bonnett vent piped to suppression pool.

4.3.2 Vacuum breaker sizing and arrangement shall meet G.E. functional requirements given in specification 22A4622 and data sheet 22A4622AR, e.g.:

- Vacumm breaker $A/\sqrt{k}$ ratio is equal to or greater than $0.30 Ft^2$
- Opening time of 0.2 second or less.
- Opening ΔP of 0.2 psid and full open ΔP of 0.5 psid.

4.3.3 System pipe sizing shall meet the requirements of the system flow and pressure drop criteria for all modes of operation as given in data sheet 22A4622Ar and process diagram 105D5575 and 131C7911C, e.g.:

- SRV discharge flowrate of $1x10^6$ lb/hr saturated steam at 550 psia.

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Independent Design Review Checklist

PIPE STRESS

SRV

Reviewer L.J. Weingart / Vuong Phi

Checklist No. PI-01

Date 12/1/83

Item	Satisfactory Yes	Satisfactory No	Comments
1. System Boundaries a. Check that all required branch lines are included. b. Check that, if system starts at a branch attachment point, that attachment point is justified as an anchor. - Refer to P&IDs and Criteria for Decoupling, 83102-DC-1 Sect. 4.3.3.	X X		
2. Piping Classification - Check for consistency with P&IDs (GAI Dwg. Nos. D-320-605 and D-320-701) for nuclear classification and GAI Dwg. Nos. D-304-025 (MSRV), D-304-501 (MSD) and D-304-703 (HPCS) for seismic classification.	X		
3. Design & Maximum Pressure - Check for consistency with GAI Project Design Specifications DSP-E22-1-4549-00 (HPCS) and DSP-B21-1-4549-00 (MSRV and MSD).	X		
4. Thermal Loading a. Maximum Temperature - Check for consistency with GAI Project Design Specifications DSP-E22-1-4549-00 (HPCS) and DSP-B21-1-4549-00 (MSRV and MSD).		X	@ P = 550 psig, T_{SAT} = 480°F (per GAI Specification B21, Table 1.) maximum temperature input = 450°F. No significant impact.

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Independent Design Review Checklist

PIPE STRESS

SRV

Reviewer: [handwritten signature] / Vuong Phi

Checklist No. PI-01

Date 12/1/83

Item	Satisfactory Yes	Satisfactory No	Comments
b. Operational Modes - Refer to GAI Project Design Specifications DSP-E22-1-4549-00 (HPCS) and DSP-B21-1-4549-00 (MSRV and MSD) P&IDS and GE Document Nos. as specified in 83102-DC-1, Section 4.6.2.		X	No documentation to support the thermal modes and temperature distribution used. Thermal mode TH4 used a piping temperature of 195°F. The correct temperature is 250°F. (Apparently, the wrong section from Table 6 of GAI Spec. B21 was used.) See Observation PI-00-03(a).
c. Equipment Nozzle Movements - Refer to equipment drawings and check any hand calculations.			N/A
d. Branch Attachment Point Movements (if applicable) - Refer to thermal calculation computer output for run pipe.			N/A
5. ARS Dynamic Loading			
a. OBE Spectra	X		
b. DBE Spectra	X		
c. RV1 Spectra	X		
d. PS Spectra	X		
e. CO Spectra	X		
f. AP Spectra	X		

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Independent Design Review Checklist

PIPE STRESS

SRV

Reviewer R J Weingart

Checklist No. PI-01

Date 12/1/83

Item	Satisfactory Yes	Satisfactory No	Comments
g. CHUG Spectra - Check that the spectra at appropriate damping values for all pertinent buildings at the proper elevations have been included in the enveloped spectra and that the proper interpolation technique has been used (i.e., computer technique matches spectra curves).	X		
6. Time History Dynamic Loading (SRV Discharge Piping) - Check that the appropriate time history loads have been applied at the proper locations (i.e., at each change in direction).	X		• The original RELAP5 runs did not treat reducing components properly (not specifically documented). • System G03 was rerun and the results showed no significant difference in loads (documented). • The wrong load table was applied on the last leg (i.e., thrust load instead of transient load). This is conservative.

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Independent Design Review Checklist

PIPE STRESS

SRV

Reviewer Vuong Phi / K. K. Wong

Checklist No. PI-01

Date 12-1-83

Item	Satisfactory Yes	Satisfactory No	Comments
7. Seismic and Hydrodynamic Anchor Movements - Check movements to assure that proper buildings have been considered. Refer to GAI Document No. PY-STR-1121. If piping passes between buildings or is connected to different structures, check movements for proper phase.		X	• Differential movements between drywell and foundation mat should be included. However, impact is small. • Piping and support is at El. 629'; however, SAM is calculated at El. 618' 6". Impact is small. • SAM was input at X direction should be Z direction. See Observation PI-01-02.
8. Jet Impingement Loading - Check that loads are properly computed and input to the piping analysis. Check that proper directions are considered. Refer to GAI Drawing List PY-DIDR-030 and GAI Specifications DSP-B21-1-4549-00, Rev. 1, and DSP-E22-1-4549-00, Rev. 1.		X	See Observation PI-00-04 Case 6.a in Table 7 of specification. The input is conservative, since only the force component perpendicular to the pipe is impinging. The component along the pipe axis will not be impinging but was included in the input.
9. Impact and Drag Loading a. Pool Swell b. Weir Swell	 X X		

Independent Design Review Checklist

PIPE STRESS

SRV

Reviewer [signature] **Checklist No.** PI-01

Date 12/1/83

Item	Satisfactory Yes	Satisfactory No	Comments
c. SRV - Check that loads are properly computed and input to the piping analysis. Refer to 83102-DC-1, Section 4.8.11.	X		
10. Section Properties a. Pipe OD b. Pipe Wall Thickness c. Insulation Thickness and Weight d. Weight of Contents - Refer to GE Design Specifications 22A5454 (MSRV and MSD) and 22A6547 (HPCS).	 X X X X		12" sch 160 spool piece not shown on P&ID or installation specifications for GI-3. This is a special note to the isometric.
11. Material Properties a. Sc b. Sh c. Ec (Thermal Analysis) d. E_h e. α (coefficient of thermal expansion) f. Poisson's ratio - Refer to GE Design Specifications 22A5454 (MSRV and MSD) and 22A6547 (HPCS), ASME B&PV, Sec. III, Appendix I and 83102-DC-1, Sec. 4.7.4.	 X X X X X X		

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Independent Design Review Checklist

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Reviewer [signature] | Checklist No. PI-01

Date 12/1/83

Item	Satisfactory Yes	Satisfactory No	Comments
12. Geometry			
a. Diagnostic Messages	X		
b. Element Data Table - Check lengths, pipe properties, material properties, code specification, bend radii and angles.		X	Elbow 17A-19 No6 GR C - specification calls for GR B throughout. The GR C specification is a special note to the isometric. 8" error at J19 to 26 (noted by GAI).
c. Node Data Table - Check for consistency with input and isometric. - Check for nodes between supports in same direction.	X		
13. Restraints			
a. Location, type, and orientation - Check for agreement with isometric.		X	• Struts @ PT. SP21 pinned about Y axis. • Orientation differences (w/no DCC's): H436 - 40° vs. 38° (minor) H112 - 21°40' vs. 17°54' (minor) H112 - 17°55' vs. 18°11' (minor H064 - 78°8' vs. 81°24' (minor) H066 - 41°45' vs. 35°34' (acceptable) H068 - 38°10' vs. 34° (acceptable) See Observation PI-00-03(c).

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Date 12/1/83

Item	Satisfactory Yes	Satisfactory No	Comments
b. Stiffness - Refer to 83102-DC-2 Exhibit 4.4-1.		X	No stiffness input - all rigid. See Observation PI-00-01. The calculation for the lumped weight at the support attachment points is not sufficiently detailed with respect to documentation of individual weight references. Most seem to be reasonable.
14. Valves a. Location - Check for agreement with isometric.	X		
b. Modeling - Refer to valve drawing and 83102-DC-1 Sect. 4.7.6.		X	See Observation PI-00-02(a)
15. Fittings a. Location and type - Refer to P&ID and isometric.	X		
b. SIF - Refer to ASME B&PV Sect. III, subsections NB-3680, NC-3670, and ND-3670 and computer input.		X	Incorrect SIF's @ Points 2, F1, and F2. See Observation PI-01-01.

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Independent Design Review Checklist

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Reviewer [signature]

Checklist No. PI-01

Date 12/1/83

Item	Satisfactory Yes	Satisfactory No	Comments
16. Weldolets a. Location - Refer to isometric. b. SIF - Refer to appropriate Bonney Forge publications.			N/A
17. Nozzle Flexibility - Refer to equipment drawings (e.g., check that nozzles on thin shells have not been input as being rigid).			N/A
18. Penetrations & Sleeves a. Modeling - Refer to penetration details. b. SIF - Check details to determine proper SIF. c. Pipe Deflections - Check that deflections do not cause interference.			N/A
19. Mass Point Spacing - Check for adequacy to 33 Hz for seismic analysis and 60 Hz for hydrodynamic analysis.	X		

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Independent Design Review Checklist

PIPE STRESS

SRV

Reviewer: (signature) / Vuong Phi

Checklist No. PI-01

Date 12/1/83

Item	Satisfactory: Yes	Satisfactory: No	Comments
20. Cut-off Frequency/No. of Modes a. Seismic - To 33 Hz b. Hydrodynamic - To 60 Hz or greater depending upon the individual response spectra	 X X		Cut-off Frequency = 150 Hz.
21. Damping a. OBE b. DBE c. RV1 d. RV2 (SRV discharge only) e. VCL f. CO g. AP h. CHUG - Refer to 83102-DC-1, Section 4.8.5.	 X X X X X X X X		
22. Modal Combination - Refer to NRC Regulatory Guide 1.92.	 X		
23. Gravity Output a. Displacements - Less than 0.1"	 X		

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Independent Design Review Checklist

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Reviewer [signature] | Checklist No. PI-01

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Item	Satisfactory Yes	Satisfactory No	Comments
b. Stresses - Satisfy code eqns.	X		
c. Loads - Downward Direction	X		
24. Thermal Output			
a. Displacements - Less than 3" or consistent with temperature, piping layout and restraint configuration	X		
b. Stresses - Satisfy code eqns.	X		
c. Loads - Consistent with temperature, piping layout and restraint configuration	X		
25. Dynamic Analysis Output			
a. Displacements - Less than 1" or consistent with spectra, mass distribution, mode shapes, piping layout and restraint configuration	X		
b. Stresses - Satisfy code eqns.	X		
c. Loads - Consistent with spectra, mass distribution, mode shapes, piping layout and restraint configuration	X		

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Independent Design Review Checklist

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Reviewer [signature] / [signature]

Checklist No. PI-01

Date 12/1/83

Item	Satisfactory Yes	Satisfactory No	Comments
d. Mass Participation - Refer to 83102-DC-1, Sect. 4.8.5(f).		X	Information for rigid response analysis is not documented. The rigid response is SRSSed with the inertia values for OBE, SSE, SRV, and PS load cases only. AP rigid response not considered. Ok due to number of modes included. CHUG/Co is negligible.
26. Anchor Movement (Seismic and Hydrodynamic) Output			
a. Displacements - Consistent with input movements, piping layout, and restraint configuration	X		
b. Stresses - Satisfy code eqns.	X		
c. Loads - Consistent with input movements, piping layout, and restraint configuration	X		
27. Jet Impingement, Impact and Drag Output			
a. Displacements - Less than 1" or consistent with input loadings, piping layout and restraint configuration	X		
b. Stress - Satisfy Code eqns.	X		

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Independent Design Review Checklist

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Reviewer: [handwritten signature] / [handwritten signature]

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Date 12/1/83

Item	Satisfactory Yes	Satisfactory No	Comments
c. Loads - Consistent with input loadings, piping layout and restraint configuration	X		
28. Load Combination - Consistent with 83102-DC-1 Sect. 4.4	X		Consistent with updated copy of PPSAI.
29. Equipment Nozzle Loads - Refer to equipment drawings	X		
30. Valve Acceleration - Refer to 83102-DC-1 Sect. 4.8.5(e) and Valve Drawings		X	Valve acceleration exceeds 3 g's for the horizontal direction. See Observation PI-00-03(b).
31. Flanges - Refer to NB-3647	X		

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Independent Design Review Checklist

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Reviewer [signatures]

Checklist No. PI-01

Date 12/1/83

Item	Satisfactory Yes	Satisfactory No	Comments
32. Welded Attachments - Check for consideration of local stresses at lugs and stanchions. - Refer to WRC Bulletins 107 and 198.	X		The welded attachments at supports H061, H163, and H221 are being analyzed separately using more refined techniques (i.e., FEM). Noted in analysis package.
33. Functional Capability - Refer to 83102-DC-1 Sect. 4.5.3.		X	Incorrect selection of the worst case for evaluation. See Observation PI-00-02(b).
ADDITIONAL ITEMS FOR CLASS 1 PIPING 1. Load Case Evaluation - Refer to pressure/temperature histogram (see GE documents referenced in 83102-DC-1, Section 4.6.2). a. All cases in the pressure/temperature histogram have been considered. b. Proper number of operational cycles for all events including hydrotest c. Proper definition of both pressure, temperature and flow for all events d. Clear definition of the time span and event time function (ramp, step, or other) for loadings			N/A

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Independent Design Review Checklist

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Reviewer [signature]

Checklist No. PI-01

Date 12/1/83

Item	Satisfactory Yes	Satisfactory No	Comments
2. Thermal Transient Evaluation a. All discontinuities, whether structural (i.e., thickness change) or material (i.e., stainless to carbon) have been evaluated for $\lvert\alpha_a \tau_a - \alpha_b \tau_b\rvert$. b. Computer analyses or hand calculations for calculating thermal gradients have been referenced and checked. c. Time steps during ramps are sufficient to ensure that the maximum gradients are determined.			N/A
3. Stress Indices Usage a. Proper B, C, and K indices have been specified for all components and incorporated into the analysis - Refer to NB-3683, applicable Bonney Forge Weldolet and Sockolet publications. b. Proper type of component welded joint (girth butt weld or longitudinal butt weld) has been specified when selecting stress indices. - Refer to GAI Dwg. No. D-301-601. c. Hand calculations of stress indices - Check for correctness and proper code or source reference. Refer to Table NB3638.2-1 and Bonney Forge publications.			N/A

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Reviewer [signature]

Checklist No. PI-01

Date 12/1/83

Item	Satisfactory Yes	Satisfactory No	Comments
4. Material Properties/Allowable Stress Usage a. E_c (cold modulus of elasticity) b. E_H (hot modulus of elasticity) c. μ (Poisson's Ratio) d. α (coefficient of thermal expansion) e. S_m (design allowable stress intensity) f. m, n (material parameters for NB-3228.3) - Refer to GAI Project Design Specifications 22A5454 (MSRV and MSD) and 22A6547 (HPCS), 83102-DC-1 Section 4.7.4, and Appendix I of the code.			N/A
5. ASME Code Class Acceptability a. Proper load cases have been formed and load cases have been combined in the proper equations. b. Type of analysis is properly described (i.e., ASME Class 1 standard or simplified elastic-plastic). c. Cumulative usage factor - Check to assure that the factor does not exceed 1.0 (0.1 for no-break regions).			N/A

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Independent Design Review Checklist

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Reviewer Vuong Phi / [signature]

Checklist No. PI-02

Date 12-1-83

Item	Satisfactory Yes	Satisfactory No	Comments
1. System Boundaries a. Check that all required branch lines are included. b. Check that, if system starts at a branch attachment point, that attachment point is justified as an anchor. - Refer to P&IDs and Criteria for Decoupling, 83102-DC-1 Sect. 4.3.3.	X X		
2. Piping Classification - Check for consistency with P&IDs (GAI Dwg. Nos. D-320-605 and D-320-701) for nuclear classification and GAI Dwg. Nos. D-304-025 (MSRV), D-304-501 (MSD) and D-304-703 (HPCS) for seismic classification.	X		
3. Design & Maximum Pressure - Check for consistency with GAI Project Design Specifications DSP-E22-1-4549-00 (HPCS) and DSP-B21-1-4549-00 (MSRV and MSD).	X		
4. Thermal Loading a. Maximum Temperature - Check for consistency with GAI Project Design Specifications DSP-E22-1-4549-00 (HPCS) and DSP-B21-1-4549-00 (MSRV and MSD).	X		

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Reviewer Vuong Phi

Checklist No. PI-02

Date 12-1-83

Item	Satisfactory Yes	Satisfactory No	Comments
b. Operational Modes - Refer to GAI Project Design Specifications DSP-E22-1-4549-00 (HPCS) and DSP-B21-1-4549-00 (MSRV and MSD) P&IDS and GE Document Nos. as specified in 83102-DC-1, Section 4.6.2.	X		
c. Equipment Nozzle Movements - Refer to equipment drawings and check any hand calculations.		X	The length of nozzle (25") should be included to calculate for TAM. ΔR should be .621 in. (instead of .520 in.) Impact from this difference is within tolerance since the piping in this area is very flexible and there is a large margin of thermal stress and RPV nozzle loads to the allowables.
d. Branch Attachment Point Movements (if applicable) - Refer to thermal calculation computer output for run pipe.			N/A
5. ARS Dynamic Loading			
a. OBE Spectra	X		
b. DBE Spectra	X		
c. RV1 Spectra	X		
d. PS Spectra	X		
e. CO Spectra	X		
f. AP Spectra	X		

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Reviewer Vuongphi / C.K. Wong

Checklist No. PI-02

Date 12-1-83

Item	Satisfactory Yes	Satisfactory No	Comments
g. CHUG Spectra - Check that the spectra at appropriate damping values for all pertinent buildings at the proper elevations have been included in the enveloped spectra and that the proper interpolation technique has been used (i.e., computer technique matches spectra curves).	X		
6. Time History Dynamic Loading (SRV Discharge Piping) - Check that the appropriate time history loads have been applied at the proper locations (i.e., at each change in direction).			N/A
7. Seismic and Hydrodynamic Anchor Movements - Check movements to assure that proper buildings have been considered. Refer to GAI Document No. PY-STR-1121. If piping passes between buildings or is connected to different structures, check movements for proper phase.	X		
8. Jet Impingement Loading - Check that loads are properly computed and input to the piping analysis. Check that proper directions are considered. Refer to GAI Drawing List PY-DIDR-030 and		X	See Observation PI-00-04. • Item 1c of Table 7 in Specification, Break LPB2LL. The total computed load is 6902.6 lbs. The

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Independent Design Review Checklist

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Reviewer C. K. Wong / J E Meyer

Checklist No. PI-02

Date 12-1-83

Item	Satisfactory Yes	Satisfactory No	Comments
GAI Specifications DSP-B21-1-4549-00, Rev. 1, and DSP-E22-1-4549-00, Rev. 1.			total load specified in the design Specification is 7488 lbs. • Item 6c of Table 7, Break L1B3CLL. M_Y at node 22 should be -3412.5 ft-lbs instead of -20,478 ft-lbs (Numerical error). This is on the conservative side. • At node 22, calculation error gave an input M_Y = -40.957 ft-lbs instead of the correct value of -6.825 ft-lbs (very conservative). (Note: static case JET6S has similar error.)
9. Impact and Drag Loading a. Pool Swell b. Weir Swell c. SRV - Check that loads are properly computed and input to the piping analysis. Refer to 83102-DC-1, Section 4.8.11.			N/A
10. Section Properties a. Pipe OD b. Pipe Wall Thickness	 X X		

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Reviewer J E Meyer

Checklist No. PI-02

Date 1-4-84

Item	Satisfactory Yes	Satisfactory No	Comments
c. Insulation Thickness and Weight	X		Insulation weight was assumed; actual weight 5% greater and should not affect calculation. Assumption was noted in project pipe stress manual but not in design input.
d. Weight of Contents - Refer to GE Design Specifications 22A5454 (MSRV and MSD) and 22A6547 (HPCS).	X		
11. Material Properties			
a. Sc	X		
b. Sh	X		
c. Ec (Thermal Analysis)	X		
d. E_h	X		
e. α (coefficient of thermal expansion)	X		
f. Poisson's ratio - Refer to GE Design Specifications 22A5454 (MSRV and MSD) and 22A6547 (HPCS), ASME B&PV, Sec. III, Appendix I and 83102-DC-1, Sec. 4.7.4.	X		

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Independent Design Review Checklist

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Reviewer [signature] / E Meyer

Checklist No. PI-02

Date 12/1/83

Item	Satisfactory Yes	Satisfactory No	Comments
12. Geometry			
a. Diagnostic Messages	X		
b. Element Data Table - Check lengths, pipe properties, material properties, code specification, bend radii and angles.	X		Minor discrepancy in location of additional node points. These locations were not needed and could have been assigned randomly with no effect.
c. Node Data Table - Check for consistency with input and isometric. - Check for nodes between supports in same direction.	X		
13. Restraints			
a. Location, type, and orientation - Check for agreement with isometric.	X		
b. Stiffness - Refer to 83102-DC-2 Exhibit 4.4-1.	X		
14. Valves			
a. Location - Check for agreement with isometric.	X		
b. Modeling - Refer to valve drawing and 83102-DC-1 Sect. 4.7.6.		X	See Observation PI-00-02(c).

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Independent Design Review Checklist

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Reviewer D J Wingart / J E Meyer

Checklist No. PI-02

Date 12/1/83

Item	Satisfactory Yes	Satisfactory No	Comments
15. Fittings a. Location and type - Refer to P&ID and isometric. b. SIF - Refer to ASME B&PV Sect. III, subsections NB-3680, NC-3670, and ND-3670 and computer input.	X (a)		b. N/A
16. Weldolets a. Location - Refer to isometric. b. SIF - Refer to appropriate Bonney Forge publications.	X (a)		b. N/A
17. Nozzle Flexibility - Refer to equipment drawings (e.g., check that nozzles on thin shells have not been input as being rigid).	X		
18. Penetrations & Sleeves a. Modeling - Refer to penetration details. b. SIF - Check details to determine proper SIF. c. Pipe Deflections - Check that deflections do not cause interference.	X (a)		a. Flued head modeled as rigid. b. N/A - Class 1. c. N/A

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Independent Design Review Checklist

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HPCS

Reviewer Vuongphi / E Meyer

Checklist No. PI-02

Date 12-1-83

Item	Satisfactory Yes	Satisfactory No	Comments
19. Mass Point Spacing - Check for adequacy to 33 Hz for seismic analysis and 60 Hz for hydrodynamic analysis.	X		Node spacing adequate to 150 Hz.
20. Cut-off Frequency/No. of Modes			
a. Seismic - To 33 Hz	X		
b. Hydrodynamic - To 60 Hz or greater depending upon the individual response spectra	X		
21. Damping			
a. OBE	X		
b. DBE	X		
c. RV1	X		
d. RV2 (SRV discharge only)	X		
e. VCL	X		
f. CO	X		
g. AP	X		
h. CHUG - Refer to 83102-DC-1, Section 4.8.5.	X		
22. Modal Combination - Refer to NRC Regulatory Guide 1.92.	X		

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Independent Design Review Checklist

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Reviewer: [signature]

Checklist No. PI-02

Date 12/1/83

Item	Satisfactory Yes	Satisfactory No	Comments
23. Gravity Output			
a. Displacements - Less than 0.1"	X		
b. Stresses - Satisfy code eqns.			N/A - Class 1
c. Loads - Downward Direction	X		
24. Thermal Output			
a. Displacements - Less than 3" or consistent with temperature, piping layout and restraint configuration	X		
b. Stresses - Satisfy code eqns.			N/A - Class 1
c. Loads - Consistent with temperature, piping layout and restraint configuration	X		
25. Dynamic Analysis Output			
a. Displacements - Less than 1" or consistent with spectra, mass distribution, mode shapes, piping layout and restraint configuration	X		
b. Stresses - Satisfy code eqns.			N/A - Class 1

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Reviewer [signature]

Checklist No. PI-02

Date 12/1/83

Item	Satisfactory Yes	Satisfactory No	Comments
c. Loads - Consistent with spectra, mass distribution, mode shapes, piping layout and restraint configuration	X		
d. Mass Participation - Refer to 83102-DC-1, Sect. 4.8.5(f).	X		
26. Anchor Movement (Seismic and Hydrodynamic) Output			
a. Displacements - Consistent with input movements, piping layout, and restraint configuration	X		
b. Stresses - Satisfy code eqns.			N/A - Class 1
c. Loads - Consistent with input movements, piping layout, and restraint configuration	X		
27. Jet Impingement, Impact and Drag Output			
a. Displacements - Less than 1" or consistent with input loadings, piping layout and restraint configuration	X		
b. Stress - Satisfy Code eqns.			N/A - Class 1
c. Loads - Consistent with input loadings, piping layout and restraint configuration	X		

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HPCS

Reviewer [handwritten signatures] Checklist No. PI-02

Date 12/1/83

Item	Satisfactory Yes	Satisfactory No	Comments
28. Load Combination - Consistent with 83102-DC-1 Sect. 4.4	X		
29. Equipment Nozzle Loads - Refer to equipment drawings	X		To be verified by GAI later (RPV nozzle).
30. Valve Acceleration - Refer to 83102-DC-1 Sect. 4.8.5(e) and Valve Drawings	X		To be verified by GAI later.
31. Flanges - Refer to NB-3647			N/A
32. Welded Attachments - Check for consideration of local stresses at lugs and stanchions. - Refer to WRC Bulletins 107 and 198.			N/A
33. Functional Capability - Refer to 83102-DC-1 Sect. 4.5.3.	X		

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Independent Design Review Checklist

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HPCS

Reviewer [signature] | Checklist No. PI-02

Date 12/1/83

Item	Satisfactory Yes	Satisfactory No	Comments
ADDITIONAL ITEMS FOR CLASS 1 PIPING			
1. Load Case Evaluation - Refer to pressure/temperature histogram (see GE documents referenced in 83102-DC-1, Section 4.6.2).			
a. All cases in the pressure/temperature histogram have been considered.	X		There are only two events during which there is flow in the HPCS and for which significant thermal transient effects would be expected. The analyst considered all events. This has little impact on the design (slightly conservative); only 8 of the 27 transient analyses were required. (Verifier comments on conservatism of certain analysis techniques but then requires a change to correct these unnecessary load cases.)
b. Proper number of operational cycles for all events including hydrotest	X		
c. Proper definition of both pressure, temperature and flow for all events		X	See Observation PI-02-01.
d. Clear definition of the time span and event time function (ramp, step, or other) for loadings	X		

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Independent Design Review Checklist

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HPCS

Reviewer [signature]

Checklist No. PI-02

Date 12/1/83

Item	Satisfactory Yes	Satisfactory No	Comments
2. Thermal Transient Evaluation			
a. All discontinuities, whether structural (i.e., thickness change) or material (i.e., stainless to carbon) have been evaluated for $\lvert\alpha_a\tau_a - \alpha_b\tau_b\rvert$.		X	There is no documentation in the report defining the section properties for: 1) Reactor nozzle, 2) Sweepolet, 3) Valves, 4) Penetration. Rockwell Drawing D82-24401-18, Rev. C (Valve F005) specifies a minimum wall of 0.87 inches (with much thicker sections at inlet ends); 0.86 inches was used. Valve F036 is much thicker (2.093 inches) and is subject to more severe transients. See Observation PI-00-03(d).
b. Computer analyses or hand calculations for calculating thermal gradients have been referenced and checked.	X		Some thermal gradients were not considered.
c. Time steps during ramps are sufficient to ensure that the maximum gradients are determined.		X	This time steps are too large for the up ramp of event 20A at nodes 24-27. Only the beginning and end points are specified. An additional point on the ramp would give further assurance that the maximum temperature differences were considered.

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Reviewer [signature]

Checklist No. PI-02

Date 12/1/83

Item	Satisfactory Yes	Satisfactory No	Comments
3. Stress Indices Usage			
a. Proper B, C, and K indices have been specified for all components and incorporated into the analysis - Refer to NB-3683, applicable Bonney Forge Weldolet and Sockolet publications.		X	Ovality for elbows was assumed to be 0. See Observation PI-00-03(e).
b. Proper type of component welded joint (girth butt weld or longitudinal butt weld) has been specified when selecting stress indices. - Refer to GAI Dwg. No. D-301-601.	X		
c. Hand calculations of stress indices - Check for correctness and proper code or source reference. Refer to Table NB3638.2-1 and Bonney Forge publications.	X		
4. Material Properties/Allowable Stress Usage			
a. E_c (cold modulus of elasticity)	X		
b. E_H (hot modulus of elasticity)	X		
c. μ (Poisson's Ratio)	X		
d. α (coefficient of thermal expansion)	X		
e. S_m (design allowable stress intensity)	X		
f. m, n (material parameters for NB-3228.3) - Refer to GAI Project Design Specifications 22A5454 (MSRV and MSD) and 22A6547 (HPCS), 83102-DC-1 Section 4.7.4, and Appendix I of the code.	X		

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Independent Design Review Checklist

PIPE STRESS

HPCS

Reviewer DJ Weingart

Checklist No. PI-02

Date 12/1/83

Item	Satisfactory Yes	Satisfactory No	Comments
5. ASME Code Class Acceptability			
a. Proper load cases have been formed and load cases have been combined in the proper equations.	X		
b. Type of analysis is properly described (i.e., ASME Class 1 standard or simplified elastic-plastic).	X		
c. Cumulative usage factor - Check to assure that the factor does not exceed 1.0 (0.1 for no-break regions).		X	Already noted in calculation and Class 1 stress report.

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Independent Design Review Checklist

PIPE STRESS

MSD

Reviewer C.K. Wong / Vuong Phi

Checklist No. PI-03

Date 12-1-83

Item	Satisfactory Yes	Satisfactory No	Comments
1. System Boundaries			
a. Check that all required branch lines are included.	X		
b. Check that, if system starts at a branch attachment point, that attachment point is justified as an anchor. - Refer to P&IDs and Criteria for Decoupling, 83102-DC-1 Sect. 4.3.3.	X		
2. Piping Classification - Check for consistency with P&IDs (GAI Dwg. Nos. D-320-605 and D-320-701) for nuclear classification and GAI Dwg. Nos. D-304-025 (MSRV), D-304-501 (MSD) and D-304-703 (HPCS) for seismic classification.	X		
3. Design & Maximum Pressure - Check for consistency with GAI Project Design Specifications DSP-E22-1-4549-00 (HPCS) and DSP-B21-1-4549-00 (MSRV and MSD).			
4. Thermal Loading			
a. Maximum Temperature - Check for consistency with GAI Project Design Specifications DSP-E22-1-4549-00 (HPCS) and DSP-B21-1-4549-00 (MSRV and MSD).	X		

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Independent Design Review Checklist

PIPE STRESS

MSD

Reviewer Vuong Phi

Checklist No. PI-03

Date 12-1-83

Item	Satisfactory Yes	Satisfactory No	Comments
b. Operational Modes - Refer to GAI Project Design Specifications DSP-E22-1-4549-00 (HPCS) and DSP-B21-1-4549-00 (MSRV and MSD) P&IDS and GE Document Nos. as specified in 83102-DC-1, Section 4.6.2.	X		
c. Equipment Nozzle Movements - Refer to equipment drawings and check any hand calculations.		X	Movements of drywell and thermal expansion of guard pipe should be considered at anchor with shield-wall (N.P. 1). See Observation PI-00-02(d).
d. Branch Attachment Point Movements (if applicable) - Refer to thermal calculation computer output for run pipe.	X		
5. ARS Dynamic Loading			• Response spectra enveloped for Zone 3 should go to elevation of structure to which the supports are attached. No significant impact. • Enveloping spectra does not include (as stated): - SSE Zone 3 DW 622 - SRV Zone 3 BS 629.52 • Tangential curves (Hydrodynamic) are not considered for enveloping and it is assumed that the radial
a. OBE Spectra		X	
b. DBE Spectra		X	
c. RV1 Spectra		X	
d. PS Spectra		X	
e. CO Spectra		X	
f. AP Spectra		X	
g. CHUG Spectra - Check that the spectra at appropriate damping values for all pertinent buildings at the proper elevations have been included in the enveloped		X	

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Independent Design Review Checklist

PIPE STRESS

MSD

Reviewer Vuong Phi

Checklist No. PI-03

Date 12-1-83

Item	Satisfactory Yes	Satisfactory No	Comments
spectra and that the proper interpolation technique has been used (i.e., computer technique matches spectra curves).			curves governs. This is not true for SRV-BS 629.52'. No significant impact.
h. Rigid Response loading	X		AP rigid response acceleration and response spectra ZPA are taken at 60 Hz. (This does not follow project procedures.) Conservative.
6. Time History Dynamic Loading (SRV Discharge Piping) - Check that the appropriate time history loads have been applied at the proper locations (i.e., at each change in direction).			N/A
7. Seismic and Hydrodynamic Anchor Movements - Check movements to assure that proper buildings have been considered. Refer to GAI Document No. PY-STR-1121. If piping passes between buildings or is connected to different structures, check movements for proper phase.		X	• The differential movements between drywell and bioshield wall should be considered for OBE, SRV, load-cases for all X, Y, Z directions. • There is no documentation to indicate that the movement of the main steam during turbine trip has been considered. See Observation PI-00-03(f).

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Independent Design Review Checklist

PIPE STRESS

MSD

Reviewer C.K. Wong / Vuong Phi

Checklist No. PI-03

Date 12-1-83

Item	Satisfactory Yes	Satisfactory No	Comments
8. Jet Impingement Loading - Check that loads are properly computed and input to the piping analysis. Check that proper directions are considered. Refer to GAI Drawing List PY-DIDR-030 and GAI Specifications DSP-B21-1-4549-00, Rev. 1, and DSP-E22-1-4549-00, Rev. 1.			N/A
9. Impact and Drag Loading a. Pool Swell b. Weir Swell c. SRV - Check that loads are properly computed and input to the piping analysis. Refer to 83102-DC-1, Section 4.8.11.			N/A
10. Section Properties			
a. Pipe OD	X		
b. Pipe Wall Thickness	X		
c. Insulation Thickness and Weight	X		Insulation weight input is less than the actual weight, but the deviation is about 6% from the total pipe weight.

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Independent Design Review Checklist

PIPE STRESS

MSD

Reviewer C.K. Wong

Checklist No. PI-03

Date 12-1-83

Item	Satisfactory Yes	Satisfactory No	Comments
d. Weight of Contents - Refer to GE Design Specifications 22A5454 (MSRV and MSD) and 22A6547 (HPCS).		X	See Observation PI-00-02(d). Tributary weight from restraints tends to be slightly less than the correct weight. OK.
11. Material Properties			
a. Sc			N/A
b. Sh			N/A
c. Ec (Thermal Analysis)	X		
d. E_h	X		E_c was used in frequency analysis. Incorrect E was used for 2" elbows (27.9×10^6 psi vs. 29.9×10^6 psi). No significant impact.
e. α (coefficient of thermal expansion)	X		α is taken at 550°F, whereas actual temperature is 575°F. Difference is small.
f. Poisson's ratio - Refer to GE Design Specifications 22A5454 (MSRV and MSD) and 22A6547 (HPCS), ASME B&PV, Sec. III, Appendix I and 83102-DC-1, Sec. 4.7.4.	X		

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Independent Design Review Checklist

PIPE STRESS

MSD

Reviewer C.K. Wong

Checklist No. PI-03

Date 12-1-83

Item	Satisfactory Yes	Satisfactory No	Comments
12. Geometry			
a. Diagnostic Messages	X		
b. Element Data Table	X		
- Check lengths, pipe properties, material properties, code specification, bend radii and angles.			
c. Node Data Table	X		
- Check for consistency with input and isometric.			
- Check for nodes between supports in same direction.			
13. Restraints			
a. Location, type, and orientation	X		H014R - horizontal deviation of 3-1/2" (OK)
- Check for agreement with isometric.			H017R - vertical deviation of 2.04' See Observation PS-00-01(m). H007R - vertical deviation of 1-1/2" (OK) Valve Support H132R is modeled at CG. Actual location is 5" above this. No significant impact on stress or support.
b. Stiffness	X		
- Refer to 83102-DC-2 Exhibit 4.4-1.			

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Independent Design Review Checklist

PIPE STRESS

MSD

Reviewer L.J. Weingart (signature)

Checklist No. PI-03

Date 12/1/83

Item	Satisfactory Yes	Satisfactory No	Comments
14. Valves a. Location - Check for agreement with isometric. b. Modeling - Refer to valve drawing and 83102-DC-1 Sect. 4.7.6.	X X		Weight/length is input for valve elements. This results in minor added lumped weights.
15. Fittings a. Location and type - Refer to P&ID and isometric. b. SIF - Refer to ASME B&PV Sect. III, subsections NB-3680, NC-3670, and ND-3670 and computer input.	X		N/A - Class 1
16. Weldolets a. Location - Refer to isometric. b. SIF - Refer to appropriate Bonney Forge publications.			N/A
17. Nozzle Flexibility - Refer to equipment drawings (e.g., check that nozzles on thin shells have not been input as being rigid).			N/A

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Independent Design Review Checklist

PIPE STRESS

MSD

Reviewer C.K. Wong / [signature]

Checklist No. PI-03

Date 12-1-83

Item	Satisfactory Yes	Satisfactory No	Comments
18. Penetrations & Sleeves			
a. Modeling - Refer to penetration details.	X		
b. SIF - Check details to determine proper SIF.			N/A - Class 1
c. Pipe Deflections - Check that deflections do not cause interference.	X		
19. Mass Point Spacing - Check for adequacy to 33 Hz for seismic analysis and 60 Hz for hydrodynamic analysis.	X		One member (87) exceeds the spacing requirements for 60 Hz. The effect will be very localized.
20. Cut-off Frequency/No. of Modes			
a. Seismic - To 33 Hz	X		
b. Hydrodynamic - To 60 Hz or greater depending upon the individual response spectra	X		

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Independent Design Review Checklist

PIPE STRESS

MSD

Reviewer [handwritten signatures] **Checklist No.** PI-03

Date 12/1/83

Item	Satisfactory Yes	Satisfactory No	Comments
21. Damping			
a. OBE	X		
b. DBE	X		
c. RV1	X		
d. RV2 (SRV discharge only)	X		
e. VCL	X		
f. CO	X		
g. AP	X		
h. CHUG	X		
- Refer to 83102-DC-1, Section 4.8.5.			
22. Modal Combination - Refer to NRC Regulatory Guide 1.92.	X		
23. Gravity Output			
a. Displacements - Less than 0.1"		X	Maximum gravity displacement is -.1287" > .1" at node point H57 (vertical) and .2108" at H59, (horizontal). OK.
b. Stresses - Satisfy code eqns.			N/A - Class 1
c. Loads - Downward Direction	X		

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Independent Design Review Checklist

PIPE STRESS

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Reviewer [signature]

Checklist No. PI-03

Date 12/1/83

Item	Satisfactory Yes	Satisfactory No	Comments
24. Thermal Output	X		
a. Displacements - Less than 3" or consistent with temperature, piping layout and restraint configuration			
b. Stresses - Satisfy code eqns.			N/A - Class 1
c. Loads - Consistent with temperature, piping layout and restraint configuration	X		
25. Dynamic Analysis Output			
a. Displacements - Less than 1" or consistent with spectra, mass distribution, mode shapes, piping layout and restraint configuration	X		
b. Stresses - Satisfy code eqns.			N/A - Class 1
c. Loads - Consistent with spectra, mass distribution, mode shapes, piping layout and restraint configuration	X		
d. Mass Participation - Refer to 83102-DC-1, Sect. 4.8.5(f).	X		

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Independent Design Review Checklist

PIPE STRESS

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Reviewer [signature]

Checklist No. PI-03

Date 12/1/83

Item	Satisfactory Yes	Satisfactory No	Comments
26. Anchor Movement (Seismic and Hydrodynamic) Output a. Displacements - Consistent with input movements, piping layout, and restraint configuration	X		
b. Stresses - Satisfy code eqns.			N/A - Class 1
c. Loads - Consistent with input movements, piping layout, and restraint configuration	X		
27. Jet Impingement, Impact and Drag Output a. Displacements - Less than 1" or consistent with input loadings, piping layout and restraint configuration	X		
b. Stress - Satisfy Code eqns.			N/A - Class 1
c. Loads - Consistent with input loadings, piping layout and restraint configuration	X		
28. Load Combination - Consistent with 83102-DC-1 Sect. 4.4	X		

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Independent Design Review Checklist

PIPE STRESS

MSD

Reviewer Vuong Phi / J E Meyer

Checklist No. PI-03

Date 12-1-83

Item	Satisfactory Yes	Satisfactory No	Comments
29. Equipment Nozzle Loads - Refer to equipment drawings			N/A. Loads at penetration P-H23 will be qualified later. (Page 12.1 of 1N22G01C).
30. Valve Acceleration - Refer to 83102-DC-1 Sect. 4.8.5(e) and Valve Drawings		X	Valve accelerations exceed 3 g's for horizontal direction. However, request to vendor for qualification is documented.
31. Flanges - Refer to NB-3647			N/A
32. Welded Attachments - Check for consideration of local stresses at lugs and stanchions. - Refer to WRC Bulletins 107 and 198.			N/A
33. Functional Capability - Refer to 83102-DC-1 Sect. 4.5.3.			N/A

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Independent Design Review Checklist

PIPE STRESS

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Reviewer [signature]

Checklist No. PI-03

Date 12/1/83

Item	Satisfactory Yes	Satisfactory No	Comments
ADDITIONAL ITEMS FOR CLASS 1 PIPING			
1. Load Case Evaluation - Refer to pressure/temperature histogram (see GE documents referenced in 83102-DC-1, Section 4.6.2).			
a. All cases in the pressure/temperature histogram have been considered.	X		Pressure pulse to 1150 psi was not considered for scram transients events 10 and 11 (load steps 3 and 4). Not significant. Others noted by verifier.
b. Proper number of operational cycles for all events including hydrotest	X		Events 10 and 11 require 180 cycles. Cycles input for downward transient = Load: (50-8) + (69-8) + (180-111) = 172 Set: (2) (7) (8) Not significant.
c. Proper definition of both pressure, temperature and flow for all events		X	Event 20 (Load step 1) should consider P = 1335 psi. 1180 psi was used. Pressure stress increase is not significant.
d. Clear definition of the time span and event time function (ramp, step, or other) for loadings	X		

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Independent Design Review Checklist

PIPE STRESS

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Reviewer [signature]

Checklist No. PI-03

Date 12/1/83

Item	Satisfactory Yes	Satisfactory No	Comments
2. Thermal Transient Evaluation (Based on P256, Rev. 0)			
a. All discontinuities, whether structural (i.e., thickness change) or material (i.e., stainless to carbon) have been evaluated for $\lvert \alpha_a \tau_a - \alpha_b \tau_b \rvert$.		X	The following discontinuities were not considered: - coupling to 2" pipe - 3"x3"x2" tee to 3" and 2" pipes - 3" pipe to 3" valve - 3" pipe to flued head See Observation PI-03-01. Fatigue evaluation for tee intersection used T_a-T_b for 3" to 2" pipe. Not significant.
b. Computer analyses or hand calculations for calculating thermal gradients have been referenced and checked.	X		a and k are not evaluated at T_{avg}. Results are slightly conservative.
c. Time steps during ramps are sufficient to ensure that the maximum gradients are determined.	X		Events 15, 16, and 17 - flow rate used was 6670 lbm/hr instead of 310 lbm/hr - Results in conservative film coefficient.
3. Stress Indices Usage			
a. Proper B, C, and K indices have been specified for all components and incorporated into the analysis - Refer to NB-3683, applicable Bonney Forge Weldolet and Sockolet publications.	X		Tapered transition joint not considered at ends of tees. OK based upon Ladish detail drawing.
b. Proper type of component welded joint (girth butt weld or longitudinal butt weld) has been specified when selecting stress indices. - Refer to GAI Dwg. No. D-301-601.	X		

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Independent Design Review Checklist

PIPE STRESS

MSD

Reviewer [signature]

Checklist No. PI-03

Date 12/1/83

Item	Satisfactory Yes	Satisfactory No	Comments
c. Hand calculations of stress indices - Check for correctness and proper code or source reference. Refer to Table NB3638.2-1 and Bonney Forge publications.			N/A
4. Material Properties/Allowable Stress Usage			
a. E_C (cold modulus of elasticity)	X		
b. E_H (hot modulus of elasticity)	X		
c. μ (Poisson's Ratio)	X		
d. α (coefficient of thermal expansion)	X		
e. S_m (design allowable stress intensity)	X		
f. m, n (material parameters for NB-3228.3) - Refer to GAI Project Design Specifications 22A5454 (MSRV and MSD) and 22A6547 (HPCS), 83102-DC-1 Section 4.7.4, and Appendix I of the code.	X		
5. ASME Code Class Acceptability			
a. Proper load cases have been formed and load cases have been combined in the proper equations.	X		
b. Type of analysis is properly described (i.e., ASME Class 1 standard or simplified elastic-plastic).	X		
c. Cumulative usage factor - Check to assure that the factor does not exceed 1.0 (0.1 for no-break regions).		X	Already noted in calculation and Class 1 Stress Report.

Independent Design Review Checklist

FLUED HEAD HPCS Type Z

PRB-3052

Reviewer J. C. Minichiello John C Minichiello

Checklist No. PI-04

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
1. Geometry Input			
a. Computer geometry (wall thicknesses, lengths of piping) matches that shown in specification PY-NTC/GAI-032.	X		
b. Material properties (both thermal and structural) agree with those from the Code of Record (1974 + W'75 addenda).	X		
c. Sufficient detail in regions of high stress concentration to define peak stresses.	X		Fillets are very generous so SCF's would be small.
2. Thermal Analysis			
a. Appropriate film coefficients are used.	X		
b. All significant transients are considered.	X		
c. The time step is small enough to preclude instability in the solution.	X		
3. Stress Analysis			
a. All piping loads are considered (per Project Design Specification PY-NTC/GAI-032).	X		
b. Drywell internal pressure is considered (per section 7.0 of the specification).	X		
c. The pressure "end cap" loads are considered.	X		

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Independent Design Review Checklist

FLUED HEAD HPCS Type Z

PRB-3052

Reviewer J. C. Minichiello John C. Minichiello

Checklist No. PI-04

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
4. Code Compliance			
a. The proper load cases are combined for:			
1. General Primary Membrane ($<S_m$) check	X		
2. General & Local Primary Membrane + Primary Bending ($<1.5\ S_m$) check	X		
3. Local Primary Membrane ($<1.5\ S_m$) check	X		
b. 1. The appropriate loads are combined for each cyclic stress condition:		X	
a) Primary + Secondary ($<3S_m$) check			
b) Fatigue Analysis			Nutech uses "the time point with the highest thermal gradient" for thermal stresses. There is no proof that one time point produces maximum thermal stresses at all points in the head. In fact, the time chosen is most probably a peak stress maximum. Any linearization of the stresses (for secondary) will underestimate the secondary stress. This is less of a concern with Nutech's method of analysis (no linearization) than if the stresses will be linearized. It still is not correct to choose only one point. See General Note.

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Independent Design Review Checklist

FLUED HEAD HPCS Type Z

PRB-3052

Reviewer J. C. Minichiello John C Minichiello

Checklist No. PI-04

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
2. All appropriate cycles are considered.	X		
3. Stress concentration factors are applied in regions of coarse grid.		N/A	
4. Usage factor <1.0	X		
			General Note: Gilbert will be redoing the code compliance work. Cygna reviewed the G.A.I. method (Ref. "Classification of Finite Element Stresses According to ASME Section III Stress Categories," W.C. Kroenke, ASME paper PVP-17, 1974.) and finds it for the most part very detailed and appropriate. Cygna's cautions on this method are detailed in a letter from T. Wittig to J. Meyer dated 10/17/83 (83102-002).

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H061

Reviewer S. Luo *S. Luo*

Checklist No. PS-01-H061

Date *12/12/83*

Item	Satisfactory Yes	Satisfactory No	Comments
1. Design Input Data: - Check that all data is used correctly. Refer to Calc. No. 1B21G08(B), Rev. 0. Refer to GAI Drawing No. 04-4549-S-322-605, Rev. B.		X	• According to the location plan, the angle Θ (19°) does not match the calculated value (40°) shown on drawing 10.1. • Drawing S-322-605, Sheet 061.1 and 061.2, Rev. B, location plan dimensions are supposed to be revised according to ECN 9152-44-1111, but dimensions shown on drawings do not match all of those shown in the ECN (angle is 40.17° based on ECN dimension). See Observation PS-00-01(a).
2. Design Assumptions & Design Methods: - Check the acceptability of the original design. Refer to Calc. No. 1B21G08(B), Rev. 0.	X		• Temperature factor was not considered in shear allowable calculation. However, this effect is minor since the actual stress was so low (pg. 10.11 of H001 Calc. set).

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Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H061

Reviewer S. Luo *S. Luo*

Checklist No. PS-01-H061

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
3. Loading Combinations: - Check for consistency with GAI Specifications. a. Nuclear Boiler System, DSP-B21-1-4549-00, Rev. 1 b. HPCS, DSP-E22-1-4549-00, Rev. 1 c. Cygna Criteria 83102-DC-2	 X X X		Individual load case data is not available for this system. Combined loads from TPIPE Output Summary were used as a basis for review.
4. Gap: a. Check for consistency with Cygna Criteria 83102-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and dynamic movements in non-restraint directions?			N/A
5. Restraints: - Check whether the design satisfies the piping analysis application requirements.	X		
6. Spring Supports: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.3.			N/A
7. Hanger Rods: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.4.			N/A

Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H061

Reviewer	S. Luo S. Luo	Checklist No.	PS-01-H061
		Date	12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
8. Snubbers: - Check consistency with Cygna Criteria 83102-DC-2, Section. 4.1.5.			N/A
9. Strut: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.6.			N/A
10. Has the inertial load of the support been included in the design?		X	See Observation PS-00-06(b).
11. Base Plates and Anchor Bolts: a. Check consistency with Cygna criteria 83102-DC-2, Section 4.1.8. b. Does anchor bolt design meet the requirement of Cygna Criteria 83102-DC-2, Section 4.5?			N/A
12. Support attachment/connection to supporting structural element: Has design calculation been provided for support attachment/connection points?	X		

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Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H061

Reviewer S. Luo S. Luo

Checklist No. PS-01-H061

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
13. Design/Interface Requirements: a. Stiffness. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.1.1?			N/A. Stiffness calculation is not required for Class 3 piping (GAI practice).
b. Stiffness. Does the design meet the requirements of GAI Perry Project Pipe Support Design Instruction Manual?			N/A
c. Stresses. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.4?	X		
14. Inspect the following load cases, as applicable, for reasonableness (see Cygna Criteria 83102-DC-2, for definitions): a. DW h. PR b. T i. AP c. SUS j. PS d. OCC k. SRV e. OBE l. CHUG f. SSE m. CO g. JI n. WEIR o. FL	X		Individual load case data is not available for this system. Combined loads from TPIPE Output Summary were used as a basis for review.
15. Design Output: a. Does the design meet the functional requirements as defined in the piping analysis?	X		
b. Does the design reflect correctly all the physical arrangements shown on GAI drawing(s)?	X		

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Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H062

Reviewer S. Luo *S. Luo* — Checklist No. PS-01-H062

Date *12/12/83*

Item	Satisfactory Yes	Satisfactory No	Comments
1. Design Input Data: - Check that all data is used correctly. Refer to Calc. No. 1B21G08(B), Rev. 0 (Sec. 1, 10 and 11). Refer to GAI Drawing No. 04-4549-S-322-605, Rev. E.		X	• Hot and cold setting values calculated in Section 1 (pg. 1.5) and Section 10 (pg. 10.3) were incorrect (see DCC-07). See Observation PS-00-07(a) • Wrong eye nut allowable was used (pg. 1.5). However, the right allowable is still greater than the applied load. See Observation PS-00-05(a). • The maximum thermal displacement instead of normal thermal displacement was used in the cold setting calculation (pg. 1.7 and 7.4).
2. Design Assumptions & Design Methods: - Check the acceptability of the original design. Refer to Calc. No. 1B21G08(B), Rev. 0.	X		
3. Loading Combinations: - Check for consistency with GAI Specifications.			Individual load case data is not available for this system.
a. Nuclear Boiler System, DSP-B21-1-4549-00, Rev. 1	X		Combined loads from TPIPE Output Summary were used as a basis for review.
b. HPCS, DSP-E22-1-4549-00, Rev. 1	X		
c. Cygna Criteria 83102-DC-2	X		

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Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H062

Reviewer S. Luo *S. Luo*

Checklist No. PS-01-H062

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
4. Gap: a. Check for consistency with Cygna Criteria 83102-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and dynamic movements in non-restraint directions?			N/A
5. Restraints: - Check whether the design satisfies the piping analysis application requirements.	X		
6. Spring Supports: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.3.		X	Cold setting calculation was not correct. See Observation PS-00-07(a).
7. Hanger Rods: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.4.			N/A

Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H062

Reviewer S. Luo	S. Luo	**Checklist No.**	PS-01-H062
		Date	12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
8. Snubbers: - Check consistency with Cygna Criteria 83102-DC-2, Section. 4.1.5.			N/A
9. Strut: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.6.			N/A
10. Has the inertial load of the support been included in the design?		X	See Observation PS-00-06(b).
11. Base Plates and Anchor Bolts: a. Check consistency with Cygna criteria 83102-DC-2, Section 4.1.8. b. Does anchor bolt design meet the requirement of Cygna Criteria 83102-DC-2, Section 4.5?			N/A
12. Support attachment/connection to supporting structural element: Has design calculation been provided for support attachment/connection points?	X		

Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H062

Reviewer S. Luo *S. Luo*

Checklist No. PS-01-H062

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
13. Design/Interface Requirements: a. Stiffness. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.1.1? b. Stiffness. Does the design meet the requirements of GAI Perry Project Pipe Support Design Instruction Manual? c. Stresses. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.4?	X (c)		N/A. Stiffness calculation is not required for spring support. N/A
14. Inspect the following load cases, as applicable, for reasonableness (see Cygna Criteria 83102-DC-2, for definitions): a. DW h. PR b. T i. AP c. SUS j. PS d. OCC k. SRV e. OBE l. CHUG f. SSE m. CO g. JI n. WEIR o. FL	X		Individual load case data is not available for this system. Combined loads from TPIPE Output Summary were used as a basis for review.

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H062

Reviewer S. Luo *S. Luo*

Checklist No. PS-01-H062

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
15. Design Output:			
a. Does the design meet the functional requirements as defined in the piping analysis?	X		
b. Does the design reflect correctly all the physical arrangements shown on GAI drawing(s)?		X	• Missing plate 1/2 x 10 x 10 on material call out table (pg. 1.6). 10" x 10" x 1/2" base plate was intended in the design but was not properly specified in the drawing. The 1/4" all around fillet weld to embedment plate was not specified. See Observation PS-00-01(b). • Cold setting shown on drawing is not calculated correctly. See Observation PS-00-07(a). • CL and HL shown on material call out table were not correct. See Observation PS-00-07(a).

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H063

Reviewer S. Luo *S. Luo* Checklist No. PS-01-H063

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
1. Design Input Data: - Check that all data is used correctly. Refer to Calc. No. 1B21G08(B), Rev. 0. Refer to GAI Drawing No. 04-4549-S-322-605, Rev. D.		X	The calculation provided by verifier was not based on the current support configuration (pg. 1.8). Revision C of the support drawing was used. See Observation PS-00-01(c).
2. Design Assumptions & Design Methods: - Check the acceptability of the original design. Refer to Calc. No. 1B21G08(B), Rev. 0.		X	The design calculation and verification calculation (pgs. 1.9 thru 1.15) are based on Rev. C drawings. Additional calculations are required to check member connections to embedment plates and effects from changes due to ECN 9627-44-1201 (i.e., adding support 1G61-H033 to the frame). See Observation PS-00-01(c).
3. Loading Combinations: - Check for consistency with GAI Specifications. a. Nuclear Boiler System, DSP-B21-1-4549-00, Rev. 1 b. HPCS, DSP-E22-1-4549-00, Rev. 1 c. Cygna Criteria 83102-DC-2	 X X X		Individual load case data is not available for this system. Combined loads from TPIPE Output Summary were used as a basis for review.

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H063

Reviewer S. Luo *S. Luo*

Checklist No. PS-01-H063

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
4. Gap: a. Check for consistency with Cygna Criteria 83102-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and dynamic movements in non-restraint directions?			N/A
5. Restraints: - Check whether the design satisfies the piping analysis application requirements.	X		
6. Spring Supports: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.3.			N/A
7. Hanger Rods: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.4.			N/A
8. Snubbers: - Check consistency with Cygna Criteria 83102-DC-2, Section. 4.1.5.	X		Stroke set at midpoint.

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H063

Reviewer S. Luo S. Luo

Checklist No. PS-01-H063

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
9. Strut: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.6.			N/A
10. Has the inertial load of the support been included in the design?		X	See Observation PS-00-06(b).
11. Base Plates and Anchor Bolts: a. Check consistency with Cygna criteria 83102-DC-2, Section 4.1.8. b. Does anchor bolt design meet the requirement of Cygna Criteria 83102-DC-2, Section 4.5?			N/A
12. Support attachment/connection to supporting structural element: Has design calculation been provided for support attachment/connection points?		X	Design calculation is not up to date. (See comment on Item 2 of this Checklist.)
13. Design/Interface Requirements: a. Stiffness. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.1.1? b. Stiffness. Does the design meet the requirements of GAI Perry Project Pipe Support Design Instruction Manual?			N/A. Stiffness calculation is not required for Class 3 piping. N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H063

Reviewer S. Luo S. Luo

Checklist No. PS-01-H063

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
c. Stresses. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.4?	X		
14. Inspect the following load cases, as applicable, for reasonableness (see Cygna Criteria 83102-DC-2, for definitions): a. DW h. PR b. T i. AP c. SUS j. PS d. OCC k. SRV e. OBE l. CHUG f. SSE m. CO g. JI n. WEIR o. FL	X		Individual load case data is not available for this system. Combined loads from TPIPE Output Summary were used as a basis for review.
15. Design Output: a. Does the design meet the functional requirements as defined in the piping analysis? b. Does the design reflect correctly all the physical arrangements shown on GAI drawing(s)?	 X X		

Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H064

Reviewer S. Luo S. Luo

Checklist No. PS-01-H064

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
1. Design Input Data: - Check that all data is used correctly. Refer to Calc. No. 1B21G08(B), Rev. 0. Refer to GAI Drawing No. 04-4549-S-322-605, Rev. C.	X		
2. Design Assumptions & Design Methods: - Check the acceptability of the original design. Refer to Calc. No. 1B21G08(B), Rev. 0.	X		Swing angle was not checked. However, it is within the allowable range.
3. Loading Combinations: - Check for consistency with GAI Specifications. a. Nuclear Boiler System, DSP-B21-1-4549-00, Rev. 1 b. HPCS, DSP-E22-1-4549-00, Rev. 1 c. Cygna Criteria 83102-DC-2	X X X		Individual load case data is not available for this system. Combined loads from TPIPE Output Summary were used as a basis for review.
4. Gap: a. Check for consistency with Cygna Criteria 83102-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and dynamic movements in non-restraint directions?			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H064

Reviewer S. Luo *S. Luo* | Checklist No. PS-01-H064

Date *12/12/83*

Item	Satisfactory Yes	Satisfactory No	Comments
5. Restraints: - Check whether the design satisfies the piping analysis application requirements.	X		
6. Spring Supports: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.3.			N/A
7. Hanger Rods: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.4.			N/A
8. Snubbers: - Check consistency with Cygna Criteria 83102-DC-2, Section. 4.1.5.	X		Stroke set at midpoint.
9. Strut: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.6.			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H064

Reviewer: S. Luo *S. Luo*

Checklist No. PS-01-H064

Date *12/12/83*

Item	Satisfactory Yes	Satisfactory No	Comments
10. Has the inertial load of the support been included in the design?		X	See Observation PS-00-06(b).
11. Base Plates and Anchor Bolts: a. Check consistency with Cygna criteria 83102-DC-2, Section 4.1.8. b. Does anchor bolt design meet the requirement of Cygna Criteria 83102-DC-2, Section 4.5?			N/A
12. Support attachment/connection to supporting structural element: Has design calculation been provided for support attachment/connection points?	X		
13. Design/Interface Requirements: a. Stiffness. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.1.1? b. Stiffness. Does the design meet the requirements of GAI Perry Project Pipe Support Design Instruction Manual? c. Stresses. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.4?	 X		N/A. Stiffness calculation is not required for Class 3 piping. N/A

Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H064

Reviewer: S. Luo *S. Luo*

Checklist No. PS-01-H064

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
14. Inspect the following load cases, as applicable, for reasonableness (see Cygna Criteria 83102-DC-2, for definitions): a. DW h. PR b. T i. AP c. SUS j. PS d. OCC k. SRV e. OBE l. CHUG f. SSE m. CO g. JI n. WEIR o. FL	X		Individual load case data is not available for this system. Combined loads from TPIPE Output Summary were used as a basis for review.
15. Design Output: a. Does the design meet the functional requirements as defined in the piping analysis?	X		
b. Does the design reflect correctly all the physical arrangements shown on GAI drawing(s)?		X	RAP-231 has not been incorporated on the drawings. See Observation PS-00-01(d).

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H065

Reviewer S. Luo *S. Luo*

Checklist No. PS-01-H065

Date *12/12/83*

Item	Satisfactory Yes	Satisfactory No	Comments
1. Design Input Data: - Check that all data is used correctly. Refer to Calc. No. 1B21G08(B), Rev. 0. Refer to GAI Drawing No. 04-4549-S-322-605, Rev. D.	X		Design verification calculation was based on Rev. C of drawings. OK.
2. Design Assumptions & Design Methods: - Check the acceptability of the original design. Refer to Calc. No. 1B21G08(B), Rev. 0.	X		It is better to assume half of the lugs are active in designing the lugs. However, proper shimming makes this acceptable.
3. Loading Combinations: - Check for consistency with GAI Specifications. a. Nuclear Boiler System, DSP-B21-1-4549-00, Rev. 1 b. HPCS, DSP-E22-1-4549-00, Rev. 1 c. Cygna Criteria 83102-DC-2	 X X X		Individual load case data is not available for this system. Combined loads from TPIPE Output Summary were used as a basis for review.
4. Gap: a. Check for consistency with Cygna Criteria 83102-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and dynamic movements in non-restraint directions?			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H065

Reviewer S. Luo *S. Luo*

Checklist No. PS-01-H065

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
5. Restraints: - Check whether the design satisfies the piping analysis application requirements.	X		
6. Spring Supports: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.3.			N/A
7. Hanger Rods: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.4.			N/A
8. Snubbers: - Check consistency with Cygna Criteria 83102-DC-2, Section. 4.1.5.	X		Stroke set at midpoint. The swing angle was not checked but it is within the allowable range.
9. Strut: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.6.			N/A

Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H065

Reviewer S. Luo S. Luo

Checklist No. PS-01-H065

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
10. Has the inertial load of the support been included in the design?		X	See Observation PS-00-06(b).
11. Base Plates and Anchor Bolts: a. Check consistency with Cygna criteria 83102-DC-2, Section 4.1.8. b. Does anchor bolt design meet the requirement of Cygna Criteria 83102-DC-2, Section 4.5?			N/A
12. Support attachment/connection to supporting structural element: Has design calculation been provided for support attachment/connection points?	X		
13. Design/Interface Requirements: a. Stiffness. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.1.1? b. Stiffness. Does the design meet the requirements of GAI Perry Project Pipe Support Design Instruction Manual? c. Stresses. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.4?	 X		N/A. Stiffness calculation is not required for Class 3 piping. N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H065

Reviewer S. Luo *S. Luo*

Checklist No. PS-01-H065

Date *12/12/83*

Item	Satisfactory Yes	Satisfactory No	Comments
14. Inspect the following load cases, as applicable, for reasonableness (see Cygna Criteria 83102-DC-2, for definitions): a. DW h. PR b. T i. AP c. SUS j. PS d. OCC k. SRV e. OBE l. CHUG f. SSE m. CO g. JI n. WEIR o. FL	X		Individual load case data is not available for this system. Combined loads from TPIPE Output Summary were used as a basis for review.
15. Design Output: a. Does the design meet the functional requirements as defined in the piping analysis? b. Does the design reflect correctly all the physical arrangements shown on GAI drawing(s)?	 X X		

Checklist References: RAP No. OR-V-235
ECN 9781-44-1341

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H066

Reviewer S. Luo *S. Luo*

Checklist No. PS-01-H066

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
1. Design Input Data: - Check that all data is used correctly. Refer to Calc. No. 1B21G08(B), Rev. 0. Refer to GAI Drawing No. 04-4549-S-322-605, Rev. D.		X	Rear bracket angle used in design does not match the angle calculated from the dimensions shown on drawings. However, since the applied loads are small, this effect is minor (about 8° difference). See Observation PS-00-01(e). Design calculation was based on Rev. C drawings.
2. Design Assumptions & Design Methods: - Check the acceptability of the original design. Refer to Calc. No. 1B21G08(B), Rev. 0.	X		
3. Loading Combinations: - Check for consistency with GAI Specifications. a. Nuclear Boiler System, DSP-B21-1-4549-00, Rev. 1 b. HPCS, DSP-E22-1-4549-00, Rev. 1 c. Cygna Criteria 83102-DC-2	 X X X		Individual load case data is not available for this system. Combined loads from T?IPE Output Summary were used as a basis for review.
4. Gap: a. Check for consistency with Cygna Criteria 83102-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and dynamic movements in non-restraint directions?			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H066

Reviewer S. Luo *S. Luo*

Checklist No. PS-01-H066

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
5. Restraints: - Check whether the design satisfies the piping analysis application requirements.	X		
6. Spring Supports: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.3.			N/A
7. Hanger Rods: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.4.			N/A
8. Snubbers: - Check consistency with Cygna Criteria 83102-DC-2, Section. 4.1.5.	X		Stroke set at midpoint.
9. Strut: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.6.			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1821-H066

Reviewer S. Luo S. Luo

Checklist No. PS-01-H066

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
10. Has the inertial load of the support been included in the design?		X	See Observation PS-00-06(b).
11. Base Plates and Anchor Bolts: a. Check consistency with Cygna criteria 83102-DC-2, Section 4.1.8. b. Does anchor bolt design meet the requirement of Cygna Criteria 83102-DC-2, Section 4.5?			N/A
12. Support attachment/connection to supporting structural element: Has design calculation been provided for support attachment/connection points?	X		
13. Design/Interface Requirements:			
a. Stiffness. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.1.1?			N/A. Stiffness calculation is not required for Class 3 piping.
b. Stiffness. Does the design meet the requirements of GAI Perry Project Pipe Support Design Instruction Manual?			N/A
c. Stresses. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.4?	X		

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H066

Reviewer S. Luo S. Luo

Checklist No. PS-01-H066

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
14. Inspect the following load cases, as applicable, for reasonableness (see Cygna Criteria 83102-DC-2, for definitions): a. DW h. PR b. T i. AP c. SUS j. PS d. OCC k. SRV e. OBE l. CHUG f. SSE m. CO g. JI n. WEIR o. FL	X		Individual load case data is not available for this system. Combined loads from TPIPE Output Summary were used as a basis for review.
15. Design Output:			
a. Does the design meet the functional requirements as defined in the piping analysis?	X		
b. Does the design reflect correctly all the physical arrangements shown on GAI drawing(s)?		X	• Horizontal angle 48° shown on sheet 066.1 of drawing is in conflict with angle computed using dimensions shown on Sheet 066.2 of drawing (41.76°). See Observation PS-00-01(e). • The applied loads shown on drawing were written incorrectly.

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H067

Reviewer S. Luo *S. Luo*

Checklist No. PS-01-H067

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
1. Design Input Data: - Check that all data is used correctly. Refer to Calc. No. 1B21G08(B), Rev. 0. Refer to GAI Drawing No. 04-4549-S-322-605, Rev. D.		X	Restraint direction used in design calculation is about 9° different from the direction calculated based on the current support configuration. (Design calculation is based on Rev. C drawings.) See Observation PS-00-01(f).
2. Design Assumptions & Design Methods: - Check the acceptability of the original design. Refer to Calc. No. 1B21G08(B), Rev. 0.	X		Incorrect restraint direction does not have significant effect on the adequacy of this hanger since the members are very strong.
3. Loading Combinations: - Check for consistency with GAI Specifications. a. Nuclear Boiler System, DSP-B21-1-4549-00, Rev. 1 b. HPCS, DSP-E22-1-4549-00, Rev. 1 c. Cygna Criteria 83102-DC-2	X X X		Individual load case data is not available for this system. Combined loads from TPIPE Output Summary were used as a basis for review.
4. Gap: a. Check for consistency with Cygna Criteria 83102-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and dynamic movements in non-restraint directions?			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H067

Reviewer S. Luo *S. Luo*

Checklist No. PS-01-H067

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
5. Restraints: - Check whether the design satisfies the piping analysis application requirements.	X		
6. Spring Supports: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.3.			N/A
7. Hanger Rods: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.4.			N/A
8. Snubbers: - Check consistency with Cygna Criteria 83102-DC-2, Section. 4.1.5.			N/A
9. Strut: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.6.	X		

Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H067

Reviewer S. Luo S. Luo

Checklist No. PS-01-H067

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
10. Has the inertial load of the support been included in the design?		X	See Observation PS-00-06(b).
11. Base Plates and Anchor Bolts: a. Check consistency with Cygna criteria 83102-DC-2, Section 4.1.8. b. Does anchor bolt design meet the requirement of Cygna Criteria 83102-DC-2, Section 4.5?			N/A
12. Support attachment/connection to supporting structural element: Has design calculation been provided for support attachment/connection points?	X		
13. Design/Interface Requirements: a. Stiffness. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.1.1? b. Stiffness. Does the design meet the requirements of GAI Perry Project Pipe Support Design Instruction Manual? c. Stresses. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.4?	 c. X		 a. N/A. Stiffness calculation is not required for Class 3 piping. b. N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H067

Reviewer S. Luo *S. Luo*

Checklist No. PS-01-H067

Date *12/12/83*

Item	Satisfactory Yes	Satisfactory No	Comments
14. Inspect the following load cases, as applicable, for reasonableness (see Cygna Criteria 83102-DC-2, for definitions): a. DW h. PR b. T i. AP c. SUS j. PS d. OCC k. SRV e. OBE l. CHUG f. SSE m. CO g. JI n. WEIR o. FL	X		Individual load case data is not available for this system. Combined loads from TPIPE Output Summary were used as a basis for review.
15. Design Output: a. Does the design meet the functional requirements as defined in the piping analysis? b. Does the design reflect correctly all the physical arrangements shown on GAI drawing(s)?		X X	The restrained direction shown on drawing is different from the calculated direction based on the available dimensions shown on location plan. See Observation PS-00-01(f).

Checklist Reference: RAP No. OR-SV-260

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H068

Reviewer S. Luo   S. Luo

Checklist No. PS-01-H068

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
1. Design Input Data: - Check that all data is used correctly. Refer to Calc. No. 1B21G08(B), Rev. 0. Refer to GAI Drawing No. 04-4549-S-322-605, Rev. D.		X	Rev. 0 of drawing was referenced in verification calculation, but drawing only has Revs. A, B, C and D. See Observation PS-00-01(g).
2. Design Assumptions & Design Methods: - Check the acceptability of the original design. Refer to Calc. No. 1B21G08(B), Rev. 0.		X	Snubber pin-to-pin dimension does not match the dimension in design verification calculation (pg. 1.37). See Observation PS-00-01(g).
3. Loading Combinations: - Check for consistency with GAI Specifications. a. Nuclear Boiler System, DSP-B21-1-4549-00, Rev. 1 b. HPCS, DSP-E22-1-4549-00, Rev. 1 c. Cygna Criteria 83102-DC-2	 X X X		Individual load case data is not available for this system. Combined loads from TPIPE Output Summary were used as a basis for review.
4. Gap: a. Check for consistency with Cygna Criteria 83102-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and dynamic movements in non-restraint directions?			N/A

Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H068

Reviewer S. Luo *S. Luo* **Checklist No.** PS-01-H068

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
5. Restraints: - Check whether the design satisfies the piping analysis application requirements.	X		
6. Spring Supports: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.3.			N/A
7. Hanger Rods: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.4.			N/A
8. Snubbers: - Check consistency with Cygna Criteria 83102-DC-2, Section. 4.1.5.		X	The snubber size shown in the call-out table violated the minimum pin-to-pin distance and is different from the size specified in the design calculation (pg. 1.37). See Observation PS-00-01(g).
9. Strut: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.6.			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H068

Reviewer S. Luo *S. Luo*

Checklist No. PS-01-H068

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
10. Has the inertial load of the support been included in the design?		X	See Observation PS-00-06(b).
11. Base Plates and Anchor Bolts: a. Check consistency with Cygna criteria 83102-DC-2, Section 4.1.8. b. Does anchor bolt design meet the requirement of Cygna Criteria 83102-DC-2, Section 4.5?			N/A
12. Support attachment/connection to supporting structural element: Has design calculation been provided for support attachment/connection points?	X		
13. Design/Interface Requirements: a. Stiffness. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.1.1? b. Stiffness. Does the design meet the requirements of GAI Perry Project Pipe Support Design Instruction Manual? c. Stresses. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.4?	 a. b. c. X		 a. N/A. Stiffness calculation is not required for Class 3 piping. b. N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H068

Reviewer S. Luo S. Luo

Checklist No. PS-01-H068

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
14. Inspect the following load cases, as applicable, for reasonableness (see Cygna Criteria 83102-DC-2, for definitions): a. DW h. PR b. T i. AP c. SUS j. PS d. OCC k. SRV e. OBE l. CHUG f. SSE m. CO g. JI n. WEIR o. FL	X		Individual load case data is not available for this system. Combined loads from TPIPE Output Summary were used as a basis for review.
15. Design Output:			
a. Does the design meet the functional requirements as defined in the piping analysis?		X	See Observation PS-00-01(g).
b. Does the design reflect correctly all the physical arrangements shown on GAI drawing(s)?		X	Local axis (SX) directions are opposite between Drawing Sheet 1/2 and 2/2. OK.

Checklist Reference: RAP No. OR-SV-251.

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H112

Reviewer S. Luo S. Luo

Checklist No. PS-01-H112

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
1. Design Input Data: - Check that all data is used correctly. Refer to Calc. No. 1B21G08(B), Rev. 0. Refer to GAI Drawing No. 04-4549-S-322-605, Rev. D.	X		Verification calculation was based on Rev. C of the drawings.
2. Design Assumptions & Design Methods: - Check the acceptability of the original design. Refer to Calc. No. 1B21G08(B), Rev. 0.	X		
3. Loading Combinations: - Check for consistency with GAI Specifications. a. Nuclear Boiler System, DSP-B21-1-4549-00, Rev. 1 b. HPCS, DSP-E22-1-4549-00, Rev. 1 c. Cygna Criteria 83102-DC-2	 X X X		Individual load case data is not available for this system. Combined loads from TPIPE Output Summary were used as a basis for review.
4. Gap: a. Check for consistency with Cygna Criteria 83102-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and dynamic movements in non-restraint directions?			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H112

Reviewer S. Luo S. Luo

Checklist No. PS-01-H112

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
5. Restraints: - Check whether the design satisfies the piping analysis application requirements.	X		
6. Spring Supports: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.3.			N/A
7. Hanger Rods: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.4.			N/A
8. Snubbers: - Check consistency with Cygna Criteria 83102-DC-2, Section. 4.1.5.		X	Snubber size shown on the call-out table violates the minimum pin-to-pin distance and is different from the size specified in the design calculation (pg. 1.45). See Observation PS-00-01(h).
9. Strut: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.6.			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H112

Reviewer S. Luo S. Luo

Checklist No. PS-01-H112

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
10. Has the inertial load of the support been included in the design?		X	See Observation PS-00-06(b).
11. Base Plates and Anchor Bolts: a. Check consistency with Cygna criteria 83102-DC-2, Section 4.1.8. b. Does anchor bolt design meet the requirement of Cygna Criteria 83102-DC-2, Section 4.5?			N/A
12. Support attachment/connection to supporting structural element: Has design calculation been provided for support attachment/connection points?	X		
13. Design/Interface Requirements: a. Stiffness. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.1.1? b. Stiffness. Does the design meet the requirements of GAI Perry Project Pipe Support Design Instruction Manual? c. Stresses. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.4?	 X		 N/A. Stiffness calculation is not required for Class 3 piping. N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H112

Reviewer S. Luo S. Luo

Checklist No. PS-01-H112

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
14. Inspect the following load cases, as applicable, for reasonableness (see Cygna Criteria 83102-DC-2, for definitions): a. DW h. PR b. T i. AP c. SUS j. PS d. OCC k. SRV e. OBE l. CHUG f. SSE m. CO g. JI n. WEIR o. FL	X		Individual load case data is not available for this system. Combined loads from TPIPE Output Summary were used as a basis for review.
15. Design Output: a. Does the design meet the functional requirements as defined in the piping analysis? b. Does the design reflect correctly all the physical arrangements shown on GAI drawing(s)?		X X	Notes on Sheet 1.40 of verification calculation refer to Sheets 3 and 4 for sketches. The sheet numbers are not correct and should be Sheets 1.41 and 1.42. See Observation PS-00-01(h).

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H163

Reviewer S. Luo *S. Luo*

Checklist No. PS-01-H163

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
1. Design Input Data: - Check that all data is used correctly. Refer to Calc. No. 1B21G08(B), Rev. 0. Refer to GAI Drawing No. 04-4549-S-322-605, Rev. E.		X	• The thickness of the ring should be only 0.875" (1.1875" was used in design calculation). • The wall thickness and inside diameter of sleeve does not match the specified pipe size 14 ϕ" sch 40S (pg. 10.32). See Observation PS-00-05(b).
2. Design Assumptions & Design Methods: - Check the acceptability of the original design. Refer to Calc. No. MK-1B21-H163, Rev. 0.		X	• The width of ring is only 5 1/2", but 12" is assumed in design calculation (pg. 10.32). • The bending stress exceeds the allowable limit since the wrong section properties were used in the design calculation (pg. 10.36). Only the ring thickness should be used in the calculation of the section properties. • Friction force is not considered in lug design. • The assumptions shown on pg. 10.30 (two forces) do not match the actual case (one force).

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H163

Reviewer S. Luo *S. Luo*

Checklist No. PS-01-H163

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
			• Lugs size L_1 used in the computer analysis does not match the actual size (pg. 10.38). See Observation PS-OC-05(b).
3. Loading Combinations: - Check for consistency with GAI Specifications. a. Nuclear Boiler System, DSP-B21-1-4549-00, Rev. 1 b. HPCS, DSP-E22-1-4549-00, Rev. 1 c. Cygna Criteria 83102-DC-2	 X X X		Combined loads from TPIPE Output Summary were used as a basis for review.
4. Gap: a. Check for consistency with Cygna Criteria 83102-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and dynamic movements in non-restraint directions?	 X		 N/A
5. Restraints: - Check whether the design satisfies the piping analysis application requirements.	X		
6. Spring Supports: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.3.			N/A

Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H163

Reviewer S. Luo S. Luo **Checklist No.** PS-01-H163

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
7. Hanger Rods: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.4.			N/A
8. Snubbers: - Check consistency with Cygna Criteria 83102-DC-2, Section. 4.1.5.			N/A
9. Strut: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.6.			N/A
10. Has the inertial load of the support been included in the design?	X		
11. Base Plates and Anchor Bolts: a. Check consistency with Cygna criteria 83102-DC-2, Section 4.1.8. b. Does anchor bolt design meet the requirement of Cygna Criteria 83102-DC-2, Section 4.5?			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H163

Reviewer S. Luo *S. Luo*

Checklist No. PS-01-H163

Date *12/12/83*

Item	Satisfactory Yes	Satisfactory No	Comments
12. Support attachment/connection to supporting structural element: Has design calculation been provided for support attachment/connection points?			N/A
13. Design/Interface Requirements:			
a. Stiffness. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.1.1?			N/A
b. Stiffness. Does the design meet the requirements of GAI Perry Project Pipe Support Design Instruction Manual?			N/A
c. Stresses. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.4?		X	See Observation PS-00-05(b).
14. Inspect the following load cases, as applicable, for reasonableness (see Cygna Criteria 83102-DC-2, for definitions): a. DW b. T c. SUS d. OCC e. OBE f. SSE g. JI h. PR i. AP j. PS k. SRV l. CHUG m. CO n. WEIR o. FL	X		Combined loads from TPIPE Output Summary were used as a basis for review.

Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H163

Reviewer	S. Luo S. Luo	Checklist No.	PS-01-H163
		Date	12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
15. Design Output:			
a. Does the design meet the functional requirements as defined in the piping analysis?		X	Ring failed in bending. GAI is redesigning. See Observation PS-00-05(b).
b. Does the design reflect correctly all the physical arrangements shown on GAI drawing(s)?	X		

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H172

Reviewer S. Luo *S. Luo*

Checklist No. PS-01-H172

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
1. Design Input Data: - Check that all data is used correctly. Refer to Calc. No. 1B21G08(B), Rev. 0. Refer to GAI Drawing No. 04-4549-S-322-605, Rev. C.	X		Rev. B of the drawings were used in the verification calculation.
2. Design Assumptions & Design Methods: - Check the acceptability of the original design. Refer to Calc. No. 1B21G08(B), Rev. 0.	X		
3. Loading Combinations: - Check for consistency with GAI Specifications. a. Nuclear Boiler System, DSP-B21-1-4549-00, Rev. 1 b. HPCS, DSP-E22-1-4549-00, Rev. 1 c. Cygna Criteria 83102-DC-2	X X X		Individual load case data is not available for this system. Combined loads from TPIPE Output Summary were used as a basis for review.
4. Gap: a. Check for consistency with Cygna Criteria 83102-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and dynamic movements in non-restraint directions?			N/A

Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H172

Reviewer S. Luo *S. Luo*

Checklist No. PS-01-H172

Date *12/12/83*

Item	Satisfactory Yes	Satisfactory No	Comments
5. Restraints: - Check whether the design satisfies the piping analysis application requirements.	X		
6. Spring Supports: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.3.			N/A
7. Hanger Rods: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.4.			N/A
8. Snubbers: - Check consistency with Cygna Criteria 83102-DC-2, Section. 4.1.5.			N/A
9. Strut: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.6.	X		

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H172

Reviewer S. Luo S. Luo

Checklist No. PS-01-H172

Date 12/12/82

Item	Satisfactory Yes	Satisfactory No	Comments
10. Has the inertial load of the support been included in the design?		X	See Observation PS-00-06(b).
11. Base Plates and Anchor Bolts: a. Check consistency with Cygna criteria 83102-DC-2, Section 4.1.8. b. Does anchor bolt design meet the requirement of Cygna Criteria 83102-DC-2, Section 4.5?			N/A
12. Support attachment/connection to supporting structural element: Has design calculation been provided for support attachment/connection points?	X		
13. Design/Interface Requirements: a. Stiffness. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.1.1? b. Stiffness. Does the design meet the requirements of GAI Perry Project Pipe Support Design Instruction Manual? c. Stresses. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.4?	 X		 N/A. Stiffness calculation is not required for Class 3 piping. N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H172

Reviewer S. Luo *S. Luo*

Checklist No. PS-01-H172

Date *12/12/83*

Item	Satisfactory Yes	Satisfactory No	Comments
14. Inspect the following load cases, as applicable, for reasonableness (see Cygna Criteria 83102-DC-2, for definitions): a. DW h. PR b. T i. AP c. SUS j. PS d. OCC k. SRV e. OBE l. CHUG f. SSE m. CO g. JI n. WEIR o. FL	X		Individual load case data is not available for this system. Combined loads from TPIPE Output Summary were used as a basis for review.
15. Design Output: a. Does the design meet the functional requirements as defined in the piping analysis? b. Does the design reflect correctly all the physical arrangements shown on GAI drawing(s)?	 X X		

Checklist References: Doc. No. DCC-02
RAP No. OR-SV-239

Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H221

Reviewer S. Luo S. Luo

Checklist No. PS-01-H221

Date /12/83

Item	Satisfactory Yes	Satisfactory No	Comments
1. Design Input Data: - Check that all data is used correctly. Refer to Calc. No. 1B21G08(B), Rev. 0. Refer to GAI Drawing No. 04-4549-S-322-605, Rev. C.	X		
2. Design Assumptions & Design Methods: - Check the acceptability of the original design. Refer to Calc. No. 1B21G08(B), Rev. 0.	X		The higher loads were used in design.
3. Loading Combinations: - Check for consistency with GAI Specifications. a. Nuclear Boiler System, DSP-B21-1-4549-00, Rev. 1 b. HPCS, DSP-E22-1-4549-00, Rev. 1 c. Cygna Criteria 83102-DC-2	 X X X		Individual load case data is not available for this system. Combined loads from TPIPE Output Summary were used as a basis for review.
4. Gap: a. Check for consistency with Cygna Criteria 83102-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and dynamic movements in non-restraint directions?			N/A

Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H221

Reviewer S. Luo S. Luo

Checklist No. PS-01-H221

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
5. Restraints: - Check whether the design satisfies the piping analysis application requirements.	X		
6. Spring Supports: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.3.			N/A
7. Hanger Rods: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.4.			N/A
8. Snubbers: - Check consistency with Cygna Criteria 83102-DC-2, Section. 4.1.5.			N/A
9. Strut: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.6.			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H221

Reviewer S. Luo *S. Luo*

Checklist No. PS-01-H221

Date 12/12/82

Item	Satisfactory Yes	Satisfactory No	Comments
10. Has the inertial load of the support been included in the design?		X	See Observation PS-00-06(b).
11. Base Plates and Anchor Bolts: a. Check consistency with Cygna criteria 83102-DC-2, Section 4.1.8. b. Does anchor bolt design meet the requirement of Cygna Criteria 83102-DC-2, Section 4.5?			N/A
12. Support attachment/connection to supporting structural element: Has design calculation been provided for support attachment/connection points?	X		
13. Design/Interface Requirements: a. Stiffness. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.1.1? b. Stiffness. Does the design meet the requirements of GAI Perry Project Pipe Support Design Instruction Manual? c. Stresses. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.4?	c. X		a. N/A. Stiffness calculation is not required for Class 3 piping. b. N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H221

Reviewer S. Luo *S. Luo*

Checklist No. PS-01-H221

Date *12/12/83*

Item	Satisfactory Yes	Satisfactory No	Comments
14. Inspect the following load cases, as applicable, for reasonableness (see Cygna Criteria 83102-DC-2, for definitions): a. DW h. PR b. T i. AP c. SUS j. PS d. OCC k. SRV e. OBE l. CHUG f. SSE m. CO g. JI n. WEIR o. FL	X		Individual load case data is not available for this system. Combined loads from TPIPE Output Summary were used as a basis for review.
15. Design Output: a. Does the design meet the functional requirements as defined in the piping analysis? b. Does the design reflect correctly all the physical arrangements shown on GAI drawing(s)?	 X X		

Checklist References: RAP No. OR-SV-233
ECN-10096-44-1471, Rev. A
Calc. 1B21G09(B), Rev. 0
(From MK-1B21-H203).

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H436

Reviewer S. Luo *S. Luo*

Checklist No. PS-01-H436

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
1. Design Input Data: - Check that all data is used correctly. Refer to Calc. No. 1B21G08(B), Rev. 1. Refer to GAI Drawing No. 04-4549-S-322-605, Rev. A.	X		Rev. 0 calculation is not available for this support. The review is based on Rev. 1 calculation (which is in progress). See Observation PS-00-01(i).
2. Design Assumptions & Design Methods: - Check the acceptability of the original design. Refer to Calc. No. 1B21G08(B), Rev. 1.	X		Allowables have not been reduced for temperature effect. Stresses are still below reduced allowables.
3. Loading Combinations: - Check for consistency with GAI Specifications. a. Nuclear Boiler System, DSP-B21-1-4549-00, Rev. 1 b. HPCS, DSP-E22-1-4549-00, Rev. 1 c. Cygna Criteria 83102-DC-2	 X X X		Individual load case data is not available for this system. Combined loads from TPIPE Output Summary were used as a basis for review.
4. Gap: a. Check for consistency with Cygna Criteria 83102-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and dynamic movements in non-restraint directions?			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H436

Reviewer S. Luo S. Luo

Checklist No. PS-01-H436

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
5. Restraints: - Check whether the design satisfies the piping analysis application requirements.	X		
6. Spring Supports: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.3.			N/A
7. Hanger Rods: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.4.			N/A
8. Snubbers: - Check consistency with Cygna Criteria 83102-DC-2, Section. 4.1.5.			N/A
9. Strut: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.6.	X		

Reviewer S. Luo S. Luo **Checklist No.** PS-01-H436

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
10. Has the inertial load of the support been included in the design?		X	See Observation PS-00-06(b).
11. Base Plates and Anchor Bolts: a. Check consistency with Cygna criteria 83102-DC-2, Section 4.1.8. b. Does anchor bolt design meet the requirement of Cygna Criteria 83102-DC-2, Section 4.5?			N/A
12. Support attachment/connection to supporting structural element: Has design calculation been provided for support attachment/connection points?	X		
13. Design/Interface Requirements: a. Stiffness. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.1.1? b. Stiffness. Does the design meet the requirements of GAI Perry Project Pipe Support Design Instruction Manual? c. Stresses. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.4?	 X		 N/A. Stiffness calculation is not required for Class 3 piping. N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1B21-H436

Reviewer S. Luo *S. Luo*

Checklist No. PS-01-H436

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
14. Inspect the following load cases, as applicable, for reasonableness (see Cygna Criteria 83102-DC-2, for definitions): a. DW h. PR b. T i. AP c. SUS j. PS d. OCC k. SRV e. OBE l. CHUG f. SSE m. CO g. JI n. WEIR o. FL	X		Individual load case data is not available for this system. Combined loads from TPIPE Output Summary were used as a basis for review.
15. Design Output:			
a. Does the design meet the functional requirements as defined in the piping analysis?	X		
b. Does the design reflect correctly all the physical arrangements shown on GAI drawing(s)?	X		

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1E22-H001

Reviewer S. Luo S. Luo

Checklist No. PS-02-H001

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
1. Design Input Data: - Check that all data is used correctly. Refer to Calc. No. 1E22G04(B), Rev. 1. Refer to GAI Drawing No. 04-4549-S-322-701, Rev. E.		X	Wrong section properties used in shear and deflection calculation (pg. 10.4). TS 5 x 5 x 1/2 was used instead of 6" ϕ sch 160 pipe. See Observation PS-02-01(a)
2. Design Assumptions & Design Methods: - Check the acceptability of the original design. Refer to Calc. No. 1E22G04(B), Rev. 1.		X	• See Item 13c. • The bending stress was combined conservatively by absolute sum instead of SRSS of two bending moments for circular cross section (pg. 10.3). • The same calculation was used for the welds between items A and B and items B and F. This calculcation did not consider the additional moment due to the eccentricity between B and F. However, weld is still acceptable.
3. Loading Combinations: - Check for consistency with GAI Specifications.			
a. Nuclear Boiler System, DSP-B21-1-4549-00, Rev. 1			N/A
b. HPCS, DSP-E22-1-4549-00, Rev. 1	X		
c. Cygna Criteria 83102-DC-2		X	See Observation PS-00-02(a).

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1E22-H001

Reviewer S. Luo S. Luo

Checklist No. PS-02-H001

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
4. Gap: a. Check for consistency with Cygna Criteria 83102-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and dynamic movements in non-restraint directions?			N/A
5. Restraints: - Check whether the design satisfies the piping analysis application requirements.	X		
6. Spring Supports: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.3.			N/A
7. Hanger Rods: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.4.			N/A
8. Snubbers: - Check consistency with Cygna Criteria 83102-DC-2, Section. 4.1.5.	X		Stroke set at midpoint.

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1E22-H001

Reviewer S. Luo S. Luo

Checklist No. PS-02-H001

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
9. Strut: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.6.			N/A
10. Has the inertial load of the support been included in the design?		X	See Observation PS-00-06(b).
11. Base Plates and Anchor Bolts: a. Check consistency with Cygna criteria 83102-DC-2, Section 4.1.8. b. Does anchor bolt design meet the requirement of Cygna Criteria 83102-DC-2, Section 4.5?			N/A
12. Support attachment/connection to supporting structural element: Has design calculation been provided for support attachment/connection points?	X		
13. Design/Interface Requirements: a. Stiffness. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.1.1? b. Stiffness. Does the design meet the requirements of GAI Perry Project Pipe Support Design Instruction Manual?	a. X b. X		"E" value due to the temperature was not considered in stiffness calculation. However, this effect is minor in this case (pgs. 10.1 and 10.2). See Observation PS-02-01(b).

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1E22-H001

Reviewer S. Luo S. Luo

Checklist No. PS-02-H001

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
c. Stresses. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.4?		X	Weld between item D and F failed. See Observation PS-02-01(c).
14. Inspect the following load cases, as applicable, for reasonableness (see Cygna Criteria 83102-DC-2, for definitions): a. DW h. PR b. T i. AP c. SUS j. PS d. OCC k. SRV e. OBE l. CHUG f. SSE m. CO g. JI n. WEIR o. FL		X	Jet impingement load on support was not included in the design of the support. See Observation PS-02-02.
15. Design Output: a. Does the design meet the functional requirements as defined in the piping analysis?	X		
b. Does the design reflect correctly all the physical arrangements shown on GAI drawing(s)?		X	Dimensions of some items in the support drawings are not clearly defined (e.g., length of item D, and length of weld between F and D). Therefore, there is no guarantee that the dimensions used in the design are provided (e.g., weld length). See Observation PS-02-01(d).

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1E22-H002

Reviewer S. Luo S. Luo

Checklist No. PS-02-H002

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
1. Design Input Data: - Check that all data is used correctly. Refer to Calc. No. 1E22G04(B), Rev. 1. Refer to GAI Drawing No. 04-4549-S-322-701, Rev. 1.	X		
2. Design Assumptions & Design Methods: - Check the acceptability of the original design. Refer to Calc. No. 1E22G04(B), Rev. 1.	X		
3. Loading Combinations: - Check for consistency with GAI Specifications.			
a. Nuclear Boiler System, DSP-B21-1-4549-00, Rev. 1			N/A
b. HPCS, DSP-E22-1-4549-00, Rev. 1	X		It is acceptable (based on DCC-14).
c. Cygna Criteria 83102-DC-2		X	See Observation PS-00-02(a).
4. Gap: a. Check for consistency w : Cygna Criteria 83102-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and dynamic movements in non-restraint directions?			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1F22-H002

Reviewer S. Luo *S. Luo*

Checklist No. PS-02-H002

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
5. Restraints: - Check whether the design satisfies the piping analysis application requirements.	X		
6. Spring Supports: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.3.			N/A
7. Hanger Rods: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.4.			N/A
8. Snubbers: - Check consistency with Cygna Criteria 83102-DC-2, Section. 4.1.5.	X		Stroke set at midpoint.
9. Strut: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.6.			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1E22-H002

Reviewer S. Luo *S. Luo*

Checklist No. PS-02-H002

Date *12/12/83*

Item	Satisfactory Yes	Satisfactory No	Comments
10. Has the inertial load of the support been included in the design?		X	See Observation PS-00-06(b).
11. Base Plates and Anchor Bolts: a. Check consistency with Cygna criteria 83102-DC-2, Section 4.1.8. b. Does anchor bolt design meet the requirement of Cygna Criteria 83102-DC-2, Section 4.5?			N/A
12. Support attachment/connection to supporting structural element: Has design calculation been provided for support attachment/connection points?	X		
13. Design/Interface Requirements: a. Stiffness. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.1.1? b. Stiffness. Does the design meet the requirements of GAI Perry Project Pipe Support Design Instruction Manual? c. Stresses. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.4?	 X X X		

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Independent Design Review Checklist

PIPE SUPPORT MK-1E22-H002

Reviewer S. Luo S. Luo

Checklist No. PS-02-H002

Date 2/12/82

Item	Satisfactory Yes	Satisfactory No	Comments
14. Inspect the following load cases, as applicable, for reasonableness (see Cygna Criteria 83102-DC-2, for definitions): a. DW h. PR b. T i. AP c. SUS j. PS d. OCC k. SRV e. OBE l. CHUG f. SSE m. CO g. JI n. WEIR o. FL		X	See comments on Item 14 of Checklist PS-02-H001.
15. Design Output:			
a. Does the design meet the functional requirements as defined in the piping analysis?	X		
b. Does the design reflect correctly all the physical arrangements shown on GAI drawing(s)?1E22G04 (B),	X		

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Independent Design Review Checklist

PIPE SUPPORT MK-1E22-H003

Reviewer S. Luo S. Luo

Checklist No. PS-02-H003

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
1. Design Input Data: - Check that all data is used correctly. Refer to Calc. No. 1E22G04(B), Rev. 1. Refer to GAI Drawing No. 04-4549-S-322-701, Rev. C.		X	Cold setting value shown on drawing did not have backup calculation. Also, the normal mode movement is not specified in computing cold loads. See Observation PS-00-07(b).
2. Design Assumptions & Design Methods: - Check the acceptability of the original design. Refer to Calc. No. 1E22G04(B), Rev. 1.	X		• Design load used in verifier's design calculation was less than the current load. However, since the stress levels are low, the support is adequate to take current load.
		X	• The cold load used by the verifier was based on an incorrect calculation. See Observation PS-00-05(c).
3. Loading Combinations: - Check for consistency with GAI Specifications.			
a. Nuclear Boiler System, DSP-B21-1-4549-00, Rev. 1			N/A
b. HPCS, DSP-E22-1-4549-00, Rev. 1	X		
c. Cygna Criteria 83102-DC-2	X		

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1E22-H003

Reviewer S. Luo *S. Luo*

Checklist No. PS-02-H003

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
4. Gap: a. Check for consistency with Cygna Criteria 83102-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and dynamic movements in non-restraint directions?			N/A
5. Restraints: - Check whether the design satisfies the piping analysis application requirements.	X		
6. Spring Supports: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.3.		X	No calculation to check spring top-out or bottom-out. See Observation PS-00-07(f).
7. Hanger Rods: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.4.			N/A
8. Snubbers: - Check consistency with Cygna Criteria 83102-DC-2, Section. 4.1.5.			N/A

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Independent Design Review Checklist

PIPE SUPPORT MK-1E22-H003

Reviewer S. Luo *S. Luo* Checklist No. PS-02-H003

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
9. Strut: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.6.			N/A
10. Has the inertial load of the support been included in the design?		X	See Observation PS-00-06(b).
11. Base Plates and Anchor Bolts: a. Check consistency with Cygna criteria 83102-DC-2, Section 4.1.8. b. Does anchor bolt design meet the requirement of Cygna Criteria 83102-DC-2, Section 4.5?			N/A
12. Support attachment/connection to supporting structural element: Has design calculation been provided for support attachment/connection points?	X		
13. Design/Interface Requirements: a. Stiffness. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.1.1? b. Stiffness. Does the design meet the requirements of GAI Perry Project Pipe Support Design Instruction Manual?			N/A N/A

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Independent Design Review Checklist

PIPE SUPPORT MK-1E22-H003

Reviewer S. Luo S. Luo

Checklist No. PS-02-H003

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
c. Stresses. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.4?	X		
14. Inspect the following load cases, as applicable, for reasonableness (see Cygna Criteria 83102-DC-2, for definitions): a. DW h. PR b. T i. AP c. SUS j. PS d. OCC k. SRV e. OBE l. CHUG f. SSE m. CO g. JI n. WEIR o. FL	X		
15. Design Output: a. Does the design meet the functional requirements as defined in the piping analysis? b. Does the design reflect correctly all the physical arrangements shown on GAI drawing(s)?	 X X		

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1E22-H004

Reviewer S. Luo *S. Luo*

Checklist No. PS-02-H004

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
1. Design Input Data: - Check that all data is used correctly. Refer to Calc. No. 1E22G04(B), Rev. 1. Refer to GAI Drawing No. 04-4549-S-322-701, Rev. D.	X		
2. Design Assumptions & Design Methods: - Check the acceptability of the original design. Refer to Calc. No. 1E22G04(B), Rev. 1.	X		Design loads are much higher than current loads (acceptable).
3. Loading Combinations: - Check for consistency with GAI Specifications.			
a. Nuclear Boiler System, DSP-B21-1-4549-00, Rev. 1			N/A
b. HPCS, DSP-E22-1-4549-00, Rev. 1	X		
c. Cygna Criteria 83102-DC-2		X	See Observation PS-00-02(a).
4. Gap: a. Check for consistency with Cygna Criteria 83102-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and dynamic movements in non-restraint directions?			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1E22-H004

Reviewer S. Luo *S. Luo*

Checklist No. PS-02-H004

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
5. Restraints: - Check whether the design satisfies the piping analysis application requirements.	X		
6. Spring Supports: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.3.			N/A
7. Hanger Rods: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.4.			N/A
8. Snubbers: - Check consistency with Cygna Criteria 83102-DC-2, Section. 4.1.5.			N/A
9. Strut: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.6.	X		Swing angle was not checked, but it is still within the allowable range.
10. Has the inertial load of the support been included in the design?		X	See Observation PS-00-06(b).

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Independent Design Review Checklist

PIPE SUPPORT MK-1E22-H004

Reviewer S. Luo S. Luo

Checklist No. PS-02-H004

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
11. Base Plates and Anchor Bolts: a. Check consistency with Cygna criteria 83102-DC-2, Section 4.1.8. b. Does anchor bolt design meet the requirement of Cygna Criteria 83102-DC-2, Section 4.5?			N/A
12. Support attachment/connection to supporting structural element: Has design calculation been provided for support attachment/connection points?	X		
13. Design/Interface Requirements: a. Stiffness. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.1.1?	X		
b. Stiffness. Does the design meet the requirements of GAI Perry Project Pipe Support Design Instruction Manual?	X		The spring constant for this support (pg. 7.2) was based on the size 40 rigid sway strut which was replaced by a 3" ϕ sch 40 pipe due to the minimum pin-to-pin distance. However, a solid circular section was used in stiffness calculation. This will reduce the original stiffness by 85% but it will still be greater than the allowable. See Observation PS-00-05(d).

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Independent Design Review Checklist

PIPE SUPPORT MK-1E22-H004

Reviewer S. Luo S. Luo **Checklist No.** PS-02-H004

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
c. Stresses. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.4?	X		
14. Inspect the following load cases, as applicable, for reasonableness (see Cygna Criteria 83102-DC-2, for definitions): a. DW b. T c. SUS d. OCC e. OBE f. SSE g. JI h. PR i. AP j. PS k. SRV l. CHUG m. CO n. WEIR o. FL	X		
15. Design Output: a. Does the design meet the functional requirements as defined in the piping analysis?	X		
b. Does the design reflect correctly all the physical arrangements shown on GAI drawing(s)?		X	Item L shown on call-out table does not match the design dimension shown in design calculation (pg. 10.33) and detail "L" shown on the drawing. However, both dimensions are acceptable. Restraint direction shown on the drawing does not match the real configuration. See Observation PS-00-01(1).

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Independent Design Review Checklist

PIPE SUPPORT MK-1E22-H005

Reviewer S. Luo S. Luo

Checklist No. PS-02-H005

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
1. Design Input Data: - Check that all data is used correctly. Refer to Calc. No. 1E22G04(B), Rev. 1. Refer to GAI Drawing No. 04-4549-S-322-701, Rev. A.	X		
2. Design Assumptions & Design Methods: - Check the acceptability of the original design. Refer to Calc. No. 1E22G04(B), Rev. 1.	X		1.5 load factor was used in design calculation which is acceptable.
3. Loading Combinations: - Check for consistency with GAI Specifications. a. Nuclear Boiler System, DSP-B21-1-4549-00, Rev. 1			N/A
b. HPCS, DSP-E22-1-4549-00, Rev. 1	X		
c. Cygna Criteria 83102-DC-2		X	See Observation PS-00-02(a).
4. Gap: a. Check for consistency with Cygna Criteria 83102-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and dynamic movements in non-restraint directions?			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1E22-H005

Reviewer S. Luo *S. Luo*

Checklist No. PS-02-H005

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
5. Restraints: - Check whether the design satisfies the piping analysis application requirements.	X		
6. Spring Supports: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.3.			N/A
7. Hanger Rods: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.4.			N/A
8. Snubbers: - Check consistency with Cygna Criteria 83102-DC-2, Section. 4.1.5.	X		Stroke set at midpoint.
9. Strut: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.6.			N/A

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Independent Design Review Checklist

PIPE SUPPORT MK-1E22-H005

Reviewer S. Luo S. Luo

Checklist No. PS-02-H005

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
10. Has the inertial load of the support been included in the design?		X	See Observation PS-00-06(b).
11. Base Plates and Anchor Bolts: a. Check consistency with Cygna criteria 83102-DC-2, Section 4.1.8. b. Does anchor bolt design meet the requirement of Cygna Criteria 83102-DC-2, Section 4.5?			N/A
12. Support attachment/connection to supporting structural element: Has design calculation been provided for support attachment/connection points?	X		
13. Design/Interface Requirements: a. Stiffness. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.1.1? b. Stiffness. Does the design meet the requirements of GAI Perry Project Pipe Support Design Instruction Manual? c. Stresses. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.4?	 X X X		

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Independent Design Review Checklist

PIPE SUPPORT MX-1E22-H005

Reviewer S. Luo *S. Luo*

Checklist No. PS-02-H005

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
14. Inspect the following load cases, as applicable, for reasonableness (see Cygna Criteria 83102-DC-2, for definitions): a. DW h. PR b. T i. AP c. SUS j. PS d. OCC k. SRV e. OBE l. CHUG f. SSE m. CO g. JI n. WEIR o. FL	X		
15. Design Output:			
a. Does the design meet the functional requirements as defined in the piping analysis?	X		
b. Does the design reflect correctly all the physical arrangements shown on GAI drawing(s)?	X		

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Independent Design Review Checklist

PIPE SUPPORT MK-1E22-H006

Reviewer S. Luo *S. Luo*		**Checklist No.**	PS-02-H006
		Date	12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
1. Design Input Data: - Check that all data is used correctly. Refer to Calc. No. 1E22G04(B), Rev. 1. Refer to GAI Drawing No. 04-4549-S322-701, Rev. B.	X		
2. Design Assumptions & Design Methods: - Check the acceptability of the original design. Refer to Calc. No. 1E22G04(B), Rev. 1.	X		• Loads from 1E22-H005 used in this design calculation were slightly less than the current loads (FY = 13.9 kips, FZ = 25.9 kips). The support is adequate, due to the low stresses. • Support frame weight was not included in the design. See Observation PS-00-06(a).
3. Loading Combinations: - Check for consistency with GAI Specifications. a. Nuclear Boiler System, DSP-B21-1-4549-00, Rev. 1 b. HPCS, DSP-E22-1-4549-00, Rev. 1 c. Cygna Criteria 83102-DC-2	 (a) (b) X (c) X		 N/A (a)
4. Gap: a. Check for consistency with Cygna Criteria 83102-DC-2 Section 4.1.2.			N/A

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Independent Design Review Checklist

PIPE SUPPORT MK-1E22-H006

Reviewer S. Luo S. Luo

Checklist No. PS-02-H006

Date 12/12/82

Item	Satisfactory Yes	Satisfactory No	Comments
b. Does the gap accommodate thermal and dynamic movements in non-restraint directions?			
5. Restraints: - Check whether the design satisfies the piping analysis application requirements.	X		
6. Spring Supports: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.3.	X		Cold setting calculation was not based on the normal thermal mode THN1 and there is no calculation to back up the cold setting shown on drawing. However, the design is still OK.
7. Hanger Rods: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.4.			N/A
8. Snubbers: - Check consistency with Cygna Criteria 83102-DC-2, Section. 4.1.5.			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1E22-H006

Reviewer S. Luo *S. Luo* Checklist No. PS-02-H006

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
9. Strut: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.6.			N/A
10. Has the inertial load of the support been included in the design?		X	See Observation PS-00-06(b).
11. Base Plates and Anchor Bolts: a. Check consistency with Cygna criteria 83102-DC-2, Section 4.1.8. b. Does anchor bolt design meet the requirement of Cygna Criteria 83102-DC-2, Section 4.5?			N/A
12. Support attachment/connection to supporting structural element: Has design calculation been provided for support attachment/connection points?	X		
13. Design/Interface Requirements: a. Stiffness. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.1.1? b. Stiffness. Does the design meet the requirements of GAI Perry Project Pipe Support Design Instruction Manual?			 a. N/A b. N/A

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Independent Design Review Checklist

PIPE SUPPORT MK-1E22-H006

Reviewer S. Luo S. Luo

Checklist No. PS-02-H006

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
c. Stresses. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.4?	X		
14. Inspect the following load cases, as applicable, for reasonableness (see Cygna Criteria 83102-DC-2, for definitions): a. DW h. PR b. T i. AP c. SUS j. PS d. OCC k. SRV e. OBE l. CHUG f. SSE m. CO g. JI n. WEIR o. FL	X		
15. Design Output: a. Does the design meet the functional requirements as defined in the piping analysis? b. Does the design reflect correctly all the physical arrangements shown on GAI drawing(s)?	 X X		

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H003

Reviewer R. Baliga R. BALIGA

Checklist No. PS-03-H003

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
1. Design Input Data: - Check that all data is used correctly. Refer to Calc. No. 1N22G01(B), Rev. 1. Refer to GAI Drawing No. 04-4549-S-322-121, Rev. A.		X	No reference is provided. Design is based on superseded loads rigid support. Snubber design is not provided. See Observation PS-00-01(t).
2. Design Assumptions & Design Methods: - Check the acceptability of the original design. Refer to Calc. No. 1N22G01(B), Rev. 1.	X		
3. Loading Combinations: - Check for consistency with GAI Specifications.			No reference is provided for load combination computer output.
a. Nuclear Boiler System, DSP-B21-1-4549-00, Rev. 1	X		
b. HPCS, DSP-E22-1-4549-00, Rev. 1			N/A
c. Cygna Criteria 83102-DC-2		X	See Observation PS-00-02(a).
4. Gap: a. Check for consistency with Cygna Criteria 83102-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and dynamic movements in non-restraint directions?			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H003

Reviewer R. Baliga R. BALIGA

Checklist No. PS-03-H003

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
5. Restraints: - Check whether the design satisfies the piping analysis application requirements.	X		
6. Spring Supports: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.3.			N/A
7. Hanger Rods: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.4.			N/A
8. Snubbers: - Check consistency with Cygna Criteria 83102-DC-2, Section. 4.1.5.	X		Cold setting is not shown on drawing sheet. Offset is not shown on support drawing. See Observation PS-00-01(t).
9. Strut: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.6.			N/A

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Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H003

Reviewer R. Baliga R. BALIGA

Checklist No. PS-03-H003

Date 12/11/8?

Item	Satisfactory Yes	Satisfactory No	Comments
10. Has the inertial load of the support been included in the design?		X	See Observation PS-00-06(b).
11. Base Plates and Anchor Bolts: a. Check consistency with Cygna criteria 83102-DC-2, Section 4.1.8. b. Does anchor bolt design meet the requirement of Cygna Criteria 83102-DC-2, Section 4.5?			N/A
12. Support attachment/connection to supporting structural element: Has design calculation been provided for support attachment/connection points?	X		No calculation is provided, but the weld connection is OK.
13. Design/Interface Requirements: a. Stiffness. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.1.1? b. Stiffness. Does the design meet the requirements of GAI Perry Project Pipe Support Design Instruction Manual? c. Stresses. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.4?	 X	X X	Change in stiffness due to snubber change from PSA-1/4 to PSA-1. See Observation PS-00-01(q).

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Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H003

Reviewer R. Baliga R. BALIGA

Checklist No. PS-03-H003

Date 12/15/83

Item	Satisfactory Yes	Satisfactory No	Comments
14. Inspect the following load cases, as applicable, for reasonableness (see Cygna Criteria 83102-DC-2, for definitions): a. DW h. PR b. T i. AP c. SUS j. PS d. OCC k. SRV e. OBE l. CHUG f. SSE m. CO g. JT n. WEIR o. FL	X		
15. Design Output:			
a. Does the design meet the functional requirements as defined in the piping analysis?	X		
b. Does the design reflect correctly all the physical arrangements shown on GAI drawing(s)?		X	Snubber offset is not shown on support drawing. See Observation PS-00-01(t).

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Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H004

Reviewer R. Baliga R. BALIGA

Checklist No. PS-03-H004

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
1. Design Input Data: - Check that all data is used correctly. Refer to Calc. No. 1N22G01(B), Rev. 1. Refer to GAI Drawing No. 044549S-322-121, Rev. A.	X		No reference is provided. Design is based on superseded loads. No proper documentation. Design is acceptable.
2. Design Assumptions & Design Methods: - Check the acceptability of the original design. Refer to Calc. No. 1N22G01(B), Rev. 1.	X		
3. Loading Combinations: - Check for consistency with GAI Specifications. a. Nuclear Boiler System, DSP-B21-1-4549-00, Rev. 1 b. HPCS, DSP-E22-1-4549-00, Rev. 1 c. Cygna Criteria 83102-DC-2	X 	 X	 N/A See Observation PS-00-02(a).
4. Gap: a. Check for consistency with Cygna Criteria 83102-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and dynamic movements in non-restraint directions?			N/A

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H004

Reviewer R. Baliga R. BALIGA

Checklist No. PS-03-H004

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
5. Restraints: - Check whether the design satisfies the piping analysis application requirements.	X		
6. Spring Supports: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.3.			N/A
7. Hanger Rods: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.4.			N/A
8. Snubbers: - Check consistency with Cygna Criteria 83102-DC-2, Section. 4.1.5.	X		
9. Strut: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.6.			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H004

Reviewer R. Baliga R. BALIGA

Checklist No. PS-03-H004

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
10. Has the inertial load of the support been included in the design?		X	See Observation PS-00-06(b).
11. Base Plates and Anchor Bolts: a. Check consistency with Cygna criteria 83102-DC-2, Section 4.1.8. b. Does anchor bolt design meet the requirement of Cygna Criteria 83102-DC-2, Section 4.5?			N/A
12. Support attachment/connection to supporting structural element: Has design calculation been provided for support attachment/connection points?	X		Design calculations are not shown but the connection is OK. See Observation PS-00-01(u).
13. Design/Interface Requirements: a. Stiffness. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.1.1?		X	Change in stiffness due to snubber change from PSA-1/4 to PSA-1. See Observation PS-00-01(q).
b. Stiffness. Does the design meet the requirements of GAI Perry Project Pipe Support Design Instruction Manual?		X	See Observation PS-00-05(k).
c. Stresses. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.4?	X		

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H004

Reviewer R. Baliga R. BALIGA **Checklist No.** PS-03-H004

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
14. Inspect the following load cases, as applicable, for reasonableness (see Cygna Criteria 83102-DC-2, for definitions): a. DW h. PR b. T i. AP c. SUS j. PS d. OCC k. SRV e. OBE l. CHUG f. SSE m. CO g. JI n. WEIR o. FL	X		
15. Design Output:			
a. Does the design meet the functional requirements as defined in the piping analysis?	X		
b. Does the design reflect correctly all the physical arrangements shown on GAI drawing(s)?	X		

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Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H005

Reviewer R. Baliga R. BALIGA **Checklist No.** PS-03-H005

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
1. Design Input Data: - Check that all data is used correctly. Refer to Calc. No. 1N22G01(B), Rev. 1. Refer to GAI Drawing No. 04-4549-S-322-121, Rev. A.	X		No reference is provided for loads on calculation sheet. Thermal modes are not defined. Poor documentation, but acceptable.
2. Design Assumptions & Design Methods - Check the acceptability of the original design. Refer to Calc. No. 1N22G01(B), Rev. 1.	X		Acceptable, but no proper documentation.
3. Loading Combinations: - Check for consistency with GAI Specifications.			
a. Nuclear Boiler System, DSP-B21-1-4549-00, Rev. 1	X		
b. HPCS, DSP-E22-1-4549-00, Rev. 1			N/A
c. Cygna Criteria 83102-DC-2	X		
4. Gap: a. Check for consistency with Cygna Criteria 83102-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and dynamic movements in non-restraint directions?			N/A; spring hanger

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Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H005

Reviewer R. Baliga R. BALIGA

Checklist No. PS-03-H005

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
5. Restraints: - Check whether the design satisfies the piping analysis application requirements.	X		
6. Spring Supports: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.3.	X		Spring should be checked for seismic movements to avoid touching of top and bottom of spring. See Observation PS-00-07(f).
7. Hanger Rods: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.4.			N/A
8. Snubbers: - Check consistency with Cygna Criteria 83102-DC-2, Section. 4.1.5.			N/A
9. Strut: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.6.			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H005

Reviewer R. Baliga R. BALIGA

Checklist No. PS-03-H005

Date 12/13/8[illegible]

Item	Satisfactory Yes	Satisfactory No	Comments
10. Has the inertial load of the support been included in the design?		X	See Observation PS-00-06(b).
11. Base Plates and Anchor Bolts: a. Check consistency with Cygna criteria 83102-DC-2, Section 4.1.8. b. Does anchor bolt design meet the requirement of Cygna Criteria 83102-DC-2, Section 4.5?			N/A; attached to existing steel.
12. Support attachment/connection to supporting structural element: Has design calculation been provided for support attachment/connection points?	X		Exact moment distributed to structural steel is not calculated, but OK.
13. Design/Interface Requirements: a. Stiffness. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.1.1? b. Stiffness. Does the design meet the requirements of GAI Perry Project Pipe Support Design Instruction Manual? c. Stresses. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.4?	 X X X		 Stiffness calculation for steel frame is not shown. See Observation PS-00-01(r).

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H005

Reviewer R. Baliga R. BALIGA

Checklist No. PS-03-H005

Date 12/15/83

Item	Satisfactory Yes	Satisfactory No	Comments
14. Inspect the following load cases, as applicable, for reasonableness (see Cygna Criteria 83102-DC-2, for definitions): a. DW h. PR b. T i. AP c. SUS j. PS d. OCC k. SRV e. OBE l. CHUG f. SSE m. CO g. JI n. WEIR o. FL	X		
15. Design Output:			
a. Does the design meet the functional requirements as defined in the piping analysis?	X		
b. Does the design reflect correctly all the physical arrangements shown on GAI drawing(s)?	X		

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H006

Reviewer R. Baliga R. BALIGA

Checklist No. PS-03-H006

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
1. Design Input Data: - Check that all data is used correctly. Refer to Calc. No. 1N22G01(B), Rev. 1. Refer to GAI Drawing No. 04-4549-S-322-121, Rev. A.	X		No reference for loads. Thermal modes are not defined. Poor documentation.
2. Design Assumptions & Design Methods: - Check the acceptability of the original design. Refer to Calc. No. 1N22G01(B), Rev. 1.	X		
3. Loading Combinations: - Check for consistency with GAI Specifications.			
a. Nuclear Boiler System, DSP-B21-1-4549-00, Rev. 1	X		
b. HPCS, DSP-E22-1-4549-00, Rev. 1			N/A
c. Cygna Criteria 83102-DC-2		X	See Observation PS-00-02(a).
4. Gap: a. Check for consistency with Cygna Criteria 83102-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and dynamic movements in non-restraint directions?			N/A. With thermal movements in unrestrained direction, swing angle is within 5°.

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H006

Reviewer R. Baliga *R. BALIGA* **Checklist No.** PS-03-H006

Date *12/15/83*

Item	Satisfactory Yes	Satisfactory No	Comments
5. Restraints: - Check whether the design satisfies the piping analysis application requirements.	X		
6. Spring Supports: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.3.			N/A
7. Hanger Rods: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.4.			N/A
8. Snubbers: - Check consistency with Cygna Criteria 83102-DC-2, Section. 4.1.5.	X		
9. Strut: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.6.			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H006

Reviewer R. Baliga R. BALIGA

Checklist No. PS-03-H006

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
10. Has the inertial load of the support been included in the design?		X	See Observation PS-00-06(b).
11. Base Plates and Anchor Bolts: a. Check consistency with Cygna criteria 83102-DC-2, Section 4.1.8. b. Does anchor bolt design meet the requirement of Cygna Criteria 83102-DC-2, Section 4.5?			N/A
12. Support attachment/connection to supporting structural element: Has design calculation been provided for support attachment/connection points?	X		
13. Design/Interface Requirements: a. Stiffness. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.1.1? b. Stiffness. Does the design meet the requirements of GAI Perry Project Pipe Support Design Instruction Manual? c. Stresses. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.4?	 a. b. c. X	 a. X b. X	 Change in stiffness due to snubber change from PSA-1/4 to PSA-1. See Observation PS-00-01(q). See Observation PS-00-05(k).

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H006

Reviewer R. Baliga R. BALIGA

Checklist No. PS-03-H006

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
14. Inspect the following load cases, as applicable, for reasonableness (see Cygna Criteria 83102-DC-2, for definitions): a. DW h. PR b. T i. AP c. SUS j. PS d. OCC k. SRV e. OBE l. CHUG f. SSE m. CO g. JI n. WEIR o. FL	X		
15. Design Output: a. Does the design meet the functional requirements as defined in the piping analysis? b. Does the design reflect correctly all the physical arrangements shown on GAI drawing(s)?	 X X		

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H007

Reviewer R. Baliga R. BALIGA

Checklist No. PS-03-H007

Date 12/15/83

Item	Satisfactory Yes	Satisfactory No	Comments
1. Design Input Data: - Check that all data is used correctly. Refer to Calc. No. 1N22G01(B), Rev. 1. Refer to GAI Drawing No. 04-4549-S-322-121, Rev. A.	X		No calculation is provided for final design, but OK. Design is based on Calculation Sect. 11, Sub. 4, pg. 10-13c, d.
2. Design Assumptions & Design Methods: - Check the acceptability of the original design. Refer to Calc. No. 1N22G01(B), Rev. 1.	X		Design for superseded loads are available. Design sketch does not match with the final support drawing (see above).
3. Loading Combinations: - Check for consistency with GAI Specifications. a. Nuclear Boiler System, DSP-B21-1-4549-00, Rev. 1	X		
b. HPCS, DSP-E22-1-4549-00, Rev. 1			N/A
c. Cygna Criteria 83102-DC-2		X	See Observation PS-00-02.
4. Gap: a. Check for consistency with Cygna Criteria 83102-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and dynamic movements in non-restraint directions?			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H007

Reviewer R. Baliga R. BALIGA

Checklist No. PS-03-H007

Date 12/1/83

Item	Satisfactory Yes	Satisfactory No	Comments
5. Restraints: - Check whether the design satisfies the piping analysis application requirements.	X		
6. Spring Supports: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.3.			N/A
7. Hanger Rods: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.4.			N/A
8. Snubbers: - Check consistency with Cygna Criteria 83102-DC-2, Section. 4 1.5.	X		
9. Strut: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.6.			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H007

Reviewer R. Baliga R. BALIGA

Checklist No. PS-03-H007

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
10. Has the inertial load of the support been included in the design?		X	See Observation PS-00-06(b).
11. Base Plates and Anchor Bolts: a. Check consistency with Cygna criteria 83102-DC-2, Section 4.1.8. b. Does anchor bolt design meet the requirement of Cygna Criteria 83102-DC-2, Section 4.5?			N/A
12. Support attachment/connection to supporting structural element: Has design calculation been provided for support attachment/connection points?	X		See Observation PS-00-05(1).
13. Design/Interface Requirements: a. Stiffness. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.1.1? b. Stiffness. Does the design meet the requirements of GAI Perry Project Pipe Support Design Instruction Manual? c. Stresses. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.4?	 a. b. c. X	 a. X b. X c.	 Stiffness calculation is not provided. See Observation PS-00-01(v).

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Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H007

Reviewer R. Baliga R. BALIGA

Checklist No. PS-03-H007

Date 12/15/82

Item	Satisfactory Yes	Satisfactory No	Comments
14. Inspect the following load cases, as applicable, for reasonableness (see Cygna Criteria 83102-DC-2, for definitions): a. DW h. PR b. T i. AP c. SUS j. PS d. OCC k. SRV e. OBE l. CHUG f. SSE m. CO g. JI n. WEIR o. FL	X		
15. Design Output:			
a. Does the design meet the functional requirements as defined in the piping analysis?	X		
b. Does the design reflect correctly all the physical arrangements shown on GAI drawing(s)?	X		

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H008

Reviewer R. Baliga R. BALIGA

Checklist No. PS-03-H008

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
1. Design Input Data: - Check that all data is used correctly. Refer to Calc. No. 1N22G01(B), Rev. 1. Refer to GAI Drawing No. 04-4549-S-322-121, Rev. A.	X		
2. Design Assumptions & Design Methods: - Check the acceptability of the original design. Refer to Calc. No. 1N22G01(B), Rev. 1.	X		
3. Loading Combinations: - Check for consistency with GAI Specifications.			
a. Nuclear Boiler System, DSP-B21-1-4549-00, Rev. 1	X		
b. HPCS, DSP-E22-1-4549-00, Rev. 1			N/A
c. Cygna Criteria 83102-DC-2		X	See Observation PS-00-02(a).
4. Gap: a. Check for consistency with Cygna Criteria 83102-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and dynamic movements in non-restraint directions?			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H008

Reviewer R. Baliga R. BALIGA **Checklist No.** PS-03-H008

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
5. Restraints: - Check whether the design satisfies the piping analysis application requirements.	X		
6. Spring Supports: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.3.			N/A
7. Hanger Rods: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.4.			N/A
8. Snubbers: - Check consistency with Cygna Criteria 83102-DC-2, Section. 4.1.5.		X	Resetting of snubber is required. Set 2 7/8" outside and 1 1/8" inside. See Observation PS-00-07(e).
9. Strut: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.6.			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H008

Reviewer R. Baliga R. BALIGA

Checklist No. PS-03-H008

Date 12/13/8

Item	Satisfactory Yes	Satisfactory No	Comments
10. Has the inertial load of the support been included in the design?		X	See Observation PS-00-06(b).
11. Base Plates and Anchor Bolts: a. Check consistency with Cygna criteria 83102-DC-2, Section 4.1.8. b. Does anchor bolt design meet the requirement of Cygna Criteria 83102-DC-2, Section 4.5?			N/A
12. Support attachment/connection to supporting structural element: Has design calculation been provided for support attachment/connection points?	X		
13. Design/Interface Requirements: a. Stiffness. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.1.1? b. Stiffness. Does the design meet the requirements of GAI Perry Project Pipe Support Design Instruction Manual? c. Stresses. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.4?	 X	X X	Change in stiffness due to snubber change from PSA-1/2 to PSA-1. See Observation PS-00-01(q). See Observation PS-00-05(k).

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Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H008

Reviewer R. Baliga R. BALIGA

Checklist No. PS-03-H008

Date 12/13/8

Item	Satisfactory Yes	Satisfactory No	Comments
14. Inspect the following load cases, as applicable, for reasonableness (see Cygna Criteria 83102-DC-2, for definitions): a. DW h. PR b. T i. AP c. SUS j. PS d. OCC k. SRV e. OBE l. CHUG f. SSE m. CO g. JI n. WEIR o. FL	X		
15. Design Output:			
a. Does the design meet the functional requirements as defined in the piping analysis?	X		
b. Does the design reflect correctly all the physical arrangements shown on GAI drawing(s)?	X		

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H009

Reviewer R. Baliga R. BALIGA

Checklist No. PS-03-H009

Date 12/15/83

Item	Satisfactory Yes	Satisfactory No	Comments
1. Design Input Data: - Check that all data is used correctly. Refer to Calc. No. 1N22G01(B), Rev. 1. Refer to GAI Drawing No. 04-4549-S-322-121, Rev. A.	X		No reference is provided for loads.
2. Design Assumptions & Design Methods: - Check the acceptability of the original design. Refer to Calc. No. 1N22G01(B), Rev. 1.	X		
3. Loading Combinations: - Check for consistency with GAI Specifications.			Design loads are much larger than actual loads. Hence, OK.
a. Nuclear Boiler System, DSP-B21-1-4549-00, Rev. 1	X		
b. HPCS, DSP-E22-1-4549-00, Rev. 1			N/A
c. Cygna Criteria 83102-DC-2		X	See Observation PS-00-02(a).
4. Gap: a. Check for consistency with Cygna Criteria 83102-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and dynamic movements in non-restraint directions?			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H009

Reviewer R. Baliga R. BALIGA

Checklist No. PS-03-H009

Date 12/11/83

Item	Satisfactory Yes	Satisfactory No	Comments
5. Restraints: - Check whether the design satisfies the piping analysis application requirements.	X		
6. Spring Supports: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.3.			N/A
7. Hanger Rods: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.4.			N/A
8. Snubbers: - Check consistency with Cygna Criteria 83102-DC-2, Section. 4.1.5.	X		
9. Strut: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.6.			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H009

Reviewer R. Baliga *R. Baliga* Checklist No. PS-03-H009

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
10. Has the inertial load of the support been included in the design?		X	See Observation PS-00-06(b).
11. Base Plates and Anchor Bolts: a. Check consistency with Cygna criteria 83102-DC-2, Section 4.1.8. b. Does anchor bolt design meet the requirement of Cygna Criteria 83102-DC-2, Section 4.5?			N/A
12. Support attachment/connection to supporting structural element: Has design calculation been provided for support attachment/connection points?	X		
13. Design/Interface Requirements: a. Stiffness. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.1.1? b. Stiffness. Does the design meet the requirements of GAI Perry Project Pipe Support Design Instruction Manual? c. Stresses. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.4?	 X	X X	Change in stiffness due to snubber change from PSA-1/4 to PSA-1/2. See Observation PS-00-01(q). See Observation PS-00-05(k).

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H009

Reviewer R. Baliga *R. BALIGA*

Checklist No. PS-03-H009

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
14. Inspect the following load cases, as applicable, for reasonableness (see Cygna Criteria 83102-DC-2, for definitions): a. DW h. PR b. T i. AP c. SUS j. PS d. OCC k. SRV e. OBE l. CHUG f. SSE m. CO g. JI n. WEIR o. FL	X		
15. Design Output: a. Does the design meet the functional requirements as defined in the piping analysis? b. Does the design reflect correctly all the physical arrangements shown on GAI drawing(s)?	X		

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H010

Reviewer R. Baliga R. BALIGA

Checklist No. PS-03-H010

Date 12/13/85

Item	Satisfactory Yes	Satisfactory No	Comments
1. Design Input Data: - Check that all data is used correctly. Refer to Calc. No. 1N22G01(B), Rev. 1. Refer to GAI Drawing No. 04-4549-S-322-121, Rev. A.	X		
2. Design Assumptions & Design Methods: - Check the acceptability of the original design. Refer to Calc. No. 1N22G01(B), Rev. 1.	X		
3. Loading Combinations: - Check for consistency with GAI Specifications.			
a. Nuclear Boiler System, DSP-B21-1-4549-00, Rev. 1	X		
b. HPCS, DSP-E22-1-4549-00, Rev. 1			N/A
c. Cygna Criteria 83102-DC-2	X		
4. Gap: a. Check for consistency with Cygna Criteria 83102-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and dynamic movements in non-restraint directions?			N/A

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H010

Reviewer R. Baliga R. BALIGA **Checklist No.** PS-03-H010

Date 12/13/82

Item	Satisfactory Yes	Satisfactory No	Comments
5. Restraints: - Check whether the design satisfies the piping analysis application requirements.	X		
6. Spring Supports: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.3.	X		Spring should be checked against the seismic movements to avoid the touching of top and bottom of the spring. See Observation PS-00-07(f).
7. Hanger Rods: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.4.			N/A
8. Snubbers: - Check consistency with Cygna Criteria 83102-DC-2, Section. 4.1.5.			N/A
9. Strut: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.6.			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H010

Reviewer R. Baliga R. BALIGA

Checklist No. PS-03-H010

Date 12/13/85

Item	Satisfactory Yes	Satisfactory No	Comments
10. Has the inertial load of the support been included in the design?		X	See Observation PS-00-06(b).
11. Base Plates and Anchor Bolts: a. Check consistency with Cygna criteria 83102-DC-2, Section 4.1.8. b. Does anchor bolt design meet the requirement of Cygna Criteria 83102-DC-2, Section 4.5?			N/A
12. Support attachment/connection to supporting structural element: Has design calculation been provided for support attachment/connection points?	X		
13. Design/Interface Requirements: a. Stiffness. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.1.1? b. Stiffness. Does the design meet the requirements of GAI Perry Project Pipe Support Design Instruction Manual? c. Stresses. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.4?	X X X		Spring is connected to L4 x 4 x 3/8 which is spanned across two existing W12 X 40. Calculation of stiffness for angle (5'-0" long) is not shown, but OK.

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H010

Reviewer R. Baliga *R. BALIGA*

Checklist No. PS-C3-H010

Date *12/13/82*

Item	Satisfactory Yes	Satisfactory No	Comments
14. Inspect the following load cases, as applicable, for reasonableness (see Cygna Criteria 83102-DC-2, for definitions): a. DW h. PR b. T i. AP c. SUS j. PS d. OCC k. SRV e. OBE l. CHUG f. SSE m. CO g. JI n. WEIR o. FL	X		
15. Design Output:			
a. Does the design meet the functional requirements as defined in the piping analysis?	X		
b. Does the design reflect correctly all the physical arrangements shown on GAI drawing(s)?	X		

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H011

Reviewer R. Baliga *R. BALIGA* Checklist No. PS-03-H011

Date *12/13/83*

Item	Satisfactory Yes	Satisfactory No	Comments
1. Design Input Data: - Check that all data is used correctly. Refer to Calc. No. 1N22G01(B), Rev. 1. Refer to GAI Drawing No. 04-4549-S-322-121, Rev. E.	X		
2. Design Assumptions & Design Methods: - Check the acceptability of the original design. Refer to Calc. No. 1N22G01(B), Rev. 1.	X		
3. Loading Combinations: - Check for consistency with GAI Specifications.			Loads are taken from unreferenced computer output.
a. Nuclear Boiler System, DSP-B21-1-4549-00, Rev. 1	X		
b. HPCS, DSP-E22-1-4549-00, Rev. 1			N/A
c. Cygna Criteria 83102-DC-2		X	See Observation PS-00-02(a).
4. Gap: a. Check for consistency with Cygna Criteria 83102-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and dynamic movements in non-restraint directions?			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H011

Reviewer R. Baliga *R. BALIGA* Checklist No. PS-03-H011

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
5. Restraints: - Check whether the design satisfies the piping analysis application requirements.	X		
6. Spring Supports: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.3.			N/A
7. Hanger Rods: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.4.			N/A
8. Snubbers: - Check consistency with Cygna Criteria 83102-DC-2, Section. 4.1.5.		X	See Observation PS-00-07(e).
9. Strut: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.6.			N/A

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H011

Reviewer R. Baliga R. BALIGA

Checklist No. PS-03-H011

Date 12/11/83

Item	Satisfactory Yes	Satisfactory No	Comments
10. Has the inertial load of the support been included in the design?		X	See Observation PS-00-06(b).
11. Base Plates and Anchor Bolts: a. Check consistency with Cygna criteria 83102-DC-2, Section 4.1.8. b. Does anchor bolt design meet the requirement of Cygna Criteria 83102-DC-2, Section 4.5?			N/A
12. Support attachment/connection to supporting structural element: Has design calculation been provided for support attachment/connection points?	X		
13. Design/Interface Requirements: a. Stiffness. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.1.1? b. Stiffness. Does the design meet the requirements of GAI Perry Project Pipe Support Design Instruction Manual? c. Stresses. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.4?	 X	X X	Change in stiffness due to snubber change from PSA-1/2 to PSA-3. See Observation PS-00-01(q). See Observation PS-00-05(k).

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H011

Reviewer R. Baliga R. BALIGA

Checklist No. PS-03-H011

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
14. Inspect the following load cases, as applicable, for reasonableness (see Cygna Criteria 83102-DC-2, for definitions): a. DW h. PR b. T i. AP c. SUS j. PS d. OCC k. SRV e. OBE l. CHUG f. SSE m. CO g. JI n. WEIR o. FL	X		
15. Design Output:			
a. Does the design meet the functional requirements as defined in the piping analysis?	X		
b. Does the design reflect correctly all the physical arrangements shown on GAI drawing(s)?	X		

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H012

Reviewer R. Baliga *R. BALIGA*

Checklist No. PS-03-H012

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
1. Design Input Data: - Check that all data is used correctly. Refer to Calc. No. 1N22G01(B), Rev. 1. Refer to GAI Drawing No. 04-4549-S-322-121, Rev. A.	X		
2. Design Assumptions & Design Methods: - Check the acceptability of the original design. Refer to Calc. No. 1N22G01(B), Rev. 1.	X		
3. Loading Combinations: - Check for consistency with GAI Specifications.			Taken directly from computer output which is not referenced.
a. Nuclear Boiler System, DSP-B21-1-4549-00, Rev. 1	X		
b. HPCS, DSP-E22-1-4549-00, Rev. 1			N/A
c. Cygna Criteria 83102-DC-2		X	See Observation PS-00-02(a).
4. Gap: a. Check for consistency with Cygna Criteria 83102-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and dynamic movements in non-restraint directions?			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H012

Reviewer R. Baliga R. BALIGA

Checklist No. PS-03-H012

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
5. Restraints: - Check whether the design satisfies the piping analysis application requirements.	X		
6. Spring Supports: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.3.			N/A
7. Hanger Rods: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.4.			N/A
8. Snubbers: - Check consistency with Cygna Criteria 83102-DC-2, Section. 4.1.5.	X		
9. Strut: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.6.			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H012

Reviewer R. Baliga R. BALIGA

Checklist No. PS-03-H012

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
10. Has the inertial load of the support been included in the design?		X	See Observation PS-00-06(b).
11. Base Plates and Anchor Bolts: a. Check consistency with Cygna criteria 83102-DC-2, Section 4.1.8. b. Does anchor bolt design meet the requirement of Cygna Criteria 83102-DC-2, Section 4.5?			N/A
12. Support attachment/connection to supporting structural element: Has design calculation been provided for support attachment/connection points?	X		
13. Design/Interface Requirements: a. Stiffness. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.1.1? b. Stiffness. Does the design meet the requirements of GAI Perry Project Pipe Support Design Instruction Manual? c. Stresses. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.4?	 a. b. c. X	 a. X b. X	 Change in stiffness due to snubber change from PSA-1/2 to PSA-1. See Observation PS-00-01(q). See Observation PS-00-05(k).

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H012

Reviewer R. Baliga R. BALIGA

Checklist No. PS-03-H012

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
14. Inspect the following load cases, as applicable, for reasonableness (see Cygna Criteria 83102-DC-2, for definitions): a. DW h. PR b. T i. AP c. SUS j. PS d. OCC k. SRV e. OBE l. CHUG f. SSE m. CO g. JI n. WEIR o. FL	X		
15. Design Output: a. Does the design meet the functional requirements as defined in the piping analysis?	X		
b. Does the design reflect correctly all the physical arrangements shown on GAI drawing(s)?	X		

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H013

Reviewer R. Baliga R. BALIGA

Checklist No. PS-03-H013

Date 12/13/8

Item	Satisfactory Yes	Satisfactory No	Comments
1. Design Input Data: - Check that all data is used correctly. Refer to Calc. No. 1N22G01(B), Rev. 1. Refer to GAI Drawing No. 04-4549-S-322-121, Rev. A.	X		No reference is provided.
2. Design Assumptions & Design Methods: - Check the acceptability of the original design. Refer to Calc. No. 1N22G01(B), Rev. 1.	X		
3. Loading Combinations: - Check for consistency with GAI Specifications.			
a. Nuclear Boiler System, DSP-B21-1-4549-00, Rev. 1	X		
b. HPCS, DSP-E22-1-4549-00, Rev. 1			N/A
c. Cygna Criteria 83102-DC-2		X	See Observation PS-00-02(a).
4. Gap: a. Check for consistency with Cygna Criteria 83102-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and dynamic movements in non-restraint directions?			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H013

Reviewer R. Baliga R BALIGA

Checklist No. PS-03-H013

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
5. Restraints: - Check whether the design satisfies the piping analysis application requirements.	X		
6. Spring Supports: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.3.			N/A
7. Hanger Rods: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.4.			N/A
8. Snubbers: - Check consistency with Cygna Criteria 83102-DC-2, Section. 4.1.5.		X	Snubber should be set at 0.325". See Observation PS-00-07(e).
9. Strut: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.6.			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H013

Reviewer R. Baliga R. BALIGA

Checklist No. PS-03-H013

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
10. Has the inertial load of the support been included in the design?		X	See Observation PS-00-06(b).
11. Base Plates and Anchor Bolts: a. Check consistency with Cygna criteria 83102-DC-2, Section 4.1.8. b. Does anchor bolt design meet the requirement of Cygna Criteria 83102-DC-2, Section 4.5?			N/A
12. Support attachment/connection to supporting structural element: Has design calculation been provided for support attachment/connection points?	X		
13. Design/Interface Requirements: a. Stiffness. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.1.1? b. Stiffness. Does the design meet the requirements of GAI Perry Project Pipe Support Design Instruction Manual? c. Stresses. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.4?	 X X X		

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H013

Reviewer R. Baliga R. BALIGA

Checklist No. PS-03-H013

Date 12/11/82

Item	Satisfactory Yes	Satisfactory No	Comments
14. Inspect the following load cases, as applicable, for reasonableness (see Cygna Criteria 83102-DC-2, for definitions): a. DW h. PR b. T i. AP c. SUS j. PS d. OCC k. SRV e. OBE l. CHUG f. SSE m. CO g. JI n. WEIR o. FL	X		
15. Design Output: a. Does the design meet the functional requirements as defined in the piping analysis?	X		
b. Does the design reflect correctly all the physical arrangements shown on GAI drawing(s)?	X		

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H014

Reviewer R. Baliga R. BALIGA

Checklist No. PS-03-H014

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
1. Design Input Data: - Check that all data is used correctly. Refer to Calc. No. 1N22G01(B), Rev. 1. Refer to GAI Drawing No. 044549S-322-121, Rev. B.	X		No reference is provided. Loads in Y-direction given on calculation sheet are not for this hanger (Y-load is for support H148). OK. See Observation PS-00-01(w).
2. Design Assumptions & Design Methods: - Check the acceptability of the original design. Refer to Calc. No. 1N22G01(B), Rev. 1.	X		
3. Loading Combinations: - Check for consistency with GAI Specifications.			Loads on drawing sheet are directly taken from computer output which is not referenced.
a. Nuclear Boiler System, DSP-B21-1-4549-00, Rev. 1	X		
b. HPCS, DSP-E22-1-4549-00, Rev. 1			N/A
c. Cygna Criteria 83102-DC-2		X	See Observation PS-00-02(a).
4. Gap: a. Check for consistency with Cygna Criteria 83102-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and dynamic movements in non-restraint directions?			N/A

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H014

Reviewer R. Baliga R. BALIGA

Checklist No. PS-03-H014

Date 12/19/83

Item	Satisfactory Yes	Satisfactory No	Comments
5. Restraints: - Check whether the design satisfies the piping analysis application requirements.	X		Design calculation for hanger H014 shows loads in X and Y direction. Support drawing shows hanger H014 only in X-direction and hanger H148 in Y-direction. Acceptable.
6. Spring Supports: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.3.			N/A
7. Hanger Rods: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.4.			N/A
8. Snubbers: - Check consistency with Cygna Criteria 83102-DC-2, Section. 4.1.5.	X		
9. Strut: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.6.			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H014

Reviewer R. Baliga R. BALIGA

Checklist No. PS-03-H014

Date 12/13/85

Item	Satisfactory Yes	Satisfactory No	Comments
10. Has the inertial load of the support been included in the design?		X	See Observation PS-00-06(b).
11. Base Plates and Anchor Bolts: a. Check consistency with Cygna criteria 83102-DC-2, Section 4.1.8. b. Does anchor bolt design meet the requirement of Cygna Criteria 83102-DC-2, Section 4.5?			N/A
12. Support attachment/connection to supporting structural element: Has design calculation been provided for support attachment/connection points?	X		
13. Design/Interface Requirements: a. Stiffness. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.1.1? b. Stiffness. Does the design meet the requirements of GAI Perry Project Pipe Support Design Instruction Manual? c. Stresses. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.4?	 a. b. c. X	 a. X b. X	Change in stiffness due to snubber change from PSA-1/2 to PSA-1. See Observation PS-00-01(q). See Observation PS-00-05(k)

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H014

Reviewer R. Baliga R. BALIGA

Checklist No. PS-03-H014

Date 12/13/8?

Item	Satisfactory Yes	Satisfactory No	Comments
14. Inspect the following load cases, as applicable, for reasonableness (see Cygna Criteria 83102-DC-2, for definitions): a. DW h. PR b. T i. AP c. SUS j. PS d. OCC k. SRV e. OBE l. CHUG f. SSE m. CO g. JI n. WEIR o. FL	X		
15. Design Output:			
a. Does the design meet the functional requirements as defined in the piping analysis?	X		
b. Does the design reflect correctly all the physical arrangements shown on GAI drawing(s)?	X		

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H015

Reviewer R. Baliga R. BALIGA

Checklist No. PS-03-H015

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
1. Design Input Data: - Check that all data is used correctly. Refer to Calc. No. 1N22G01(B), Rev. 1. Refer to GAI Drawing No. 04-4549-S-322-121, Rev. B.	X		Design is not updated to the latest loads. No reference is provided.
2. Design Assumptions & Design Methods: - Check the acceptability of the original design. Refer to Calc. No. 1N22G01(B), Rev. 1.	X		
3. Loading Combinations: - Check for consistency with GAI Specifications.			
a. Nuclear Boiler System, DSP-B21-1-4549-00, Rev. 1	X		
b. HPCS, DSP-E22-1-4549-00, Rev. 1			N/A
c. Cygna Criteria 83102-DC-2		X	See Observation PS-00-02(a).
4. Gap: a. Check for consistency with Cygna Criteria 83102-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and dynamic movements in non-restraint directions?			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H015

Reviewer R. Baliga R. BALIGA

Checklist No. PS-03-H015

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
5. Restraints: - Check whether the design satisfies the piping analysis application requirements.	X		
6. Spring Supports: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.3.			N/A
7. Hanger Rods: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.4.			N/A
8. Snubbers: - Check consistency with Cygna Criteria 83102-DC-2, Section. 4.1.5.	X		
9. Strut: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.6.			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H015

Reviewer R. Baliga *R. BALIGA*

Checklist No. PS-03-H015

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
10. Has the inertial load of the support been included in the design?		X	See Observation PS-00-06(b).
11. Base Plates and Anchor Bolts: a. Check consistency with Cygna criteria 83102-DC-2, Section 4.1.8. b. Does anchor bolt design meet the requirement of Cygna Criteria 83102-DC-2, Section 4.5?			N/A
12. Support attachment/connection to supporting structural element: Has design calculation been provided for support attachment/connection points?	X		
13. Design/Interface Requirements: a. Stiffness. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.1.1? b. Stiffness. Does the design meet the requirements of GAI Perry Project Pipe Support Design Instruction Manual? c. Stresses. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.4?	 X (c)	X (a) X (b)	Change in stiffness due to snubber change from PSA-1/2 to PSA-1. See Observation PS-00-01(q). See Observation PS-00-05(k)

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H015

Reviewer R. Baliga R. BALIGA **Checklist No.** PS-03-H015

Date 12/15/83

Item	Satisfactory Yes	Satisfactory No	Comments
14. Inspect the following load cases, as applicable, for reasonableness (see Cygna Criteria 83102-DC-2, for definitions): a. DW h. PR b. T i. AP c. SUS j. PS d. OCC k. SRV e. OBE l. CHUG f. SSE m. CO g. JI n. WEIR o. FL	X		
15. Design Output: a. Does the design meet the functional requirements as defined in the piping analysis?	X		
b. Does the design reflect correctly all the physical arrangements shown on GAI drawing(s)?	X		

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H016

Reviewer S. Luo S. Luo

Checklist No. PS-03-H016

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
1. Design Input Data: - Check that all data is used correctly. Refer to Calc. No. 1N22G01(B), Rev. 1. Refer to GAI Drawing No. 04-4549-S-322-121, Rev. 2.	X		
2. Design Assumptions & Design Methods: - Check the acceptability of the original design. Refer to Calc. No. 1N22G01(B), Rev. 1.	X		Design load was higher than current load. OK.
3. Loading Combinations: - Check for consistency with GAI Specifications.			
a. Nuclear Boiler System, DSP-B21-1-4549-00, Rev. 1	X		
b. HPCS, DSP-E22-1-4549-00, Rev. 1			N/A
c. Cygna Criteria 83102-DC-2		X	See Observation PS-00-02(a).
4. Gap: a. Check for consistency with Cygna Criteria 83102-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and dynamic movements in non-restraint directions?			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H016

Reviewer S. Luo S. Luo

Checklist No. PS-03-H016

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
5. Restraints: - Check whether the design satisfies the piping analysis application requirements.	X		
6. Spring Supports: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.3.			N/A
7. Hanger Rods: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.4.			N/A
8. Snubbers: - Check consistency with Cygna Criteria 83102-DC-2, Section. 4.1.5.	X		Set at midstroke.
9. Strut: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.6.			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H016

Reviewer S. Luo S. Luo

Checklist No. PS-03-H016

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
10. Has the inertial load of the support been included in the design?		X	See Observation PS-00-02.
11. Base Plates and Anchor Bolts: a. Check consistency with Cygna criteria 83102-DC-2, Section 4.1.8. b. Does anchor bolt design meet the requirement of Cygna Criteria 83102-DC-2, Section 4.5?			N/A
12. Support attachment/connection to supporting structural element: Has design calculation been provided for support attachment/connection points?	X		
13. Design/Interface Requirements: a. Stiffness. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.1.1? b. Stiffness. Does the design meet the requirements of GAI Perry Project Pipe Support Design Instruction Manual? c. Stresses. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.4?	 X	X X	Change in stiffness due to snubber change to PSA-1. See Observation PS-00-01(q).

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H016

Reviewer S. Luo S. Luo

Checklist No. PS-03-H016

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
14. Inspect the following load cases, as applicable, for reasonableness (see Cygna Criteria 83102-DC-2, for definitions): a. DW h. PR b. T i. AP c. SUS j. PS d. OCC k. SRV e. OBE l. CHUG f. SSE m. CO g. JI n. WEIR o. FL	X		
15. Design Output:			
a. Does the design meet the functional requirements as defined in the piping analysis?	X		
b. Does the design reflect correctly all the physical arrangements shown on GAI drawing(s)?	X		

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H017

Reviewer S. Luo *S. Luo*

Checklist No. PS-03-H017

Date *12/13/83*

Item	Satisfactory Yes	Satisfactory No	Comments
1. Design Input Data: - Check that all data is used correctly. Refer to Calc. No. 1N22G01(B), Rev. 1. Refer to GAI Drawing No. 04--454-9-S322-121, Rev. A.	X		
2. Design Assumptions & Design Methods: - Check the acceptability of the original design. Refer to Calc. No. 1N22G01(B), Rev. 1.	X		See Observation PS-00-005(f).
3. Loading Combinations: - Check for consistency with GAI Specifications. a. Nuclear Boiler System, DSP-B21-1-4549-00, Rev. 1	X		
b. HPCS, DSP-E22-1-4549-00, Rev. 1			N/A
c. Cygna Criteria 83102-DC-2		X	See Observation PS-00-02(a).
4. Gap: a. Check for consistency with Cygna Criteria 83102-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and dynamic movements in non-restraint directions?			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H017

Reviewer S. Luo S. Luo

Checklist No. PS-03-H017

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
5. Restraints: - Check whether the design satisfies the piping analysis application requirements.	X		
6. Spring Supports: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.3.			N/A
7. Hanger Rods: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.4.			N/A
8. Snubbers: - Check consistency with Cygna Criteria 83102-DC-2, Section. 4.1.5.	X		
9. Strut: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.6.			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-HC17

Reviewer S. Luo S. Luo

Checklist No. PS-03-H017

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
10. Has the inertial load of the support been included in the design?		X	See Observation PS-00-06(b)
11. Base Plates and Anchor Bolts: a. Check consistency with Cygna criteria 83102-DC-2, Section 4.1.8. b. Does anchor bolt design meet the requirement of Cygna Criteria 83102-DC-2, Section 4.5?			N/A
12. Support attachment/connection to supporting structural element: Has design calculation been provided for support attachment/connection points?	X		
13. Design/Interface Requirements: a. Stiffness. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.1.1? b. Stiffness. Does the design meet the requirements of GAI Perry Project Pipe Support Design Instruction Manual? c. Stresses. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.4?	 a. b. c. X	 a. X b. X c.	 a. Change in stiffness due to snubber change from PSA-1/4 to PSA-1. b. See Observation PS-00-01(q).

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H017

Reviewer S. Luo S. Luo

Checklist No. PS-03-H017

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
14. Inspect the following load cases, as applicable, for reasonableness (see Cygna Criteria 83102-DC-2, for definitions): a. DW h. PR b. T i. AP c. SUS j. PS d. OCC k. SRV e. OBE l. CHUG f. SSE m. CO g. JI n. WEIR o. FL	X		
15. Design Output:			
a. Does the design meet the functional requirements as defined in the piping analysis?	X		
b. Does the design reflect correctly all the physical arrangements shown on GAI drawing(s)?		X	See Observation PS-00-07(c).

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H018

Reviewer S. Luo S. Luo

Checklist No. PS-03-H018

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
1. Design Input Data: - Check that all data is used correctly. Refer to Calc. No. 1N22G01(B), Rev. 1. Refer to GAI Drawing No. 04-4549-S-322-121, Rev. A.		X	45° bracing member was used (pg. 10.31) in design calculation, but 30° was specified on the drawing. This effect is minor, since stresses were so low. See Observation PS-00-01(o).
2. Design Assumptions & Design Methods: - Check the acceptability of the original design. Refer to Calc. No. 1N22G01(B), Rev. 1.	X		
3. Loading Combinations: - Check for consistency with GAI Specifications. a. Nuclear Boiler System, DSP-B21-1-4549-00, Rev. 1	X		
b. HPCS, DSP-E22-1-4549-00, Rev. 1			N/A
c. Cygna Criteria 83102-DC-2		X	See Observation PS-00-02(a).
4. Gap: a. Check for consistency with Cygna Criteria 83102-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and dynamic movements in non-restraint directions?			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H018

Reviewer S. Luo S. Luo

Checklist No. PS-03-H018

Date 12/13/85

Item	Satisfactory Yes	Satisfactory No	Comments
5. Restraints: - Check whether the design satisfies the piping analysis application requirements.	X		
6. Spring Supports: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.3.			N/A
7. Hanger Rods: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.4.			N/A
8. Snubbers: - Check consistency with Cygna Criteria 83102-DC-2, Section. 4.1.5.			N/A
9. Strut: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.6.	X		

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H018

Reviewer S. Luo S. Luo

Checklist No. PS-03-H018

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
10. Has the inertial load of the support been included in the design?		X	See Observation PS-00-06(b).
11. Base Plates and Anchor Bolts: a. Check consistency with Cygna criteria 83102-DC-2, Section 4.1.8. b. Does anchor bolt design meet the requirement of Cygna Criteria 83102-DC-2, Section 4.5?			N/A
12. Support attachment/connection to supporting structural element: Has design calculation been provided for support attachment/connection points?	X		
13. Design/Interface Requirements: a. Stiffness. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.1.1? b. Stiffness. Does the design meet the requirements of GAI Perry Project Pipe Support Design Instruction Manual? c. Stresses. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.4?	 (a) (b) (c) X	 (a) X (b) X (c)	Stiffness calculation was not provided. Stiffness values shown on Sect. 7 were based on 1/2" snubber which was replaced by a sway strut later. See Observation PS-00-05(g).

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H018

Reviewer S. Luo S. Luo

Checklist No. PS-03-H018

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
14. Inspect the following load cases, as applicable, for reasonableness (see Cygna Criteria 83102-DC-2, for definitions): a. DW h. PR b. T i. AP c. SUS j. PS d. OCC k. SRV e. OBE l. CHUG f. SSE m. CO g. JI n. WEIR o. FL	X		
15. Design Output:			
a. Does the design meet the functional requirements as defined in the piping analysis?	X		
b. Does the design reflect correctly all the physical arrangements shown on GAI drawing(s)?		X	Plan view of item E and F is not consistent with Section A-A view on Sht. 018-3. No impact on design.

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H019

Reviewer S. Luo *S. Luo*

Checklist No. PS-03-H019

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
1. Design Input Data: - Check that all data is used correctly. Refer to Calc. No. 1N22G01(B), Rev. 1. Refer to GAI Drawing No. 04-4549-S-322-121, Rev. A.		X	Wrong thermal displacement was used in cold setting calculation. See Observation PS-00-07(d).
2. Design Assumptions & Design Methods: - Check the acceptability of the original design. Refer to Calc. No. 1N22G01(B), Rev. 1.	X		No calculation available to back up the cold setting value shown on the drawing. However, it was calculated incorrectly based on the current thermal displacement. See Observation PS-00-07(d). Normal thermal movement "THN2" was not used to calculate cold setting. (Maximum of thermal displacements was used.) See Observation PS-00-07(d). Cold setting value shown on the drawing was based on the thermal displacement from the previous analysis. See Observation PS-00-07(d). Spring top-out and bottom-out were not checked in the design calculation. See Observation PS-00-07(f).

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H019

Reviewer S. Luo S. Luo

Checklist No. PS-03-H019

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
3. Loading Combinations: - Check for consistency with GAI Specifications. a. Nuclear Boiler System, DSP-B21-1-4549-00, Rev. 1 b. HPCS, DSP-E22-1-4549-00, Rev. 1 c. Cygna Criteria 83102-DC-2	 X X		 N/A
4. Gap: a. Check for consistency with Cygna Criteria 83102-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and dynamic movements in non-restraint directions?			N/A
5. Restraints: - Check whether the design satisfies the piping analysis application requirements.	X		
6. Spring Supports: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.3.		X	See comments on Item 2 of this checklist.
7. Hanger Rods: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.4.			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H019

Reviewer S. Luo S. Luo **Checklist No.** PS-03-H019

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
8. Snubbers: - Check consistency with Cygna Criteria 83102-DC-2, Section. 4.1.5.			N/A
9. Strut: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.6.			N/A
10. Has the inertial load of the support been included in the design?		X	See Observation PS-00-06(b).
11. Base Plates and Anchor Bolts: a. Check consistency with Cygna criteria 83102-DC-2, Section 4.1.8. b. Does anchor bolt design meet the requirement of Cygna Criteria 83102-DC-2, Section 4.5?			N/A
12. Support attachment/connection to supporting structural element: Has design calculation been provided for support attachment/connection points?	X		

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H019

Reviewer S. Luo S. Luo

Checklist No. PS-03-H019

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
13. Design/Interface Requirements:			
a. Stiffness. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.1.1?			N/A
b. Stiffness. Does the design meet the requirements of GAI Perry Project Pipe Support Design Instruction Manual?			N/A
c. Stresses. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.4?	X		
14. Inspect the following load cases, as applicable, for reasonableness (see Cygna Criteria 83102-DC-2, for definitions): a. DW h. PR b. T i. AP c. SUS j. PS d. OCC k. SRV e. OBE l. CHUG f. SSE m. CO g. JI n. WEIR o. FL	X		

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H019

Reviewer S. Luo S. Luo

Checklist No. PS-03-H019

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
15. Design Output:			
a. Does the design meet the functional requirements as defined in the piping analysis?	X		
b. Does the design reflect correctly all the physical arrangements shown on GAI drawing(s)?		X	"MVMT" shown on drawing does not match the current thermal movements. See Observation PS-00-07(d).

Checklist References: ECN 10473-44-1632.
RAP 6702.

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H126

Reviewer S. Luo *S. Luo* Checklist No. PS-03-H126

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
1. Design Input Data: - Check that all data is used correctly. Refer to Calc. No. 1N22G01(B), Rev. 1. Refe to GAI Drawing No. 04-4549-S-322-121, Rev. A.	X		
2. Design Assumptions & Design Methods: - Check the acceptability of the original design. Refer to Calc. No. 1N22G01(B), Rev. 1.	X		Young's Modulus was not adjusted for temperature effects. See Observation PS-00-05(h).
3. Loading Combinations: - Check for consistency with GAI Specifications.			
a. Nuclear Boiler System, DSP-B21-1-4549-00, Rev. 1	X		
b. HPCS, DSP-E22-1-4549-00, Rev. 1			N/A
c. Cygna Criteria 83102-DC-2		X	See Observation PS-00-02(a).
4. Gap: a. Check for consistency with Cygna Criteria 83102-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and dynamic movements in non-restraint directions?			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H126

Reviewer S. Luo S. Luo

Checklist No. PS-03-H126

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
5. Restraints: - Check whether the design satisfies the piping analysis application requirements.	X		
6. Spring Supports: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.3.			N/A
7. Hanger Rods: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.4.			N/A
8. Snubbers: - Check consistency with Cygna Criteria 83102-DC-2, Section. 4.1.5.	X		
9. Strut: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.6.			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H126

Reviewer S. Luo S. Luo

Checklist No. PS-03-H126

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
10. Has the inertial load of the support been included in the design?		X	See Observation PS-00-06(b).
11. Base Plates and Anchor Bolts: a. Check consistency with Cygna criteria 83102-DC-2, Section 4.1.8. b. Does anchor bolt design meet the requirement of Cygna Criteria 83102-DC-2, Section 4.5?			N/A
12. Support attachment/connection to supporting structural element: Has design calculation been provided for support attachment/connection points?	X		
13. Design/Interface Requirements: a. Stiffness. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.1.1?		X	Support stiffness changed but still meets GAI criteria which allows for 15% variation in stiffness. See Observation PS-00-01(q).
b. Stiffness. Does the design meet the requirements of GAI Perry Project Pipe Support Design Instruction Manual?	X		
c. Stresses. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.4?	X		

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H126

Reviewer S. Luo S. Luo

Checklist No. PS-03-H126

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
14. Inspect the following load cases, as applicable, for reasonableness (see Cygna Criteria 83102-DC-2, for definitions): a. DW h. PR b. T i. AP c. SUS j. PS d. OCC k. SRV e. OBE l. CHUG f. SSE m. CO g. JI n. WEIR o. FL	X		
15. Design Output:			
a. Does the design meet the functional requirements as defined in the piping analysis?	X		
b. Does the design reflect correctly all the physical arrangements shown on GAI drawing(s)?		X	See Observation PS-00-01(p).

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H127

Reviewer S. Luo S. Luo

Checklist No. PS-03-H127

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
1. Design Input Data: - Check that all data is used correctly. Refer to Calc. No. 1N22G01(B), Rev. 1. Refer to GAI Drawing No. 04-45-9-S-322-121, Rev. A.	X		
2. Design Assumptions & Design Methods: - Check the acceptability of the original design. Refer to Calc. No. 1N22G01(B), Rev. 1.	X		Young's Modulus was not adjusted for temperature effects. See Observation PS-00-05(h).
3. Loading Combinations: - Check for consistency with GAI Specifications. a. Nuclear Boiler System, DSP-B21-1-4549-00, Rev. 1	X		
b. HPCS, DSP-E22-1-4549-00, Rev. 1			N/A
c. Cygna Criteria 83102-DC-2		X	See Observation PS-00-02(a).
4. Gap: a. Check for consistency with Cygna Criteria 83102-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and dynamic movements in non-restraint directions?			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H127

Reviewer S. Luo *S. Luo*

Checklist No. PS-03-H127

Date *12/13/83*

Item	Satisfactory Yes	Satisfactory No	Comments
5. Restraints: - Check whether the design satisfies the piping analysis application requirements.	X		
6. Spring Supports: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.3.			N/A
7. Hanger Rods: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.4.			N/A
8. Snubbers: - Check consistency with Cygna Criteria 83102-DC-2, Section. 4.1.5.	X		Snubber setting was computed on pg. 10.45 at 2.82", but was not called out on drawing. See Observation PS-00-07(e).
9. Strut: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.6.			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H127

Reviewer S. Luo S. Luo

Checklist No. PS-03-H127

Date 12/15/83

Item	Satisfactory Yes	Satisfactory No	Comments
10. Has the inertial load of the support been included in the design?		X	See Observation PS-00-06(b).
11. Base Plates and Anchor Bolts: a. Check consistency with Cygna criteria 83102-DC-2, Section 4.1.8. b. Does anchor bolt design meet the requirement of Cygna Criteria 83102-DC-2, Section 4.5?			N/A
12. Support attachment/connection to supporting structural element: Has design calculation been provided for support attachment/connection points?	X		
13. Design/Interface Requirements: a. Stiffness. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.1.1?		X	Support stiffness changed but still meets GAI criteria which allows for 15% variation in stiffness. See Observation PS-00-01(q).
b. Stiffness. Does the design meet the requirements of GAI Perry Project Pipe Support Design Instruction Manual?	X		
c. Stresses. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.4?	X		

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H127

Reviewer S. Luo S. Luo

Checklist No. PS-03-H127

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
14. Inspect the following load cases, as applicable, for reasonableness (see Cygna Criteria 83102-DC-2, for definitions): a. DW h. PR b. T i. AP c. SUS j. PS d. OCC k. SRV e. OBE l. CHUG f. SSE m. CO g. JI n. WEIR o. FL	X		
15. Design Output: a. Does the design meet the functional requirements as defined in the piping analysis?	X		
b. Does the design reflect correctly all the physical arrangements shown on GAI drawing(s)?		X	See Observation PS-00-01(p).

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H128

Reviewer S. Luo S. Luo

Checklist No. PS-03-H128

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
1. Design Input Data: - Check that all data is used correctly. Refer to Calc. No. 1N22G01(B), Rev. 1. Refer to GAI Drawing No. 04-4549-S-322-121, Rev. A.	X		
2. Design Assumptions & Design Methods: - Check the acceptability of the original design. Refer to Calc. No. 1N22G01(B), Rev. 1.	X		Young's Modulus was not adjusted for temperature effects. See Observation PS-00-05(h).
3. Loading Combinations: - Check for consistency with GAI Specifications. a. Nuclear Boiler System, DSP-B21-1-4549-00, Rev. 1 b. HPCS, DSP-E22-1-4549-00, Rev. 1 c. Cygna Criteria 83102-DC-2	X (a)	X (c)	b. N/A c. See Observation PS-00-02(a).
4. Gap: a. Check for consistency with Cygna Criteria 83102-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and dynamic movements in non-restraint directions?			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H128

Reviewer S. Luo S. Luo

Checklist No. PS-03-H128

Date 12/15/83

Item	Satisfactory Yes	Satisfactory No	Comments
5. Restraints: - Check whether the design satisfies the piping analysis application requirements.	X		
6. Spring Supports: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.3.			N/A
7. Hanger Rods: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.4.			N/A
8. Snubbers: - Check consistency with Cygna Criteria 83102-DC-2, Section. 4.1.5.	X		
9. Strut: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.6.			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H128

Reviewer S. Luo S. Luo

Checklist No. PS-03-H128

Date 12/15/83

Item	Satisfactory Yes	Satisfactory No	Comments
10. Has the inertial load of the support been included in the design?		X	See Observation PS-00-06(b).
11. Base Plates and Anchor Bolts: a. Check consistency with Cygna criteria 83102-DC-2, Section 4.1.8. b. Does anchor bolt design meet the requirement of Cygna Criteria 83102-DC-2, Section 4.5?			N/A
12. Support attachment/connection to supporting structural element: Has design calculation been provided for support attachment/connection points?	X		
13. Design/Interface Requirements: a. Stiffness. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.1.1? b. Stiffness. Does the design meet the requirements of GAI Perry Project Pipe Support Design Instruction Manual? c. Stresses. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.4?	 a. X b. X c. X		Acceptable, stiffness is close to the actual value input in the analysis.

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H128

Reviewer S. Luo S. Luo

Checklist No. PS-03-H128

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
14. Inspect the following load cases, as applicable, for reasonableness (see Cygna Criteria 83102-DC-2, for definitions): a. DW h. PR b. T i. AP c. SUS j. PS d. OCC k. SRV e. OBE l. CHUG f. SSE m. CO g. JI n. WEIR o. FL	X		
15. Design Output:			
a. Does the design meet the functional requirements as defined in the piping analysis?	X		
b. Does the design reflect correctly all the physical arrangements shown on GAI drawing(s)?		X	See Observation PS-00-01(p).

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H129

Reviewer S. Luo S. Luo

Checklist No. PS-03-H129

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
1. Design Input Data: - Check that all data is used correctly. Refer to Calc. No. 1N22G01(B), Rev. 1. Refer to GAI Drawing No. 04-4549-S-322-121, Rev. A.	X		
2. Design Assumptions & Design Methods: - Check the acceptability of the original design. Refer to Calc. No. 1N22G01(B), Rev. 1.	X		Young's Modulus was not adjusted for temperature effects. See Observation PS-00-05(h).
3. Loading Combinations: - Check for consistency with GAI Specifications. a. Nuclear Boiler System, DSP-B21-1-4549-00, Rev. 1	X		
b. HPCS, DSP-E22-1-4549-00, Rev. 1			N/A
c. Cygna Criteria 83102-DC-2		X	See Observation PS-00-02(a).
4. Gap: a. Check for consistency with Cygna Criteria 83102-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and dynamic movements in non-restraint directions?			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H129

Reviewer S. Luo S. Luo

Checklist No. PS-03-H129

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
5. Restraints: - Check whether the design satisfies the piping analysis application requirements.	X		
6. Spring Supports: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.3.			N/A
7. Hanger Rods: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.4.			N/A
8. Snubbers: - Check consistency with Cygna Criteria 83102-DC-2, Section. 4.1.5.		X	According to the dimension shown on the drawing, PSA-1 (P/N-1801163) could not be installed due to the violation of minimum pin-to-pin distance. See Observation PS-00-05(i).
9. Strut: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.6.			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H129

Reviewer S. Luo S. Luo

Checklist No. PS-03-H129

Date 2/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
10. Has the inertial load of the support been included in the design?		X	See Observation PS-00-06(b).
11. Base Plates and Anchor Bolts: a. Check consistency with Cygna criteria 83102-DC-2, Section 4.1.8. b. Does anchor bolt design meet the requirement of Cygna Criteria 83102-DC-2, Section 4.5?			N/A
12. Support attachment/connection to supporting structural element: Has design calculation been provided for support attachment/connection points?	X		
13. Design/Interface Requirements: a. Stiffness. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.1.1? b. Stiffness. Does the design meet the requirements of GAI Perry Project Pipe Support Design Instruction Manual? c. Stresses. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.4?	 X (b) X (c)	X (a)	a. Stiffness calculation did not consider the rotation of the member. Still OK.

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H129

Reviewer S. Luo S. Luo

Checklist No. PS-03-H129

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
14. Inspect the following load cases, as applicable, for reasonableness (see Cygna Criteria 83102-DC-2, for definitions): a. DW h. PR b. T i. AP c. SUS j. PS d. OCC k. SRV e. OBE l. CHUG f. SSE m. CO g. JI n. WEIR o. FL	X		
15. Design Output:			
a. Does the design meet the functional requirements as defined in the piping analysis?	X		
b. Does the design reflect correctly all the physical arrangements shown on GAI drawing(s)?		X	Cold setting value shown on the drawing call-out table must be verified. See Observation PS-00-05(i). See Observation PS-00-01(p).

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H130

Reviewer S. Luo *S. Luo*

Checklist No. PS-03-H130

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
1. Design Input Data: - Check that all data is used correctly. Refer to Calc. No. 1N22G01(B), Rev. 1. Refer to GAI Drawing No. 04-4549-S-322-121, Rev. A.	X		
2. Design Assumptions & Design Methods: - Check the acceptability of the original design. Refer to Calc. No. 1N22G01(B), Rev. 1.	X		
3. Loading Combinations: - Check for consistency with GAI Specifications.			
a. Nuclear Boiler System, DSP-B21-1-4549-00, Rev. 1	X		
b. HPCS, DSP-E22-1-4549-00, Rev. 1			N/A
c. Cygna Criteria 83102-DC-2		X	See Observation PS-00-02(a).
4. Gap: a. Check for consistency with Cygna Criteria 83102-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and dynamic movements in non-restraint directions?			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H130

Reviewer S. Luo S. Luo

Checklist No. PS-03-H130

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
5. Restraints: - Check whether the design satisfies the piping analysis application requirements.	X		
6. Spring Supports: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.3.			N/A
7. Hanger Rods: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.4.			N/A
8. Snubbers: - Check consistency with Cygna Criteria 83102-DC-2, Section. 4.1.5.	X		"N/A" was not specified on the drawing; midstroke setting is assumed.
9. Strut: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.6.			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H130

Reviewer S. Luo S. Luo

Checklist No. PS-03-H130

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
10. Has the inertial load of the support been included in the design?		X	See Observation PS-00-06(b).
11. Base Plates and Anchor Bolts: a. Check consistency with Cygna criteria 83102-DC-2, Section 4.1.8. b. Does anchor bolt design meet the requirement of Cygna Criteria 83102-DC-2, Section 4.5?			N/A
12. Support attachment/connection to supporting structural element: Has design calculation been provided for support attachment/connection points?	X		
13. Design/Interface Requirements: a. Stiffness. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.1.1?		X	Support stiffness changes but still meets GAI criteria which allows for 15% variation in stiffness.
b. Stiffness. Does the design meet the requirements of GAI Perry Project Pipe Support Design Instruction Manual?	X		See Observation PS-00-01(q).
c. Stresses. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.4?	X		

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H130

Reviewer S. Luo S. Luo

Checklist No. PS-03-H130

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comm[illegible]s
14. Inspect the following lo[illegible] cases, as applicable, for reasonableness (see Cy[illegible] [illegible]riteria 83102-DC-2, for definitions): a. DW [illegible] b. T [illegible] AP c. SUS [illegible] d. OCC k. SRV e. OBE l. CHUG f. SSE m. CO g. JI n. WEIR o. FL	X		
15. Design Outp[illegible]t: a. Does [illegible]e design meet the functional requirements as defined in the piping analysis?	X		
b. Does the design reflect correctly all the physical arrangements shown on GAI drawing(s)?		X	See Observation PS-00-01(p).

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H131

Reviewer S. Luo *S. Luo*

Checklist No. PS-03-H131

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
1. Design Input Data: - Check that all data is used correctly. Refer to Calc. No. 1N22G01(B), Rev. 1. Refer to GAI Drawing No. 04-4549-S-322-121, Rev. A.	X		
2. Design Assumptions & Design Methods: - Check the acceptability of the original design. Refer to Calc. No. 1N22G01(B), Rev. 1.		X	Welds between items C and D, appear to be inadequate. No weld check calculation provided. See Observation PS-00-05(j).
3. Loading Combinations: - Check for consistency with GAI Specifications.			
a. Nuclear Boiler System, DSP-B21-1-4549-00, Rev. 1	X		
b. HPCS, DSP-E22-1-4549-00, Rev. 1			N/A
c. Cygna Criteria 83102-DC-2		X	See Observation PS-00-02.
4. Gap: a. Check for consistency with Cygna Criteria 83102-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and dynamic movements in non-restraint directions?			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H131

Reviewer S. Luo *S. Luo*

Checklist No. PS-03-H131

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
5. Restraints: - Check whether the design satisfies the piping analysis application requirements.	X		
6. Spring Supports: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.3.			N/A
7. Hanger Rods: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.4.			N/A
8. Snubbers: - Check consistency with Cygna Criteria 83102-DC-2, Section. 4.1.5.	X		Stroke cannot be set at the middle (2") as specified, since the thermal movement in the restraint was already 2.0156". See Observation PS-00-05(j).
9. Strut: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.6.			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H131

Reviewer S. Luo *S. Luo*

Checklist No. PS-03-H131

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
10. Has the inertial load of the support been included in the design?		X	See Observation PS-00-06(b).
11. Base Plates and Anchor Bolts: a. Check consistency with Cygna criteria 83102-DC-2, Section 4.1.8. b. Does anchor bolt design meet the requirement of Cygna Criteria 83102-DC-2, Section 4.5?			N/A
12. Support attachment/connection to supporting structural element: Has design calculation been provided for support attachment/connection points?	X		
13. Design/Interface Requirements:			
a. Stiffness. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.1.1?	X		Computed stiffness was used in the analysis.
b. Stiffness. Does the design meet the requirements of GAI Perry Project Pipe Support Design Instruction Manual?	X		
c. Stresses. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.4?		X	See Item 2 of this Checklist.

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H131

Reviewer S. Luo S. Luo

Checklist No. PS-03-H131

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
14. Inspect the following load cases, as applicable, for reasonableness (see Cygna Criteria 83102-DC-2, for definitions): a. DW h. PR b. T i. AP c. SUS j. PS d. OCC k. SRV e. OBE l. CHUG f. SSE m. CO g. JI n. WEIR o. FL	X		
15. Design Output:			
a. Does the design meet the functional requirements as defined in the piping analysis?	X		
b. Does the design reflect correctly all the physical arrangements shown on GAI drawing(s)?		X	See Observation PS-00-01(p).

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H132

Reviewer S. Luo S. Luo

Checklist No. PS-03-H132

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
1. Design Input Data: - Check that all data is used correctly. Refer to Calc. No. 1N22G01(B), Rev. 1. Refer to GAI Drawing No. 04-4549-S-322-121, Rev. A.	X		Load used in design calculation is superseded. Support drawing shows the latest load. No reference is provided.
2. Design Assumptions & Design Methods: - Check the acceptability of the original design. Refer to Calc. No. 1N22G01(B), Rev. 1.	X		
3. Loading Combinations: - Check for consistency with GAI Specifications. a. Nuclear Boiler System, DSP-B21-1-4549-00, Rev. 1	X		Load combination is not shown. Satisfactory as per load output.
b. HPCS, DSP-E22-1-4549-00, Rev. 1			N/A
c. Cygna Criteria 83102-DC-2		X	See Observation PS-00-02(a).
4. Gap: a. Check for consistency with Cygna Criteria 83102-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and dynamic movements in non-restraint directions?			N/A

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H132

Reviewer S. Luo S. Luo

Checklist No. PS-03-H132

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
5. Restraints: - Check whether the design satisfies the piping analysis application requirements.	X		
6. Spring Supports: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.3.			N/A
7. Hanger Rods: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.4.			N/A
8. Snubbers: - Check consistency with Cygna Criteria 83102-DC-2, Section. 4.1.5.			N/A
9. Strut: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.6.	X		

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Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H132

Reviewer S. Luo S. Luo

Checklist No. PS-03-H132

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
10. Has the inertial load of the support been included in the design?		X	See Observation PS-00-06(b).
11. Base Plates and Anchor Bolts: a. Check consistency with Cygna criteria 83102-DC-2, Section 4.1.8. b. Does anchor bolt design meet the requirement of Cygna Criteria 83102-DC-2, Section 4.5?			N/A
12. Support attachment/connection to supporting structural element: Has design calculation been provided for support attachment/connection points?	X		
13. Design/Interface Requirements: a. Stiffness. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.1.1? b. Stiffness. Does the design meet the requirements of GAI Perry Project Pipe Support Design Instruction Manual? c. Stresses. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.4?	X X X		

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Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H132

Reviewer S. Luo S. Luo

Checklist No. PS-03-H132

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
14. Inspect the following load cases, as applicable, for reasonableness (see Cygna Criteria 83102-DC-2, for definitions): a. DW h. PR b. T i. AP c. SUS j. PS d. OCC k. SRV e. OBE l. CHUG f. SSE m. CO g. JI n. WEIR o. FL	X		
15. Design Output:			
a. Does the design meet the functional requirements as defined in the piping analysis?	X		
b. Does the design reflect correctly all the physical arrangements shown on GAI drawing(s)?	X		

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H148

Reviewer R. Baliga R. BALIGA

Checklist No. PS-03-H148

Date 12/12/83

Item	Satisfactory Yes	Satisfactory No	Comments
1. Design Input Data: - Check that all data is used correctly. Refer to Calc. No. 1N22G01(B), Rev. 1. and RAP 6701. Refer to GAI Drawing No. 04-4549-S-322-121, Rev. B.	X		Input data given in RAP # 6701.
2. Design Assumptions & Design Methods: - Check the acceptability of the original design. Refer to Calc. No. 1N22G01(B), Rev. 1. and RAP 6701.		X	No separate calculation is provided for the hanger. Partial calculation is shown in support H014 calculation sheet. See Observation PS-00-01(x).
3. Loading Combinations: - Check for consistency with GAI Specifications.			Per load combination computer output. No calculation is provided.
a. Nuclear Boiler System, DSP-B21-1-4549-00, Rev. 1	X		
b. HPCS, DSP-E22-1-4549-00, Rev. 1			N/A
c. Cygna Criteria 83102-DC-2		X	See Observation PS-00-02(a).
4. Gap: a. Check for consistency with Cygna Criteria 83102-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and dynamic movements in non-restraint directions?			N/A

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Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H148

Reviewer	R. Baliga	R. BALIGA	Checklist No.	PS-03-H148
			Date	12/15/83

Item	Satisfactory Yes	Satisfactory No	Comments
5. Restraints: - Check whether the design satisfies the piping analysis application requirements.	X		Per Rev. 5 of isometric drawing (D-314-011, Sht. 44).
6. Spring Supports: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.3.			N/A
7. Hanger Rods: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.4.			N/A
8. Snubbers: - Check consistency with Cygna Criteria 83102-DC-2, Section. 4.1.5.	X		
9. Strut: - Check consistency with Cygna Criteria 83102-DC-2, Section 4.1.6.			N/A

Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H148

Reviewer R. Baliga R. BALIGA

Checklist No. PS-03-H148

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
10. Has the inertial load of the support been included in the design?			N/A
11. Base Plates and Anchor Bolts: a. Check consistency with Cygna criteria 83102-DC-2, Section 4.1.8. b. Does anchor bolt design meet the requirement of Cygna Criteria 83102-DC-2, Section 4.5?			N/A
12. Support attachment/connection to supporting structural element: Has design calculation been provided for support attachment/connection points?		X	No calculation is provided for support attachment. See Observation PS-00-01(x).
13. Design/Interface Requirements: a. Stiffness. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.1.1? b. Stiffness. Does the design meet the requirements of GAI Perry Project Pipe Support Design Instruction Manual? c. Stresses. Does the design meet the requirements of Cygna Criteria 83102-DC-2, Section 4.4?	 X X 	 X	New stiffness has been reported to the analyst as per the statement on calculation sheet. No calculation is provided. See Observation PS-00-01(x).

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Independent Design Review Checklist

PIPE SUPPORT MK-1N22-H148

Reviewer R. Baliga R. BALIGA **Checklist No.** PS-03-H148

Date 12/13/83

Item	Satisfactory Yes	Satisfactory No	Comments
14. Inspect the following load cases, as applicable, for reasonableness (see Cygna Criteria 83102-DC-2, for definitions): a. DW h. PR b. T i. AP c. SUS j. PS d. OCC k. SRV e. OBE l. CHUG f. SSE m. CO g. JI n. WEIR o. FL	X		
15. Design Output: a. Does the design meet the functional requirements as defined in the piping analysis?	X		
b. Does the design reflect correctly all the physical arrangements shown on GAI drawing(s)?	X		See Item 2 of this Checklist.

CYGNA

Independent Design Review Checklist

MECHANICAL

MAIN STEAM - SRVS

Reviewer R. Hess *R. W. Hess*

Checklist No. ME-01

Date *11/18/83*

Item	Satisfactory Yes	Satisfactory No	Comments
1. GAI Design Specification DSP-B21-1-4549-00, Rev. 1, incorporates system requirements for flow, pressure, and temperature during all modes of operation as given by GE Specification 22A4622 and Process Diagram 105D5575.	X		No pressure drop is indicated between the relief valve outlet and the inlet to the quencher with a flow of 1×10^6 lb/hr in ≈ 100 feet of 10" and 12" pipe. See Observation ME-01-01.
2. Equipment and Piping Arrangement			
a. SRV discharge line sloped continuously downward from SRV to suppression pool.	X		
b. SRV discharge lines terminated below the suppression pool water level outside the drywell.	X		
c. SRV discharge lines located to evenly heat the suppression pool with discharge flow.	X		
d. SRV body drains piped to discharge lines.			N/A; none shown on drawings of valve.
e. SRV bonnet vent piped to suppression pool with 2" check valve as vacuum breaker.	X		2" check valve F100 as vacuum breaker El. 629'-0"
f. Two vacuum breaker on the SRV discharge line located in drywell as close as feasible to discharge line anchor.	X		6" stainless steel duo checks called for in Perry information list, but drawing from Anderson Greewood shows 6" swing check. No design impact.
g. Piping Materials	X		

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Independent Design Review Checklist

MECHANICAL

MAIN STEAM - SRVS

Reviewer R. Hess *R. W. Hess*

Checklist No. ME-01

Date *11/18/83*

Item	Satisfactory Yes	Satisfactory No	Comments
3. Vacuum Breaker F037 and F078			
a. $A/\sqrt{K}$ ratio equal to or greater than 0.30 ft^2.		X	Based on K = 1.6 maximum given in specification SP-639-4549-00, Rev. 1, for valve, the valve size would not meet this requirement. Actual A = .201 ft^2; per vendor drawing K = 1.408. See Observation ME-01-02.
b. Valve opening time shall be 0.2 seconds or less.	X		
c. Maximum ΔP to start opening is 0.2 psid.	X		
d. Maximum ΔP for full open condition is 0.5 psid.	X		
e. Size	X		6" specified
f. Pressure rating	X		300 lb
g. Maximum reverse ΔP	X		570 psig at 470°F
4. Flow calculation from SRV discharge to quencher		X	No calculation could be located by GAI. See Observation ME-01-01.
a. Geometry			
b. Static head			
c. Friction factor			
e. Total equivalent length			
f. Total pressure drop			
g. Flowrate 1×10^6 lb/hr sat steam at 550 psia			

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Independent Design Review Checklist

MECHANICAL

HPCS

Reviewer R. Hess *R. W. Hess*

Checklist No. ME-02

Date *11/18/83*

Item	Satisfactory Yes	Satisfactory No	Comments
1. GAI Design Specification DSP-E22-1-4549-00, Rev. 1, incorporates system requirements for flow, pressure, and temperature during all modes of operation as given by GE Specification 22A3131 and Process Diagram 762A455.		X	• GAI Specification Table 1 System Design Conditions--Design Flag 1 Conditions are given as 100 psig @ 212°F. This matches the GE table of design information on Drawing 762E455. However, the GAI operating conditions information in Table 1 lists operating conditions of 234 psig at 100°F for state points 16, 17 and 27 which are under Design Flag 1. The GAI piping classes for these pipe segments are D1-2, G1-2, and L1-2 which are acceptable for the stated operating conditions. See Observation ME-02-01(a). • GAI Specification Table 1 Mode A -- The pressure drop across valve F010 is given as 522' versus GE stated minimum of 62' and the drop across valve F011 is given as 116' versus 62'. These throttled positions of the valves were not used in sizing orifice D004. Per Calculation E22A-J the valves were assumed to be full open. See Observation ME-02-02.

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Independent Design Review Checklist

MECHANICAL

HPCS

Reviewer R. Hess R. W. Hess

Checklist No. ME-02

Date 11/18/83

Item	Satisfactory Yes	Satisfactory No	Comments
			• GAI Specification Table 1 Modes D thru J indicates the suppression pool pressure is 15 psig, while GE Drawing 762E455 either does not list a pressure or indicates it is 14.7 psia. See Observation ME-02-01(b). • GAI Specification Table 1 -- State point 1.5 pressure for all modes of operation is given as 36 psig. This does not match static head in tank at normal water level. In addition the pressure at state points 2 and 3 are also given as 36 psig under flow conditions of modes A, D, G and I. See Observation ME-02-01(c). • GAI Specification Table 1 for Modes D thru G -- The difference in pressure between the source of suction and the reactor vessel does not match the GE requirements of 1550 gpm at 1147 psid and 6110 gpm at 200 psid. See Observation ME-02-01(d). • GAI Specification Table 1 in Mode H The pressure at state points 16, 17 and 27 should be the same since they are all open to the suppession pool. See Observation ME-02-01(e).

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Independent Design Review Checklist

MECHANICAL

HPCS

Reviewer R. Hess *R. W. Hess*

Checklist No. ME-02

Date *11/18/83*

Item	Satisfactory Yes	Satisfactory No	Comments
2. Equipment and Piping Arrangement			
a. HPCS pump C001 suction below minimum water level in condensate tank and suppression pool.	X		
b. Flow Element N007 location-straight pipe length		X	Straight pipe length before inlet does not meet GE requirement of 43'. See Observation ME-02-03(c).
c. Check valve F005 located as close as possible to RV nozzle.	X		
d. Injection valve F004 located as close as possible to containment penetration.	X		
e. HPCS pump C001 low flow bypass valve F012 and test return valve F023 located as close as practical to containment penetration of the return line.		X	F023 is ≈14' from penetration. Appears it could be put closer. Based on survey, the normal distance is 1 to 5 feet. See Observation ME-02-03(b).
f. Suppression pool suction valve F015 located as close to containment as practical.	X		
g. Valve F010 located as close as practical to valve F011.	X		
h. Suppression pool suction strainer located at least 10 feet from drywell wall and below top vent at lowest elevation possible.	X		
i. Suppression pool suction strainer located outside safety relief valve discharge zones.		X	Exclusion zone center is 46'-6" from centerline of containment and extends to 56'-3" from centerline of containment. Strainer F.F. is 58' from centerline and extends to approximately 54' from centerline containment. See Observation ME-02-03(a).

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Independent Design Review Checklist

MECHANICAL

HPCS

Reviewer R. Hess R. W. Hess

Checklist No. ME-02

Date 11/18/83

Item	Satisfactory Yes	Satisfactory No	Comments
j. HPCS suction pressure indicator located two pipe diameters upstream of pump suction and five diameters downstream of any flow disrupting fixture.	X		Located on suction strainer and adjacent to tee. Not per GE primary criteria.
k. Recirculation pipe from fill pump C003 has sufficient surface area to insure convection cooling of pump bypass flow.	X		Simplified calculation for room temperature of 90°F indicates water temperature less than 150°F.
l. Valve F024 located below minimum water level in condensate tank and suppression pool.	X		Elevation 583.833' vs. 622'-6" and 589'-0".
m. Piping materials	X		Some heavier wall pipe used other than specified.
n. Location of discharge pressure indicator on HPCS Pump C001	X		Located 1' from discharge flange. Not per GE primary criteria.
3. Condensate Tank			
a. 150,000-gallon supply dedicated to HPCS.	X		
b. Adequate means of ensuring supply is available, i.e., isolation of other demands, level alarm	X		Level alarms
c. Seismic design of tank	X		
d. Freeze protection	X		Piping is buried.
4. HPCS Pump C001 NPSH			
a. Required versus available NPSH at runout flow with 212°F water and containment at 14.7 psia.	X		Acceptable, but calculation should be updated to latest geometry and pump data.
b. Available NPSH with suction strainer 50% plugged is greater than required NPSH.	X		

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Independent Design Review Checklist

MECHANICAL

HPCS

Reviewer R. Hess R. W. Hess

Checklist No. ME-02

Date 11/18/83

Item	Satisfactory Yes	Satisfactory No	Comments
5. HPCS Fill Pump C003			No sizing calculations could be located by GAI.
a. Capacity - gpm	X		40 gpm
b. Discharge Pressure	X		75' TDH
c. NPSH available versus required (3.2')	X		Based on condensate TK suction elevation.
d. Duty	X		40 year continuous
e. Specification SP-506-454, Rev. VI.		X	Inconsistent on connection sizes and minimum flow. Pump curve indicates a 1x2x7-1/2, drawing shows a 2x2x7-1/2. See Observation ME-02-08(a).
6. Suppression Pool Suction Strainer			
a. Pressure drop with strainer 50% plugged	X		1 psi specified maximum @ 8500 gpm, vendor calculation shows 0.6 psid.
b. Verification/analysis showing strainer not more than 50% plugged after 100 days post-LOCA operation		X	No such calculation/verification could be located. Strainer size and location acceptable for post loca operation per Perry FSAR Section 6.2.2.2 pgs 6.2-51 to 6.2-53.
c. Mesh size to prevent passage of particles larger than 0.094"	X		3/32" specified in SP-529-4549
7. Valve F005			
a. Size	X		

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Independent Design Review Checklist

MECHANICAL

HPCS

Reviewer R. Hess *R. W. Hess*

Checklist No. ME-02

Date *11/18/83*

Item	Satisfactory Yes	Satisfactory No	Comments
b. Remote test capability		X	Not shown on physical but air operator shown on P&ID and FSAR. See Observation ME-02-04.
c. Type		X	Swing check shown on P&ID but GAI parts list identifies as lift check. See Observation ME-02-04.
d. Rating		X	Pressure/temperature appears to match 600 lb not 900 lb as per Specification D1-1. See Observation ME-02-04. Note: GE approved use of this valve, but no information from the NRC is available.
8. Valve F036			
a. Size	X		12"
b. Type	X		Gear operated gate
c. Rating	X		900 lb B.W. end specified but Borg Warner drawing 83130-1 is for a 1500 lb valve.
d. Position indicator	X		
9. Valve F006			
a. Size	X		
b. Type	X		
c. Rating	X		1500 lb socket weld

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Independent Design Review Checklist

MECHANICAL

HPCS

Reviewer R. Hess R. W. Hess

Checklist No. ME-02

Date 11/18/83

Item	Satisfactory Yes	Satisfactory No	Comments
10. Valve F024			
a. Size	X		
b. Type		X	Swing check but no external test arm is shown on Borg Warner drawing 81510. See Observation ME-02-05.
c. Rating	X		900 lb butt weld.
11. Valve F016			
a. Size	X		
b. Type		X	Duo check drawing does not show any external test operator arm. See Observation ME-02-05.
c. Rating	X		150 lb
12. Relief Valve F014			No sizing calculations presented by GAI.
a. Size	X		1"x2" flanged
b. Set point	X		100 psig
c. Flow		X	16.2 gpm per Specification SP-523-4549, FSAR states capacity is <10 gpm. See Observation ME-02-08(c).
d. Accumulation	X		10%
e. Pressure rating	X		Specification L1-2 calls for 600 lb valves. This is a 150 lb valve by drawing.
f. Reseat pressure	X		None specified, but the valve is leak tested at 90% of set pressure.

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Independent Design Review Checklist

MECHANICAL

HPCS

Reviewer R. Hess *R. W. Hess*

Checklist No. ME-02

Date *11/18/83*

Item	Satisfactory Yes	Satisfactory No	Comments
13. Relief Valve F035			No sizing calculations presented by GAI.
a. Size	X		1-1/2"x2"
b. Set point	X		1560 psig
c. Flow	X		114 gpm
d. Accumulation	X		10%
e. Pressure rating		X	Specification D1-2 calls for 1500 lb for 2" and smaller valves. Valve drawing states this is a 900 lb valve. See Observation ME-02-08(g).
f. Reseat pressure	X		None specified but the valve is leak tested at 90% of set pressure.
14. Relief Valve F039			No sizing calculations presented by GAI.
a. Size	X		
b. Set point			N/A; not specified (Spec. SP-531-01-4549-00).
c. Accumulation			N/A; not specified.
d. Pressure rating	X		1500 lb socket weld
e. Reseat pressure			N/A; not specified.
f. Type	X		GE requires relief valve but GAI has used a lift check for thermal relief. See Observation ME-02-08(d).

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Independent Design Review Checklist

MECHANICAL

HPCS

Reviewer R. Hess R. W. Hess **Checklist No.** ME-02

Date 11/18/83

Item	Satisfactory Yes	Satisfactory No	Comments
15. Restricting Orifice D001			
a. Size	X		Calculated size of 1" diameter
b. Rating	X		
c. Material	X		
16. Restricting Orifice D002			
a. Size		X	Perry information system P7837151.S lists size as 6.51"; calculated size of 6.54". See Observation ME-02-08(e). Size may be affected by accuracy of system pressure drop calculations.
b. Rating	X		D1-2 specification calls for 900 lb for 3" and larger piping. Perry information system lists D002 as 1500 lb.
c. Material	X		
17. Restricting Orifice D003			
a. Size		X	Specification SP-506 gives minimum flow as 10 gpm and 15 gpm. Need back up calculation for available head loss. See Observation ME-02-06.
b. Rating	X		
c. Material	X		

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Independent Design Review Checklist

MECHANICAL

HPCS

Reviewer R. Hess R. V. Hess

Checklist No. ME-02

Date 11/18/83

Item	Satisfactory Yes	Satisfactory No	Comments
18. Restricting Orifice D004			
a. Size		X	Perry information system P7837151.S lists size as 4.32". Calculated size is 4.27". Sizing does not match specification DSP-E22-1-4549 state point analysis which indicates F010 and 4011 are throttled. Calculation did not include throttled position (ΔP) of valves. See Observation ME-02-08(f).
b. Rating	X		
c. Material	X		
19. Restricting Orifice D005			
a. Size		X	Calculated size of 5.1" diameter. See calculation comments on pump operating point. See Observation ME-02-08(g).
b. Rating	X		
c. Material	X		
20. Flow calculation from Condensate TK to RV nozzle			The following comments apply to calculations for mode A from Condensate TK to RV at 1550 gpm and Mode E from Condensate TK to RV at 6110 gpm.

Independent Design Review Checklist

MECHANICAL

HPCS

Reviewer R. Hess R. V. Hess

Checklist No. ME-02

Date 11/18/83

Item	Satisfactory Yes	Satisfactory No	Comments
			• No loss is included for the pump suction strainer D006. Even if strainer element is removed after startup tests, there should be some loss associated with assembly. See Observation ME-02-09(d). • The L/D used for valve F005 is 135 (swing check), but valve is a lift check and L/D should be 340. Increased head loss of 1.23' at 1550 gpm and 16.77' at 6110 gpm. See Observation ME-02-09(a). • Calculation pg. 13 indicates that the RCIC system is operating at the same time as HPCS. If not, the suction loss calculation is conservative. See Observation ME-02-09. • Static head comparison.

GAI Calculation		Elevation	
Condensate Low Water	=	633'-0"	
HPCS Pump Suction	=	571'-6-3/4"	-61.5'
RV Nozzle	=	644'-6"	
ΔH_{TOT}	=	+ 11'-6"	

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Independent Design Review Checklist

MECHANICAL

HPCS

Reviewer R. Hess *R. W. Hess*

Checklist No. ME-02

Date 11/18/83

Item	Satisfactory Yes	Satisfactory No	Comments
			Worst Case — Elevation Condensate Low Water = 622'-6" HPCS Pump Suction = 571'-6-3/4" -51' RV Nozzle = 644'-6" ΔH_{TOT} = + 22' GAI calculation is nonconservative at condensate TK level just prior to switchover to suppression pool suction. In addition, 150,000 gallon level in tank is given as 630'-9" on Drawing 302-102. See Observation ME-02-09(b). • In Mode E a suction flow rate of 7800 gpm is used for calculating suction head loss, but pump discharge flow is given as 6100 gpm. This is inconsistent but conservative. See Observation ME-02-09(c). • The head loss for valve F001 is calculated based on equation $h_L = f\ L/D\ \frac{v^2}{2g}$ with L/D = 13. However, on page 27 of calculation an additional loss of 0.4' is added for this valve. The 0.4' is a maximum drop for this valve given in GE PFD 762E455 and should not be added to

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Independent Design Review Checklist

MECHANICAL

HPCS

Reviewer R. Hess *R. W. Hess*

Checklist No. ME-02

Date 11/18/83

Item	Satisfactory Yes	Satisfactory No	Comments
			the calculated drop. However, the calculated drop is 0.51' which exceeds the GE maximum of 0.4'. Note: since this is a GE supplied valve, the 0.4' is a given for this valve and should be used to back calculate an equivalent L/D. See Observation ME-02-09(e).
			• Head loss for valve F004 has been added to loss on page 28 similar to above treatment of F001. The calculated head loss based on L/D of 13" and 12" pipe is 1.06' which is less than the GE maximum of 1.4'. In addition, the 1.4' loss has been added to the 16" diameter piping section instead of the 12" diameter piping section. See Observation ME-02-09(f).
a. Geometry	X		
b. Static head		X	
c. Friction factor	X		
d. Valve flow coefficients		X	Valve F005 L/D should be 340 not 135. Actual valve has C_v = 1993. See Observation ME-02-09(a).
e. Orifice flow coefficients	X		
f. Total equivalent length	X		Except for F005 L/D

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Independent Design Review Checklist

MECHANICAL

HPCS

Reviewer R. Hess R. W. Hess

Checklist No. ME-02

Date 11/18/83

Item	Satisfactory Yes	Satisfactory No	Comments
g. Pump curve operating point		X	Does not match curve supplied. See Observation ME-02-09(m).
h. Pipe size	X		
i. Total pressure drop		X	The total pressure drop calculated for both Modes A and E appear to be in error and will affect the orifice sizing calculations. See Observation ME-02-09(b).
j. Flow to RV at maximum and minimum pressures is 1550 gpm and 6110 gpm.	X		
21. Flow calculation from Suppression Pool to RV nozzle			The following comments apply to calculations for Mode B from Suppression Pool to RV at 1550 gpm, Mode C from Suppression Pool to RV at 6110 gpm, and Mode F from Suppression Pool to RV at 7800 gpm. • Pressure drop for pool suction strainer is given as 2.31' on page 18. Per specification SP-529-4549 this is the maximum pressure drop for the strainer at 8500 gpm with 50% of the strainer surface area blocked. A more realistic delta-P would be $\left(\frac{1500}{8500}\right)^2 2.31 = 0.08'$. See Observation ME-02-09(g).

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Independent Design Review Checklist

MECHANICAL

HPCS

Reviewer R. Hess *R. W. Hess*

Checklist No. ME-02

Date 11/18/83

Item	Satisfactory Yes	Satisfactory No	Comments
			• The suppression pool low water elevation is given as 592'-10" on page 20, but the NPSH calculation gives the minimum level as 589'-0". • The L/D and pressure drop for valve F005 is incorrect based on actual valve being a lift check and not a swing check. See Observation ME-02-09(a). • Pg. 22 (Mode C) - the resistance of valve F015 has been added into the drop for the suction line twice, once as $K = f\frac{L}{D}$ with L/D = 13 and once as the GE stated maximum of H_L = 0.07'. Since this is a GE supplied valve the 0.07' loss should be used. For 1550 gpm this would convert to $(\frac{1500}{6110})^2\ 0.07 = 0.0045'$. See Observation ME-02-09(k). • On pg. 23 of calculation the loss for valve F004 has been added twice. Once as $f\ L/D\ \frac{v^2}{2g}$ and once as the GE maximum of 1.4' at 6110 gpm. The GE valve should be used alone. See Observation ME-02-09(j).

CYGNA

Independent Design Review Checklist

MECHANICAL

HPCS

Reviewer R. Hess *R. W. Hess*

Checklist No. ME-02

Date *11/18/83*

Item	Satisfactory Yes	Satisfactory No	Comments
			• On pg. 32 of the calculation the drop for valve F015 in Mode F has been added in twice. See Observation ME-02-09(k). • In pg. 33 of the calculation it appears that the incorrect loss has been included for valve F004 in Mode F. See Observation ME-09-02(l).
a. Geometry	X		
b. Static head		X	Minimum water level in pool is 589' not 592'-10". See Observation ME-02-09(h).
c. Friction factor	X		
d. Valve flow coefficients		X	Valve F005 L/D should be 340 not 135. See Observation ME-02-09(a).
e. Orifice flow coefficients	X		
f. Total equivalent length	X		
g. Pump curve operating point		X	Does not match curve supplied. See Observation ME-02-09(m).
h. Pipe size	X		
i. Total pressure drop		X	Total pressure drop inaccuracies will affect orifice sizing. See Observation ME-02-09.
j. Flow 6110 and 1500 gpm at RV 210 and 1162	X		

CYGNA

Independent Design Review Checklist

MECHANICAL

HPCS

Reviewer R. Hess *R. W. Hess*

Checklist No. ME-02

Date 11/18/83

Item	Satisfactory Yes	Satisfactory No	Comments
22. Flow calculations from HPCS pump discharge to condensate tank			
a. Geometry	X		
b. Static head	X		
c. Friction factor	X		
d. Valve flow coefficients	X		
e. Orifice flow coefficients	X		
f. Total equivalent length	X		
g. Pump curve operating point		X	Does not match curve supplied in Byron Jackson Drawing PC 741-S-1414. Stamped "For Information Only." See Observation ME-02-09(m).
h. Pipe size	X		
i. Total pressure drop	X		
j. Flow to condensate tank is 6110 gpm	X		
23. Flow calculation from HPCS pump discharge to the suppression pool			
a. Geometry	X		
b. Static head	X		
c. Friction factor	X		
d. Valve flow coefficients	X		
e. Orifice flow coefficients	X		
f. Total equivalent length	X		
g. Pump curve operating point		X	Does not match curve supplied in Byron Jackson Drawing PC 741-S-1414. See Observation ME-02-09(m).

CYGNA

Independent Design Review Checklist

MECHANICAL

HPCS

Reviewer R. Hess *R. W. Hess*

Checklist No. ME-02

Date 11/18/83

Item	Satisfactory Yes	Satisfactory No	Comments
h. Pipe size	X		
i. Total pressure drop	X		
j. Flow to suppression pool is 7800 gpm	X		7000 gpm per pump curve.
24. Flow calculation from HPCS pump discharge thru bypass line to suppression pool			
a. Geometry	X		
b. Static head	X		
c. Friction factor	X		
d. Valve flow coefficients	X		
e. Orifice flow coefficients	X		
f. Total equivalent length	X		
g. Pump curve operating point		X	Does not match curve supplied. See Observation ME-02-09(m).
h. Pipe size	X		
i. Total pressure drop	X		
j. Flow to suppression pool is 600 gpm	X		
25. Inspection and Test			
a. All system check valves testable to verify free operation.		X	Not shown on vendor drawings. See Observation ME-02-05.
b. All active components functionally testable during normal plant operation.	X		
c. Drains provided for leak testing valves F005, F004, F010, F011, and F001.		X	Cannot verify for F001, F010 and F011. See Observation ME-02-07.

CYGNA

Independent Design Review Checklist

MECHANICAL

HPCS

Reviewer R. Hess *R. W. Hess*

Checklist No. ME-02

Date *11/18/83*

Item	Satisfactory Yes	Satisfactory No	Comments
d. Valve F005 leak detection drain from double stem packing		X	None shown on physical but 15 shown on P&ID. Valve vendor drawing has no external stem or leak off. See Observation ME-02-04.
e. ISI provisions of pipe and valves	X		

CYGNA

Independent Design Review Checklist

MECHANICAL

MSDS

Reviewer R. Hess R. W. Hess

Checklist No. ME-03

Date 11/18/83

Item	Satisfactory Yes	Satisfactory No	Comments
1. GAI Design Specification DSP-B21-1-4549-00, Rev. 1, incorporates system requirements for flow, pressure, and temperature during all modes of operation as given by GE Specification 22A4622 and Process Diagram 105D5575.		X	• The pressure drop from location 4 to 13 for a flow of 310 lb/hr is not the same for modes A, B and E. Mode A 1012.7 - 965 = 47.7 psi Mode B 1355 - 965 = 390 psi Mode C 1065 - 965 = 100 psi See Observation ME-03-01(a). • In Mode D the flow between locations 4 and 13 is 6670 lb/hr but the pressure drop between these location is given as (1065 - 965) = 100 psi, which is the same as Mode E with a flow of 310 lb/hr. See Observation ME-03-01(b). • The GAI specification indicates a continuous 310 lb/hr drain flow in Modes A, B, and E. The GE PFD Data 131C7911C and Specification 22A4622 indicate that the drain valve F033 only opens below 50% power (Mode E) and the flow is 2000 lb/hr. See Observation ME-03-01(c).

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Independent Design Review Checklist

MECHANICAL

MSDS

Reviewer R. Hess R. W. Hess

Checklist No. ME-03

Date 11/18/83

Item	Satisfactory Yes	Satisfactory No	Comments
			• Both the GE data and the GAI design specification show a 50 gpm at 125°F drain rate for Mode C. However, the two drain valves are 3/4" and there is approximately 125' of 3/4" pipe in this flow path which will signficantly reduce the drain rate with the GAI stated upstream pressure of 100 psia. In addition, no pressure drop is indicated across the two drain valves at the 50 gpm flow, i.e., 100 psia upstream and downstream. See Observation ME-03-01(d).
2. Equipment and Piping Arrangement			
a. Piping sloped to permit drainage to main condenser.	X		
b. Two MOV's provided; one inside containment and one outside containment.	X		
c. High flow MOV drain valve in parallel with low flow drain restricting orifice.	X		
d. MOV located upstream of restricting orifice to terminate drain flow.	X		
e. Piping routed to prevent crud traps.	X		
f. Piping materials	X		

Independent Design Review Checklist

MECHANICAL

MSDS

Reviewer R. Hess *R. V. Hess*

Checklist No. ME-03

Date 11/18/83

Item	Satisfactory Yes	Satisfactory No	Comments
3. Restricting Orifice D001			
a. Flow 2 x 10^3 lb/hr sat. steam @ 1000 psia		X	GAI Specification DSP-B21-4549-00 gives flow as 310 lb/hr. See Observation ME-03-02.
b. Size		X	0.125" per B/M. No sizing calculation could be located. See Observation ME-03-02.
c. $\Delta P > 600$ psi		X	No information available due to lack of sizing and pressure drop calculation. Calculation could not be located for this orifice. See Observation ME-03-02.
4. Valve F016			
a. Size	X		3"
b. Type	X		Motor operated gate
c. Rating	X		D1-1 calls for 900 lb, but valve drawing indicates 1500 lb.
d. Operator	X		Specification SP-521-02-4549-00, Rev. 5
e. Closing speed equal to or greater than 12 inches per minute		X	Closing time 20 sec. max per Borg-Warner drawing 81180 (≈ 9 in/min minimum). See Observation ME-03-05.
5. Valve F019			
a. Size	X		
b. Type	X		

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Independent Design Review Checklist

MECHANICAL

MSDS

Reviewer R. Hess *R. W. Hess*

Checklist No. ME-03

Date 11/18/83

Item	Satisfactory Yes	Satisfactory No	Comments
c. Rating	X		Specification D1-1 calls for 900 lb but valve drawing indicates 1500 lb.
d. Operator	X		Purchase Specification SP-521-02-4549-00, Rev. 5
e. Closing speed equal to OR greater than 12 inches per minute		X	Closing time 20 sec. max per Borg-Warner Drawing 81180 (≈ 9 in/min minimum). See Observation ME-03-05.
6. Valve F021			
a. Size	X		
b. Type	X		
c. Rating	X		1500 lb per drawing, line specification D1-4 calls for 900 lb.
d. Operator	X		Limitorque
7. Valve F033			
a. Size	X		
b. Type	X		
c. Rating	X		900 lb
d. Operator	X		Air
8. Flow calculation from MSIV F022 to valve F021			
a. Geometry		X	Calc. N22-3, pg. 13; see Observation ME-03-03(a).

CYGNA

Independent Design Review Checklist

MECHANICAL

MSDS

Reviewer R. Hess *R. W. Hess*

Checklist No. ME-03

Date 11/18/83

Item	Satisfactory Yes	Satisfactory No	Comments
b. Static head		X	Not included in segment 2 and 3 of calculation. see Observation ME-03-03(a).
c. Friction factor	X		
d. Valve flow coefficients		X	No K included for valves F021 or F019. See Observation ME-03-03(a).
e. Total equivalent length		X	
f. Pipe size		X	Calculation N22-3 is based on all 3" pipe not 2" and 3". See Observation ME-03-03(a).
g. Total pressure drop		X	See Observation ME-03-03.
h. Flowrate, warm-up	X		No GE criteria. GAI calculated condensate flow is 6670 lb/hr.
9. Flow calculations from MSIV F022 thru orifice D001			Same comments as for Item 8 above.
a. Geometry		X	No specific calculation presented for this flow path.
b. Static head		X	
c. Friction factor		X	
d. Valve flow coefficients		X	In addition, no K included for F033; no loss included for orifice D001
e. Total equivalent length		X	
f. Pipe size		X	Piping to F033 and D001 is 1".
g. Total pressure drop		X	
h. Flow 2×10^3 lb/hr sat. steam at 1000 psia		X	GAI used 310 lb/hr in lieu of GE specified 2000 lb/hr. See Observation ME-03-03(b).

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Independent Design Review Checklist

MECHANICAL

MSDS

Reviewer R. Hess *R. V. Hess* **Checklist No.** ME-03

Date *11/18/83*

Item	Satisfactory Yes	Satisfactory No	Comments
10. Valves F034 and F035			
a. Size	X		3/4"
b. Type	X		Globe-diaphragm sealed
c. Rating	X		1500 lb socket weld
d. 50 gpm drain flow path application		X	Valve and piping loss are too high for available drain head to meet 50 gpm flow. See Observation ME-03-04.

Observation Record

Observation No.	PI-00-01	Revision No.	0
Checklist No.	PI-01, -02, -03 General	Sheet	1 of 1
Originated By	[signature]	Date	12/2/83
Reviewed By	[signature]	Date	12/2/83

1.0 Description

Support flexibility is not considered in Class 2 or Class 3 piping analyses. Supports are input as rigid and then designed using a maximum deflection criterion of 0.1".

2.0 Requirement

Cygna Review Criteria 83102-DC-1, Rev. 0, Sect. 4.8.9.

3.0 Document Reference

3.1 GAI Analysis Report No. 1B21G08A (MSRV)

3.2 GAI Class 1 Analysis Guide No. 04, Rev. C

4.0 Design Impact

Large variations in as-built support stiffness as compared to the analyses could significantly change system mode shapes, load distribution, support loads and pipe stress.

5.0 Probable Cause

Standard GAI practice.

Attachments

A. Observation Record Review

CYGNA

Observation Record Review
Attachment A

Observation No. PI-00-01	Checklist No. PI-01, -02, -03	Revision No.	0
PFR No.		Sheet 1	of 1

	Yes	No
Closed	X	

Extent All 3 Systems

Comments

The use of rigid supports is acceptable provided that the GAI deflection criteria of 0.1 inches is sufficient to provide assurance that the flexibility of the supports will have no significant effect upon the piping analysis results (stresses and loads).

An approximate evaluation of this issue can be made utilizing a cantilevered support (limiting case) with a pipe/support system frequency of 33 Hz (i.e., the "rigid" range of the seismic spectra). Under an applied load approximately equal to the tributary mass weight on the support, the deflection, δ, for this system is approximately

$$f = \frac{1}{2\pi} \sqrt{\frac{g}{\delta}} \quad \Rightarrow \delta = 0.01''$$

This is 1/10 of the value required by the GAI criteria. This shows that the supports, themselves, can be subjected to dynamic excitation due to loads well above the ZPA level.

Based on the above, Cygna performed a review of the pipe support deflections and stiffnesses for the Main Steam Relief Valve Discharge System 1B21-G08. This review considered the GAI design calculations as well as some approximate hand calculations by Cygna. The review indicated that the deflections of supports on this system were well below the 0.1 inch limit and that the corresponding stiffnesses were sufficient to provide confidence that there would not be any significant impact on the loads and stresses in this system.

Approvals

Originator	[signature]	Date	1/6/84
Project Engineer	[signature]	Date	1/6/84
Project Manager	[signature]	Date	1/6/84
CEI Representative	[signature]	Date	2/3/84

CYGNA

Observation Record

Observation No.	PI-00-02	Revision No.	0
Checklist No.	PI-01, PI-02, PI-03 General	Sheet	1 of 5
Originated By	L J Weinert	Date	12/2/83
Reviewed By	D. K. Wong	Date	12-2-83

1.0 Description

The following items summarize minor inconsistencies noted during the review of the MSRV, HPCS and MSD piping analyses:

a. Deleted.

b. In the functional capability check for the SRV discharge line (1B21-G08A, Rev. 2), the worst case was not examined for a reducing elbow. Specifically, the 12 inch end of a 12" x 10" 90° reducing elbow was examined, but not the 10" end. The was expressly omitted because a 10" 45° elbow, having higher stresses, had already been examined. In this case, and in general, such logic is not appropriate because the stress indice for a 45° elbow is nearly 30 percent lower than for a 90° elbow.

c. In the calculation for modeling gate valves for the piping analysis, four mass points are included: (1) operator, (2) stem and yoke, (3) bonnet and (4) body. There is no mass point for the gate. Consequently, the mass moment of inertia is underestimated.

For valve 1E22-F036, this technique results in the following calculated values:

- moment arm w/o gate = 13.7 in.
- moment arm w/gate = 14.4 in.*
- ratio = 1.05

*The actual moment arm shown on the vendor drawing is 14.90 in.

d. As shown on Fig. 1, MSD piping is enclosed by a guard pipe from the drywell to the shield wall. The guard pipe is connected to the drywell and is isolated from the shield wall and containment vessel by bellows.

In performing the thermal modes analysis for MSD piping, thermal movement of the shield wall and containment vessel are expressly excluded due to the bellows at those points. Thermal movement of the drywell, on the other hand, is neither included nor addressed.

CYGNA

Observation Record

Observation No.	PI-00-02	Revision No.	0
Checklist No.	PI-01, PI-02, PI-03 General	Sheet	2 of 5
Originated By	H. Weinert	Date	12/2/83
Reviewed By	C.K. Wong	Date	12-2-83

e. The weight of water was included in the deadweight and all dynamic analyses for the MSD piping. This line is always filled with steam except during hydro testing. It should be noted that the thermal transient analysis was properly done considering the fluid properties of steam.

2.0 Requirement

a. Deleted.

b. Interim Technical Position "Functional Capability of Passive Piping Components," Mechanical Engineering Branch, Division of Systems Safety.

c. Cygna Review Criteria, 83102-DC-1, Section 4.7.6.

"Weights and centers of gravity shall be as specified on the applicable vendor supplied valve assembly drawings."

d. All significant thermal anchor movements should be considered.

e. N/A.

3.0 Document Reference

3.1 Deleted.

3.2 Deleted.

3.3 GAI "Document Evaluation of Functional Capability of Piping Components", dated July 29, 1982. (b)

3.4 GAI Stress Analysis Report 1B21G08A Rev. 2. (b)

3.5 Borg-Warner Drawing 81030. (c)

3.6 Borg-Warner Report No. 81030 (GAI No. 4549-94Q-386-1). (c)

3.7 GAI Calculation File No. 2.69.2, RNU 226. (c)

3.8 GAI Analysis Report IN2201C. (d)

CYGNA

Observation Record

Observation No.	PI-00-02	Revision No.	0
Checklist No.	PI-01, PI-02, PI-03 General	Sheet	3 of 5
Originated By	[signature]	Date	12/2/83
Reviewed By	C.K. Wong	Date	12-2-83

3.9 Nutech Report Py-NTC-GAI-034, Rev. 0. (d)

3.10 GAI Analysis 1N22G01C, Rev. 2. (e)

4.0 Potential Design Impact

a. Deleted.

b. This system still meets funcitonal requirements, however the margin is reduced from over 30 percent to 4 percent. If this same assumption was used for other similar lines, it could lead to the functional requirements not being met.

c. It should be noted that the valve is appropriately modeled to simulate the fundamental frequency predicted by the vendor.

Valve loads transferred into the piping are directly proportional to the moment arm. For Valve 1E22-F016, this corresponds to a 5 percent increase in loads, which is insignificant.

However, this matter should be investigated for other gate valves on PNPP.

d. Thermal stresses in the guard pipe and at the piping/guard pipe juncture may be incorrect. These predicted stresses will be unconservative only if the piping and drywell grow thermally in opposing directions.

e. The change in weight is summarized as follows:

Pipe Size	Input Weight (lbs./ft.)	Actual Weight (lbs./ft.)	% Decrease
2"	11.91	10.94	8.1
3"	20.72	18.38	11.3

This 11.3% in mass could increase the frequencies by as much as 5.5%. This small shift in frequencies will not significantly affect the dynamic analysis due to the conservatisms of the response spectra analysis and the broadening of spectra peaks.

5.0 Probable Cause

Minor oversights in the analysis and design.

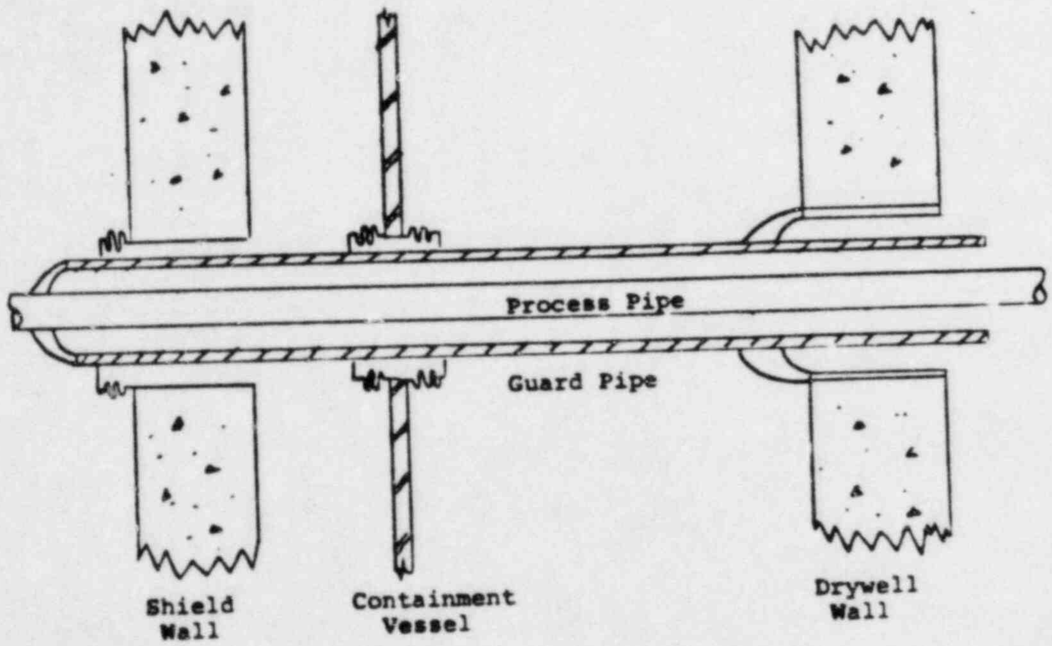
Attachments

A. Observation Record Review

Observation Record

		Revision No.	0
Observation No.	PI-00-02	Sheet	5 of 5
Checklist No.	PI-01, PI-02, PI-03 General	Date	12/2/83
Originated By	HJ Weingart	Date	12-2-83
Reviewed By	C.K. Wong		

FIGURE 1



CYGNA

Observation Record Review
Attachment A

Observation No.	PI-00-02	Checklist No.	PI-01, -02, -03	Revision No.	0
PFR No.				Sheet	1 of 1

	Yes	No
Closed	X	

Extent All 3 Systems

Comments

Based on evaluation of each of the noted items in this Observation, Cygna concludes that individually these items have no impact on design for the three systems reviewed. In addition, due to the small number of items per system, there are no cummulative effects.

Approvals

Originator	[signature]	Date	1/25/84
Project Engineer	[signature]	Date	1/25/84
Project Manager	Ted Dutting	Date	1/26/84
CEI Representative	J E Mryz	Date	2/3/84

Cleveland Electric Illuminating; 83102
Perry Nuclear Power Plant Piping Design Review

CYGNA

Observation Record

Observation No.	PI-00-03	Revision No.	0
Checklist No.	PI-01, PI-02, PI-03 General	Sheet	1 of 3
Originated By	G. Weinzapfel	Date	12/2/83
Reviewed By	D.K. Dong	Date	12-2-83

1.0 Description

The following items either lack documentation or utilize inconsistent data:

a. GAI Specification B21 requires that SRV piping within the drywell be designed for a post-LOCA condition temperature of 250°F. 195°F (185 + 10) was used.

b. Deleted.

c. Deleted.

d. There is no documentation within the calculation package justifying the thicknesses used in the thermal transient analysis for:

1) Reactor Nozzle (HPCS)

2) Sweepolet (HPCS)

3) Valves (MSD and HPCS)

4) Penetration (MSD)

5) Tee (MSD)

e. There is no documentation justifying the exclusion of the effects of bend or elbow ovalization for the HPCS.

f. There is no documentation indicating that the movement of the Main Steam lines during turbine trip has been considered for its effect on the MSD lines.

2.0 Requirement

a. GAI Project Design Specification, DSP-B21-1-4549, Rev. 1 Table 6.

b. Deleted.

c. Deleted.

Observation Record

Observation No.	PI-00-03	Revision No.	0
Checklist No.	PI-01, PI-02, PI-03 General	Sheet	2 of 3
Originated By	LJWeinert	Date	12/2/83
Reviewed By	J C K Wong	Date	12-2-83

d. Standard industry practice.

e. ASME B & PV Code Section III 1974 with addendum through Winter 1975, Subsection NB, Paragraph NB-4223.2.

f. N/A.

3.0 Reference Documents

3.1 GAI Analysis Report No. 1B21G08A, Rev. 2. (a)

3.2 Deleted.

3.3 Deleted.

3.4 GAI Analysis Report Nos. 1N22G01C, Rev. 2 and 1E22G04C, Rev. 2. (d)

3.5 GAI Analysis Report No. 1E22G04C, Rev. 2. (e)

3.6 GAI Analysis Report No. 1N22G01C, Rev. 2. (f)

4.0 Potential Design Impact

a. The following table shows the temperature considered in designing a portion of the SRV piping.

SECTION	TH1 (UPSET)	TH2 (UPSET)	TH3 (NORMAL)	TH4 (POST-LOCA)
1	450°F	450°F	145°F	195°F

195°F TO 250°F is a significant temperature rise, which could impact design stresses. However, taking into account the other design conditions (upset temperature = 450°F) and the higher allowable normally associated with post-LOCA event, the oversight in design will have no impact.

CYGNA

Observation Record

Observation No.	PI-00-03	Revision No.	0
Checklist No.	PI-01, PI-02, PI-03 General	Sheet	3 of 3
Originated By	D Wingate	Date	12/2/83
Reviewed By	C. K. Wong	Date	12-2-83

b. Deleted.

c. Deleted.

d. Individual loose sheets indicate that the values are appropriate. These sheets should be incorporated into the analysis package.

e. The following calculation shows that the pressure stress indice may increase by as much as 3 times. Per NB-4223.2 ovality is limited to .08 x Do as a maximum (could be less)

$$\therefore F_{1a} \approx 1 + .08 \frac{Do}{t} \left(\frac{1.5}{k}\right)$$

$$= 1 + .08 \frac{(12.75)}{.687} \frac{(1.5)}{\left(1 + .455 \left(\frac{12.75}{.687}\right)^3 \frac{1050}{27 \times 10^6}\right)}$$

$$F_{1a} = 3$$

$$\therefore K_1' = F_{1a} \times K_1 = 3 \times 1 = 3$$

This would be a maximum. For ANSI B16.9 elbows, the out-of-round may be less.

f. Additional stresses may occur in the drain lines due to the movement of the Main Stream lines to which they are attached.

5.0 Probable Cause

Document and design control.

Attachments

A. Observation Record Review

CYGNA

Observation Record Review
Attachment A

Observation No. PI-00-03	Checklist No. PI-01, -02, -03	Revision No.	0
PFR No.		Sheet 1	of 1

	Yes	No
Closed	X	

Extent All 3 Systems

Comments

Based on evaluation of each of the noted items in this Observation, Cygna concludes that individually these items have no impact on design for the three systems reviewed. In addition, due to the small number of items per system, there are no cummulative effects.

Approvals

Originator	L J Weingart	Date	1/25/84
Project Engineer	L J Weingart	Date	1/25/84
Project Manager	Ted T. Dettig	Date	1/26/84
CEI Representative	J E Myers	Date	2/3/84

Cleveland Electric Illuminating; 83102
Perry Nuclear Power Plant Piping Design Review

Observation Record

Observation No.	PI-00-04	Revision No.	0
Checklist No.	PI-01, PI-02, PI-03 General	Sheet	1 of 2
Originated By	C. K. Wong	Date	1-3-84
Reviewed By	[signature]	Date	1/3/84

1.0 Description

The following analysis oversights are noted for Jet Impingement load calculations:

- Main Steam Safety Relief system, 1B21 G08(A), Rev. 2, Shts. 17.5 thru 17.10.

a1. Case 6.b in Table 7 of specification. The jet load input at node point 11 should be $-F_y$ instead of F_x (597.3#), since local coordinates are used for that node point.

- High Pressure Core Spray, 1E22G04(C), Rev. 3.

b1. Item 1C of Table 7 in specification (break LPB2LL). The total load computed is 6902.6#. The total load specified in the design specification is 7488#.

b2. Item 2 of Table 7. Break SD3A.

F_z component should be included in the input.

b3. Item 3 of Table 7. Break SB3A.

F_z component should be included in the input.

b4. Item 7J of Table 7.

Force input at node A18 should be at node B18 (difference of 0.566' in elevation).

b5. Item 8 of Table 7. B33 Break RD7 (header side) Loop "B".

Jet loads on piping and valve E22-F036 are not included in the calculation. This is listed as an analysis exception in the Class 1 Stress Report, P-1001, Rev. 0.

b6. The load input for nodes 18 and A18 (Jet 6D) are interchanged.

b7. At node 13, a negative load of -1122.0# was input as a positive load.

CYGNA

Observation Record

Observation No.	PI-00-04	Revision No.	0
Checklist No.	PI-01, PI-02, PI-03 General	Sheet	2 of 2
Originated By	C. K. Wong	Date	1-3-84
Reviewed By	[signature]	Date	1/3/84

2.0 Requirement

1. GAI specification - DSP-B21-1-4549-00, Rev. 2.

2. GAI specification - DSP-E22-1-4549-00, Rev. 2.

3.0 Reference Documents

3.1 GAI analysis 1B21G08(A), Rev. 2. (a)

3.2 Computer output for 1B21G08(A), Run #JOHNVXW (1/12/83) (a)

3.3 GAI Analysis 1E22G04C, Rev. 2, Run #3, E22G4J Run ID=AOXZGCL (3/28/83) (b)

3.4 GAI Class 1 Stress Calculation 1E22G04C, Rev. 3. (b)

4.0 Potential Design Impact

1. Individually, no significant impact.

2. The combined effect could impact the accuracy of the analysis.

5.0 Probable Cause

Analysis oversights.

Attachments

A. Observation Record Review

CYGNA

Observation Record Review
Attachment A

Observation No. PI-00-04	Checklist No. PI-01, -02, -03	Revision No.	0
PFR No.		Sheet 1	of 1

	Yes	No
Closed	X	

Extent 2 of 2 Systems with Jet Loading

Comments

Further review indicates the following:

a. This item had been noted by the GAI verifier in Calculation 1B21G08A and was determined not to be significant enough to warrant reanalysis for the MSRV system. Cygna concurs with this conclusion.

b. As a result of this Observation, GAI has performed a reanalysis for the HPCS system incorporating all the specified corrections. Cygna has reviewed the input calculation for this reanalysis. GAI has stated that there was not any significant change in the results (it should be noted that per GAI, the piping is now shielded from B33 Break RD7 which closes item b5).

Based on the above, this Observation has no impact on design or safety.

Approvals

Originator	C. K. Wong	Date	1-24-84
Project Engineer	D. Weinert	Date	1/24/84
Project Manager	Ted L. Wittig	Date	1/24/84
CEI Representative	J E Murphy	Date	2/3/84

CYGNA

Observation Record

Observation No. PI-01-01		Revision No.	0
Checklist No. PI-01	MSRV	Sheet 1 of 2	
Originated By	[signature]	Date	12/2/83
Reviewed By	C. K. Wong	Date	12-2-83

1.0 Description

The stress intensification factors (SIF's) at points 2, F1, and F2 are not input properly.

POINT	ACTUAL SIF	INPUT SIF	ANALYSIS
			(PIPE/FLANGE)
2	2.1	2.1	1.083
F1	1.9	1.9	2.889/1.766
F2	1.9	1.9	2.889/1.766

Where,

actual SIF = ASME value

input SIF = value input to the TPIPE analysis

analysis SIF = value utilized by TPIPE

2.0 Requirement

ASME B & PV Code, Section III, 1974 with Addenda to Winter 1975 Subsection ND, Fig. 3673.2 (b)-1.

3.0 Document Reference

3.1 GAI computer analysis 1B21G08, Rev. 2

3.2 TPIPE Manual.

CYGNA

Observation Record

Observation No.	PI-01-01	Revision No.	0
Checklist No.	PI-01 MSRV	Sheet	2 of 2
Originated By	DJ Wermiel	Date	12/2/83
Reviewed By	C.K. Wong	Date	12-2-83

4.0 Potential Design Impact

Using the actual intended SIFs at these points results in the following ratio of maximum to allowable stress:

POINT	MAX. STRESS/ALLOWABLE
2	0.16
F1	0.26
F2	0.28

These revised stresses are clearly well within the allowable limits.

5.0 Probable Cause

This observation resulted from the analyst's attempt to override an internally computed SIF. This is specifically cautioned against in the TPIPE manual. In addition, the analyst did not review the program's interpretation of the SIF input.

Attachments

A. Observation Record Review

CYGNA

Observation Record Review

Attachment A

Observation No.	PI-01-01	Checklist No.	PI-01	Revision No.	0
PFR No.				Sheet 1 of 1	

	Yes	No
Closed	X	

Extent 1 of 1 Class 3 Systems

Comments

As shown in Section 4.0, the increased stresses using the correct SIFs, are still within the Code limits. Therefore, there is no design impact on these three systems. Even though there is no design impact on this system, GAI plans to correct the SIFs and include the corrected stresses in the analysis package.

Section 4.0 also shows that stresses at the points of concern on the SRV discharge increased to up to 28% of the Code allowable when the correct SIFs are applied. Cygna did not evaluate the impact of this issue on systems where the design margin may be less than that found in the SRV discharge.

Approvals

Originator	[signature]	Date	1/16/84
Project Engineer	[signature]	Date	1/16/84
Project Manager	Ted T. Wittig	Date	1-16-84
CEI Representative	[signature]	Date	1/20/84

Cleveland Electric Illuminating; 83102
Perry Nuclear Power Plant Piping Design Review

CYGNA

Observation Record

Observation No. PI-01-02		Revision No.	0
Checklist No. PI-01	MSRV	Sheet 1 of 1	
Originated By John C Minichiello for V. PHi		Date	12/2/83
Reviewed By [signature]		Date	12/2/83

1.0 Description

MSRV seismic anchor movements (SAM) in the z-direction are applied in the x-direction at point J1.

2.0 Requirement

Standard Industry practice.

3.0 Reference Documents

GAI TPIPE Computer Output 1B21G08, Rev. 2.

4.0 Potential Design Impact

Inputting SAM in the wrong direction will result in an incorrect stress distribution that may impact design of the MSRV piping supports.

5.0 Probable Cause

Analysis oversight. This occurs at one out of two points where movements are input in the analysis for subsystem 1B21-G008.

Attachments

A. Observation Record Review

CYGNA

Observation Record Review
Attachment A

Observation No. PI-01-02	Checklist No. PI-01	Revision No.	0
PFR No.		Sheet 1	of 1

	Yes	No
Closed	X	

Extent 1 of 3 Systems

Comments

The seismic anchor movements were correctly input by GAI in a local coordinate system corresponding to the direction of the restraint at point J1. Therefore this observation is invalid.

Approvals

Originator	Vuong Shi	Date	1-04-84
Project Engineer	[signature]	Date	1/4/84
Project Manager	Ted P. Wittig	Date	1/5/84
CEI Representative	J E Marger	Date	1/20/84

Cleveland Electric Illuminating; 83102
Perry Nuclear Power Plant Piping Design Review

CYGNA

Observation Record

Observation No.	PI-02-01	Revision No.	0
Checklist No.	PI-02 HPCS	Sheet	1 of 2
Originated By	[signature]	Date	12/2/83
Reviewed By	John C [signature]	Date	12/2/83

1.0 Description

The fatigue analysis did not consider the different thermal gradients ($\Delta T1$ and $\Delta T2$) for the sweepolet and socket welded boss. The piping thermal gradients were input as the default values and these were not overridden for the sweepolet and socket welded boss. The thermal transient analysis indicates that the only instances for which this happens to be non-conservative is for the sweepolet (Point C24) during the up transients.

In addition, the thermal transient analyses considered the flow to be zero at these same points. While this may be conservative when determining the discontinuity stresses ($T_A - T_B$), it is non-conservative in the calculation of the thermal gradients through the thickness ($\Delta T1$ and $\Delta T2$).

2.0 Requirement

a. ASME B&PV Code Section III 1974 with Addendum through Winter 1975, Subsection NB, Paragraph NB-3653.

3.0 Document Reference

3.1 GAI Analysis Report and TPIPE computer output 1E22G04C, Rev. 3.

4.0 Potential Design Impact

The stress increases at the sweepolet (based upon the original thermal transient analyses) are listed below:

CYGNA

Observation Record

Observation No. PI-02-01		Revision No.	0
Checklist No. PI-02	HPCS	Sheet 2 of 2	
Originated By [signature]		Date	12/2/83
Reviewed By [signature]		Date	12/2/83

Event	Sweepolet		Piping		Temp. Increase		Stress Increase		
	ΔT1 (°F)	ΔT2 (°F)	ΔT1 (°F)	ΔT2 (°F)	ΔT1 (°F)	ΔT2 (°F)	$\frac{E\alpha\Delta T_1}{2(1-\nu)}$ (PSI)	$\frac{E\alpha\Delta T_2}{1-\nu}$ (PSI)	$\frac{K_3 E\alpha\Delta T_1}{2(1-\nu)}$ (PSI)
12D	133	23	53	8.5	110	14.5	13306	3509	22620
20A	144.5	25.0	54.0	8.5	90.5	16.5	10947	3991	18610
20A	120.5	20.5	45.5	7.0	75.	13.5	9072	3266	15422

It should be noted that the magnitude of the increase will go up when flow is considered.

The sweepolet is already overstressed. Usage factor requirements are also exceeded for the sweepolet (2.7481) and the socket welded boss (0.2744 - No Break Zone).

Both of these components will require more refined analyses as noted in the Class 1 stress report. The reanalysis should incorporate the impact of this observation. In addition, these concerns should be addressed with regard to all Class 1 analyses due to the fact the impact may not be insignificant as shown by the above table.

5.0 Probable Cause

Analyst oversight.

Attachments

A. Observation Record Review

CYGNA

Observation Record Review
Attachment A

Observation No. PI-02-01	Checklist No. PI-02	Revision No.	0
PFR No.		Sheet 1 of	1

	Yes	No
Closed	X	

Extent 1 of 1 Systems with Branch component where Branch piping is not modeled.

Comments

GAI has reanalyzed these components using a 2D finite analysis method (P-267, Rev. 1). Cygna has not reviewed this analysis and does not intend to do so within the scope of this review. Per GAI, in this analysis flow was considered in the crotch area and the results show that the components in question now meet ASME Code requirements.

Based upon the above, this Observation is considered not to have any impact on the design or safety of the HPCS system.

Approvals

Originator	[signature]	Date	1/13/84
Project Engineer	[signature]	Date	1/13/84
Project Manager	Ted T. Wittig	Date	1/13/84
CEI Representative	[signature]	Date	1/20/84

Cleveland Electric Illuminating; 83102
Perry Nuclear Power Plant Piping Design Review

Observation Record

CYGNA

Observation No.	PI-03-01	Revision No.	0
Checklist No.	PI-03 MSD	Sheet	1 of 1
Originated By	D. Weinmont	Date	12/2/83
Reviewed By	John C. Tufarichello	Date	12/2/83

1.0 Description

The review of the thermal transient reanalysis (P-256, Rev. 0) did not consider the following discontinuities for evaluation of T_A-T_B:

1. Valve coupling to 2" pipe.
2. 3" x 3" x 2" tee to 3" pipe.
3. 3" x 3" x 2" tee to 2" pipe.
4. 3" pipe to 3" valve.
5. 3" pipe to penetration.

This analysis was rerun due to errors in fluid properties. It should be noted that the original analysis did consider these discontinuities. In addition there is no documentation to indicate that the fatigue analysis is to be rerun using the later transient analysis data.

Furthermore, the tee sections did not consider any additional thickness in the crotch area of the component.

2.0 Requirement

ASME B & PV Code Section III 1974 with addendum through Winter 1975, Subsection NB-3653.

3.0 Reference Documents

3.1 GAI Analysis 1N22G01C, Rev. 3.

3.2 GAI Analysis P-256, Rev. 0.

4.0 Potential Design Impact

The T_A-T_B effects at these discontinuities, as well as the thermal gradient effects at the tee crotch areas, may be underestimated which may lead to failure in meeting ASME Code Requirements.

5.0 Probable Cause

Analyst oversight.

Attachments

A. Observation Record Review

CYGNA

Observation Record Review
Attachment A

Observation No.	PI-03-01	Checklist No.	PI-03	Revision No.	0
PFR No.				Sheet	1 of 1

	Yes	No
Closed	X	

Extent 1 of 2 Class 1 Systems

Comments

GAI has performed a 2D thermal discontinuity analysis (P-258, Rev. 0), for items 1, 4 and 5, and plans to incorporate this information in their next revision of the fatigue analysis. Regarding the tee components, GAI has performed a study using a thickness increase of 50% in a 1D thermal analysis. Based on vendor drawings, this is a reasonable value to assume at the crotch region for the purpose of this study. This analysis showed a maximum increase of 295% in the thermal stresses (from 1900 PSI to 5600 PSI). However, due to the very high margin to both Code allowable stress (15900 PSI = 30%) and break exclusion allowables (43%) at these components, this increase does not impact the design or safety of the Main Steam Drain system.

Approvals

Originator	[signature]	Date	2/6/84
Project Engineer	[signature]	Date	2/6/84
Project Manager	Ted D. Wattig	Date	2/6/84
CEI Representative	[signature]	Date	2/8/84

CYGNA

Observation Record

Observation No.	PS-00-01	Revision No.	0
Checklist No.	PS-01, PS-02, PS-03 General	Sheet	1 of 6
Originated By	S. Luo	Date	1/3/84
Reviewed By	C. K. Wong	Date	1-3-84

1.0 Description

The following items either lack documentation or utilize inconsistent data:

- Main Steam Safety Relief System

  a. Support MK-1B21-H061

  Drawing S-322-605, Sht. 061.2, Rev. B. Location plan dimensions require revision per ECN 9152-44-1111. The dimensions shown on drawing do not incorporate all of the specified changes.

  b. Support MK-B21-H062

  Drawing S-322-605, Sht. 062.2, Rev. E. A 10" x 10" x 1/2" base plate was utilized in the design. This was not properly specified on the drawing. The 1/4" all around fillet weld to the embedment plate was not specified.

  c. Support MK-1B21-H063

  The design calculation and verification calculation (pg. 1.9 thru 1.15) were based on Rev. C of the drawings, whereas the current drawing revision is "D". Effects from support 1G61-H033 are not evaluated (Ref. ECN 9627-44-1291).

  d. Support MK-1B21-H064

  RAP No. OR-SV-231 has not been incorporated in the drawing (Dwg. S-322-605, Sht. 064.2, Rev. C).

  e. Support MK-1B21-H066

  The support rear bracket angle used in the design (Dwg. Rev. C) does not match the angle calculated from the dimensions shown on the drawings (Rev. D). Horizontal angle (48°) shown on Sht. 066.1 of the drawing is in conflict with the angle computed using dimensions shown on Sht. 066.2 of the drawing (S-322-605, Rev. D).

  The design loads shown on the drawing for the emergency condition (+18400 lbs, -19500 lbs) are incorrect. The correct design loads are: upset = ±18400 lbs and emergency = ±19500 lbs.

Observation Record

Observation No.	PS-00-01	Revision No.	0
Checklist No.	PS-01, PS-02, PS-03 General	Sheet	2 of 6
Originated By	S. Luo	Date	1/3/84
Reviewed By	C. K. Wong	Date	1-3-84

f. Support MK-1B21-H067

The restraint direction used in the design calculation differs by about 9° from the direction calculated based on the current support configuration (Dwg. S-322-605, Sht. 067.2, Rev. D).

g. Support MK-1B21-H068

The verification calculation references Rev. "0" of Dwg. S-322-605, Sht. 068.1 and 2. Letters A, B, C and D were actually used for revision number (pg. 1.34).

The snubber size (catalog number P/N 1801172) and the pin-to-pin dimension shown on the drawing do not match the size specified in the design verification calculation (pg. 1.37).

h. Support MK-1B21-H112

The snubber size (catalog number P/N 1801172) and the pin-to-pin dimension shown on the drawing do not match the size specified in the desigr verification calculation (pg. 1.45).

Notes on Sht. 1.40 of verification calculation refer to Shts. 3 and 4 for sketches. The sheet numbers are incorrect and should be Shts. 1.41 and 1.42.

i. No calculation was provided for Support MK-1B21-H436.

j. For the Main Steam Safety Relief System (1B21-G08) pipe support design, the assumption that no jet impingment load was acting on the supports requires verification. No such verification was provided in the design calculation.

- High Pressure Core Spray System

k. General

Design verification record pg. 1.1, 1.2 and 1.3 is not properly filled out. Specifically, the pertinent items are not checked off.

Observation Record

Observation No.	PS-00-01	Revision No.	0
Checklist No.	PS-01, PS-02, PS-03 General	Sheet	3 of 6
Originated By	S. Luo	Date	1/3/84
Reviewed By	C. K. Wong	Date	1-3-84

l. Support MK-1E22-H004

The dimensions of Item "L" on Dwg. Sht. 2 do not match the dimensions shown on Sht. 3, Detail "L" in the design calculation. The restraint direction shown on Dwg. S-322-701, Sht. 1, Rev. D, is incorrect.

m. General

There is insufficient information on the design verification sheet. The supporting documents section references "latest analysis."

- Main Steam Drain System

n. Support MK-1N22-H017R

The elevation shown on the isometric differs from the support drawing. There is a total elevation difference of 2.04 feet which considerably exceeds the standard criteria of one pipe diameter.

o. Support MK-1N22-H018

A 45° bracing member was used in design calculation (Pg. 10.31), whereas a 30° brace was specified in drawing (S-322-121, Rev. A). Also, the plan view of Items "E" and "F" is not consistent with Section A-A on Sht. 018.3 of the drawing.

p. Supports MK-1N22-H126; -H127; -H128; -H129; -H130 and -H131

In each of the calculations, an LCD sheet for a special piping clamp (Power Piping Co.) was included, but was not referenced or used in the calculation. Furthermore, the clamps specified in the corresponding support drawings are BE-419N series (National Valve and Manufacturing Co). Clarification of the purpose of the LCD sheets is required.

CYGNA

Observation Record

Observation No.	PS-00-01	Revision No.	0
Checklist No.	PS-01, PS-02, PS-03 General	Sheet	4 of 6
Originated By	S. Luo / R. BALIGA	Date	1/3/84
Reviewed By	C.K. Wong	Date	1-3-84

q. Many of the supports of this MSD system have revised or changed support stiffnesses. (Examples are H016, H017,H018, H130, H132...etc.) The aggregate effect of these changes have not been confirmed by analysis.

r. Deleted.

s. Deleted.

t. Support No. H003

Calculation does not show the detailed design of snubber and attachment. Cold setting and offset are not shown on the support drawing.

u. Support No. H004

Calculation is not shown for the support attachment.

v. Support No. H007

There is no calculation of stiffness presented.

w. Support No. H014

Design calculation gives loads for X and Y directions. X-direction load is for Support H014. Y direction load is for support H148.

x. Support No. H148

A separate calculation is not provided for this support or its connection. Only snubber sizing is done as a partial calculation on support H014 calculation sheet.

2.0 Requirement

Standard practice and proper documentation.

CYGNA

Observation Record

Observation No.	PS-00-01	Revision No.	0
Checklist No.	PS-01, PS-02, PS-03 General	Sheet	5 of 6
Originated By	S. Luo	Date	1/3/84
Reviewed By	C.K. Wong	Date	1-3-84

3.0 Reference Documents

- Main Steam Relief System
  - 3.1 GAI Support Design Calculation 1B21G08(B), Rev. 0 (a thru j)
  - 3.2 Drawing S322-605, Sht. 061.2, Rev. B (a)
  - 3.3 ECN 9152-44-1111 (a)
  - 3.4 Drawing S-322-605, Sht. 062.2, Rev. E (b)
  - 3.5 ECN 9627-44-1291 (c)
  - 3.6 RAP No. OR-SV-231 (d)
  - 3.7 Drawing S-322-605, Sht. 064.2, Rev. C (d)
  - 3.8 Drawing S-322-605, Sht. 066.1, Rev. D (e)
  - 3.9 Drawing S-322-605, Sht. 066.2, Rev. D (e)
  - 3.10 Drawing S-322-605, Sht. 067.2, Rev. D (f)
  - 3.11 Drawing S-322-605, Shts. 068.1 and 068.2, Rev. D (g)
- High Pressure Core Spray System
  - 3.12 GAI Support Design Calculation 1E22-G04(B), Rev. 1 (k thru m)
  - 3.13 Drawing S-322-701, Shts. 2 and 3, Rev. D (l)
- Main Steam Drain System
  - 3.14 GAI Support Design Calculation 1N22-G01(B), Rev. 1 (n thru x)
  - 3.15 GAI Load Capacity Data Sheets of Class 1 Component Supports, P-2010, Rev. 0. (n thru x)
  - 3.16 GAI program M093, Rev. 1, Load Combination Computer output, J71 A (dated 5/10/83) for N22G01 (n thru x)
  - 3.17 Power Piping Co., Pipe Hanger Catalog and Load Capacity Data Sheets (n thru x)
  - 3.18 Pacific Scientific Co., Mechanical Arrestor Catalog and Load Capacity Data Sheets (n thru x)

CYGNA

Observation Record

Observation No. PS-00-01		Revision No.	0
Checklist No.	PS-01, PS-02, PS-03 General	Sheet 6 of 6	
Originated By	S. Luo	Date	1/3/84
Reviewed By	C K Wong	Date	1-3-84

3.19 National Valve and Manufacturing Co., Basic Engineering Load Capacity Data Sheets (n thru x)

3.20 Drawing S-322-121, Sht. 018.3, Rev. A (o)

4.0 Potential Design Impact

1. Individually these items have no significant impact on design based upon:
   - A spot check of the above listed items.
   - The design margin used in the Perry Project.
2. The cumulative effect of the noted documentation problems could lead to a design deficiency.

5.0 Probable Cause

Design control.

Attachments

A. Observation Record Review

CYGNA

Observation Record Review
Attachment A

Observation No. PS-00-01	Checklist No. PS-01, 02, 03	Revision No.	0		
PFR No.		Sheet 1	of	4	

	Yes	No
Closed	X	

Extent All 3 Systems

Comments

Further review and discussions with GAI reveal the following:

a. The referenced ECN was written 7/30/82. In this change, an interference was noted which required relocation of the P.A. by 2" north and 4" east. This was incorporated in drawing Rev. B issued 8/31/82. The change block should have noted this.

b. ECN 10130-44-1485, Rev. A, issued 9/19/83 deleted the baseplate from the design. Rev. F of the support drawing notes this but is not issued pending incorporation of ECNs after Phase II inspection. Elimination of the baseplate and welding directly to the embedded plate did not require back-up calculations.

c. Back-up calculations for Rev. D of the design, which include the effects of 1G61-H033, are contained in the "pending revision" book for subsystem 1B21-G08(B), Rev. 1.

d. ECN 9781-44-1341, Rev. A, issued 7/26/83 against Rev. C of the support drawing makes the necessary changes.

e. Based on the dimensions shown on Drawing S-322-605, Sht. 066.2, Rev. D, and taking into consideration the length of the rear bracket, the computed angle is 36.1°. This closely matches the 35.6° angle used in the stress analysis. Thus, only the coordinate system shown on pg. 1 of the drawing would require revision to be correct. Per GAI, this will be corrected in their upcoming cosmetic update program prior to fuel load.

Per GAI, load summary sheets are not updated for a revised analysis if no hardware changes are necessary due to the revised loads. Their current program provides for updating miscellaneous items on the support cover sheet (cosmetic revisions) after Phase II tagging by field QA. This will occur prior to fuel load.

Approvals

Originator	G. K. Wong	Date	1-27-84
Project Engineer	[signature]	Date	1/27/84
Project Manager	Ted T. Whitting	Date	1/27/84
CEI Representative	[signature]	Date	2/3/84

CYGNA

Observation Record Review
Attachment A

Observation No.	PS-00-01	Checklist No.	PS-01, 02, 03	Revision No.	0
PFR No.				Sheet 2 of 4	

	Yes	No
Closed	X	

Extent All 3 Systems

Comments

f. Calculations supporting Rev. D of the drawing are contained in pending Rev. 1 file to 1B21-G08(B), Rev. 1. This was in response to RI #477.

g. This is a minor documentation error. Sheet ib of iii gives the correct drawing revision number for H068.

g. & h. The snubber size and pin-to-pin dimension was changed on the Power Piping drawing when they re-detailed the sheet. In accordance with GAI Fabrication Specification SP-527, fabrication drawings are submitted to the engineer (GAI) for approval prior to use for fabrication.

h. The incorrect sheet number reference is a minor documentation error which was overlooked when renumbering the sheets.

i. Calculation is contained in pending revision file for 1B21-G08B, Rev. 1.

j. Jet impingement work is still in progress. Per GAI, upon completion of this work, the assumption will be removed.

k. Page 1.1 is a superceded form. The current Design Control Procedure (DCP) utilizes GAI form 468 which is contained in the referenced package. Per GAI, pages 1.2 and 1.3 are not an official part of the design control program.

l. This piece was changed per RI #865 from PPC. When revising the GAI drawing, the bill of material was changed but not detail "L". The correct dimensions are shown on the PPC drawing.

Regarding the restraint direction, the support location plan is correct and consistent with the analysis. The discrepancy exists in the cartesian coordinate system sketch on the support cover sheet.

Approvals

Originator	G.K. Wong	Date	1-27-84
Project Engineer	[signature]	Date	1/27/84
Project Manager	Ted T. Wittig	Date	1/27/84
CEI Representative	[signature]	Date	2/3/84

Cleveland Electric Illuminating; 83102
Perry Nuclear Power Plant Piping Design Review

Observation Record Review
Attachment A

Observation No. PS-00-01	Checklist No. PS-01, 02, 03	Revision No.	0
PFR No.		Sheet 3 of 4	

	Yes	No
Closed	X	

Extent All 3 Systems

Comments

m. Although the design verification sheet does not reference any specific analysis revision in the supporting documentation section, Section 7 of the package provides all the analysis data used as reference or supporting documents.

n. Per GAI, the piping was re-routed and the analyst considered a new support location but the relocation was not picked up. This has since been corrected. Support relocations of this nature would have been picked up by the as-built program.

o. ECN 9631-44-1294, Rev. A, shows the proper orientation of the brace. Per GAI, the ECN is the governing document and the calculation will be updated to incorporate any specified changes prior to fuel load.

p. Per GAI, there was a transition period during which the PPC clamp was replacing the equivalent clamp from National Valve. In accordance with GAI Fabrication Specification SP-527, these changes are submitted to the engineer (GAI) for approval prior to fabrication.

q. Per GAI, there is a design loop to confirm final stiffness of the design with that in the analysis. This will also be accomplished when as-built dimensions are confirmed.

r. Deleted.

s. Deleted.

t. The designer referenced the snubber size required and this was verified. LCD sheets provide the capacities. No offset was intended and a lack of cold set would require PPC to set the snubber at mid-stroke. This would accommodate the movement of 0.16".

Approvals

Originator	C. K. Wong	Date	1-27-84
Project Engineer	[signature]	Date	1/27/84
Project Manager	[signature]	Date	1/27/84
CEI Representative	[signature]	Date	2/3/84

Cleveland Electric Illuminating; 83102
Perry Nuclear Power Plant Piping Design Review

CYGNA

Observation Record Review
Attachment A

Observation No. PS-00-01	Checklist No. PS-01, 02, 03	Revision No.	0	
PFR No.		Sheet 4	of	4

	Yes	No
Closed	X	
Extent	All 3 Systems	

Comments

u. Per GAI, on the previous calculation, 3" of the 1/4" weld was determined by inspection to be adequate for a load of 1,300 lbs. For Rev. A of the support, the load decreased to 1,000 lbs. The existing weld was again determined adequate by inspection. Cygna agrees with this assessment.

v. Per GAI, calculation book 1N22-G01(B), Rev. 2, contains the stiffness calculations for this support. Rev. 2 of this calculation was not in the Cygna review scope.

w. & x. The originally specified x and y restraint was designed as two individual support marks, H014 and H148. This was requested per RAP #6701.

As stated in Section 4.0, individually these items do not have impact upon design. In addition, based on the explanations above, Cygna does not consider the cumulative effect of these items to be a potential problem for the three systems reviewed.

Approvals

Originator	C. K. Wong	Date	1-27-84
Project Engineer	[signature]	Date	1/27/84
Project Manager	[signature]	Date	1/27/84
CEI Representative	[signature]	Date	2/3/84

Observation Record

Observation No.	PS-00-02	Revision No.	0
Checklist No.	PS-01, PS-02, PS-03 General	Sheet	1 of 2
Originated By	C K Wong	Date	1-3-84
Reviewed By	LJ Weingart	Date	1/3/84

1.0 Description

The following items are not consistent with design commitments, requirements or criteria:

a. The GAI method for combining dynamic inertial loads and dynamic displacement loads differs from the General Electric specification. The difference is shown below:

GAI method: $(OBE_I^2 + SRV_I^2)^{1/2} + (OBE_D^2 + SRV_D^2)^{1/2}$

General Electric method: $[(OBE_I + OBE_D)^2 + (SRV_I + SRV_D)^2]^{1/2}$

where
OBE = Operating Basis Earthquake
SRV = Safety Relief Valve
I = Inertial Load
D = Displacement Load

b. GAI Design Specifications B21 and E22 do not include Faulted Load Case No. 8 as specified in Table 3.9-21 of the PNPP FSAR.

2.0. Requirement

a. General Electric Design Specifications 22A5454, Rev. 1 and 22A6547, Rev. 0.

b. PNPP FSAR, Amendment No. 3, dated 9/11/81, Table 3.9-21.

3.0 Reference Documents

3.1 General Electric Specification for ECCS Piping Systems No. 22A6547 Rev. 0 (Table 5, Sht. No. 21) (a)

3.2 General Electric Specification for Main Steam Piping No. 22A5454 Rev. 1 (Table 8, Sht. No. 28) (a)

3.3 GAI Support Design Calculations for HPCS Calculation E22G04B (a)

3.4 Computer Load Combination Output E22G04C (4/18/83) (a)

3.5 Program M093LOC1 (a)

Observation Record

CYGNA

Observation No.	PS-00-02	Revision No.	0
Checklist No.	PS-01, PS-02, PS-03 General	Sheet	2 of 2
Originated By	C. K. Wong	Date	1-3-84
Reviewed By	[signature]	Date	1/3/84

3.6 Load Capacity Data Sheets of Class 1 Component Support P-2001, Rev. 0 (a)

3.7 GAI Design Specification DSP-B21-1-4549-00, Rev. 1 and 2 (b)

3.8 GAI Design Specification DSP-E22-1-4549-00, Rev. 1 and 2 (b)

3.9 GAI Support Design Calculation 1E22-G04(B), Rev. 1 (b)

3.10 GAI Support Design Calculation 1B21-G08(B), Rev. 0 (b)

3.11 GAI Support Design Calculation 1N22-G01(B), Rev. 1 (b)

4.0 Potential Design Impact

a. By inspection, the GAI method for combining loads is more conservative than the General Electric recommended approach. This conclusion is supported by the following sensitivity calculations:

CASE	OBE_I	SRV_I	OBE_D	SRV_D	GAI COMBINATION	GENERAL ELECTRIC COMBINATION	% DIFFERENCE
1	100	100	100	100	283	283	0
2	100	1	100	1	200	200	0
3	100	1	1	100	200	143	-40
4	100	100	1	1	143	143	0
5	4397	390	2313	5478	10361	8914	-16

Where Case 5 is an actual loading case for Support 1E22-H005.

Consequently, the GAI method is conservative and may be up to 40% conservative.

b. More severe design loads may result due to the excluded load combination.

5.0 Probable Cause

Standard GAI practice.

Attachments

A. Observation Record Review

CYGNA

Observation Record Review
Attachment A

Observation No.	PS-00-02	Checklist No.	PS-01, 02, 03	Revision No.	0
PFR No.				Sheet 1 of 1	

	Yes	No
Closed	X	

Extent All 3 Systems

Comments

Further review indicates the following:

a. As stated in Section 4.0, the GAI method for combining inertial loads and dynamic displacement loads is conservative.

b. Consideration of FSAR Load Case No. 8, for the three systems reviewed, does not result in any significant increase in support design loads.

Based on the above, this Observation does not have any impact on design or safety.

Approvals

Originator	C.K. Wong	Date	1-20-84
Project Engineer	[signature]	Date	1/20/84
Project Manager	Ted T. Witting	Date	1/20/84
CEI Representative	[signature]	Date	2/3/84

CYGNA

Observation Record

Observation No. PS-00-03		Revision No.	0
Checklist No.	PS-01, PS-02, PS-03 General	Sheet 1 of 1	
Originated By	C. K. Wong	Date	1-3-84
Reviewed By	[signature]	Date	1/3/84

1.0 Description

The signs of Jet Impingement load input for support load combinations in utilizing the computer program "M093" were not properly considered (e.g., HPCS, E22G04(C), Run No. J484, dated 4/18/83, the dynamic Jet Impingement input loads are all positive).

2.0 Requirement

1. GAI Design Specifications DSP-B21-1-4549, Rev. 1 and 2 and DSP-E22-1-4549-00, Rev. 1 and 2.

2. Perry FSAR Amendement No. 3, dated 9/11/83.

3.0 Reference Documents

3.1 GAI Support design calculation 1E22-G04(B), Rev. 1.

3.2 GAI Support design calculation 1B21-G08(B), Rev. 0.

4.0 Potential Design Impact

Incorrect signs will give incorrect design load combinations and may lead to underdesign of some supports.

5.0 Probable Cause

Design oversight.

Attachments

A. Observation Record Review

NOTE: Jet Impingement load is not applicable to the Main Steam Drain Line, 1N22-G01, per GAI memo from D. H. Hunt to J. Chang, dated 9/27/83.

CYGNA

Observation Record Review
Attachment A

Observation No.	PS-00-03	Checklist No.	PS-01, 02, 03	Revision No.	0
PFR No.	01			Sheet 1 of 1	

	Yes	No
Closed	X	

Extent 2 of 2 Systems with jet loading

Comments

Standard GAI practice for input to the "M093" combination program is to use the same sign for the support loads as that found in the TPIPE output. In general, it is critical that the signs are properly input, however, any inaccuracies in sign input are of minor consequence for the HPCS system due to the small magnitude of the weight loads.

In addition, during the course of performing further review to explain inconsistencies between input loads and output combination values for the MSRV system, GAI has discovered a bug in the "M093" program. The problem occurs when considering the negative jet impingement loads in the emergency load combinations. A value of zero is always used in this situation due to taking the maximum (instead of the minimum) between the negative load and zero. This could result in situations where support stresses exceed Code allowables due to the loads being underestimated.

Due to the potential design and safety impact associated with this problem, a PFR has been written.

Approvals

Originator	G.K. Wong	Date	1-19-84
Project Engineer	[signature]	Date	1/19/84
Project Manager	Ted T. Dalby	Date	1/19/84
CEI Representative	[signature]	Date	1/20/84

Cleveland Electric Illuminating; 83102
Perry Nuclear Power Plant Piping Design Review

CYGNA

Observation Record

Observation No.	PS-00-05	Revision No.	0
Checklist No.	PS-01, PS-02, PS-03 General	Sheet	1 of 4
Originated By	S. Luo	Date	1/3/84
Reviewed By	C. K. Wong	Date	1-3-84

1.0 Description

The following design oversights were noted:

- Main Steam Safety Relief System

  a. Support MK-1B21-H062

  The wrong eye nut allowable load was used. (Pg. 1.5)

  b. Support MK-1B21-H163

  The design is based on the calculation for support 1B21-H179 (Rev. 0) with enveloped design loads.

  b.1 The calculation and assumptions shown on Pg. 10.30 are not applicable since they do not represent the actual condition of the support.

  b.2 Allowable stress used is 1.2 S_h. S_h was mistakenly stated as S_y (Pg. 10.31).

  b.3 The width of the ring is 5-1/2", but 12" was used in the calculation. Consequently the section properties were incorrect (Dwg. S-322-605, Sht. 163.2, Rev. E).

  b.4 Penetration sleeve was specified as schedule 40. It should be schedule 30 based on the thickness of 0.375" (Pg. 10.32).

  b.5 The thickness of the ring is 0.875", but 1.1875" was used in computing the section modulus. (Pg. 10.36)

  GAI is currently redesigning this support due to the overstress caused by this item and item b.3.

  b.6 The Lug size L_1 used in the computer analysis did not match the actual size of the Lug.

  b.7 The design was based on a very simplified analysis. There are other load conditions which were not considered (e.g., friction loads etc.) A more detailed analysis model is recommended to reduce the stress level and obtain more accurate results.

CYGNA

Observation Record

Observation No.	PS-00-05	Revision No.	0
Checklist No.	PS-01, PS-02, PS-03 General	Sheet	2 of 4
Originated By	S. Luo	Date	1/13/84
Reviewed By	C K. Wong	Date	1-3-84

- High Pressure Core Spray System

  c. Support MK-1E22-H003

  The cold load (10.87^k) used by the verifier (Pg. 1.5) was based on an incorrect calculation in Section 11 (Pg. 5). The correct cold load calculation procedure in Section 10 (Pg. 10.29) should be used to update the loads and to perform verification.

  d. Support MK-1E22-H004

  The property of a solid circular section instead of a hollow tube section was used in the stiffness calculation (Pg. 7.2).

  e. Support MK-1E22-H006

  The proper loadings from H005 (Pg. 1.9; $F_y = 13.9^k$, $F_z = 25.9^k$) were not used in the design calculation (Pg. 5, Section 11, Support H006). The support frame weight was not included in the design.

- Main Steam Drain System

  f. Support MK-1N22-H017

  The moment arm used in checking the existing W12x40 should be calculated as the distance from the point of load application to the center of W12x40 beam. The distance used in the calculation was measured only to the top of the flange.

  g. Deleted.

  h. For most of the supports (MK-1N22-H126; -H127; -H128; -H129, etc.), Youngs Modulus was not adjusted for temperature effects.

  i. Deleted.

CYGNA

Observation Record

Observation No. PS-00-05		Revision No.	0
Checklist No.	PS-01, PS-02, PS-03 General	Sheet 3 of 4	
Originated By	S. Luo / R. BALIGA	Date	1/3/84
Reviewed By	C. K. Wong	Date	1-3-84

j. Deleted.

k. The following supports do not meet the GAI stiffness criteria:

1. H004	5. H011
2. H006	6. H012
3. H008	7. H014
4. H009	8. H015

l. Deleted.

2.0 Requirement

2.1 Standard Practice

2.2 ASME B&PV Code Section III, 1974 with Addenda to Winter, 1975, Subsection NF

2.3 GAI Design Specification DSP-B21-1-4549-00, Rev. 1 and 2 (MSRV and MSD)

2.4 GAI Design Specification DSP-E22-1-4549-00, Rev. 1 and 2 (HPCS)

3.0 Reference Documents

- Main Steam Relief System

3.1 GAI Support Design Calculation 1B21G08(B), Rev. 0 (a thru b)

3.2 Drawing S-322-605, Sht. 163.2, Rev. E (b)

- High Pressure Core Spray System

3.3 GAI Support Design Calculation 1E22-G04(B), Rev. 1 (c thru e)

3.4 ECN-8857-44-1004, Rev. C (e)

Observation Record

CYGNA

Observation No.	PS-00-05	**Revision No.**	0
Checklist No.	PS-01, PS-02, PS-03 General	**Sheet**	4 of 4
Originated By	S. Luo	**Date**	1/3/84
Reviewed By	C. K. Wong	**Date**	1-3-84

- Main Steam Drain System

  3.5 GAI Support Design Calculation 1N22-G01(B), Rev. 1 (f thru 1)

  3.6 GAI Load Capacity Data Sheets of Class 1 Component Supports, P-2010, Rev. 0 (f thru 1)

  3.7 GAI program M[illegible]3, Rev. 1, Load Combination Computer output, J71 A (dated 5/10/83) for N22G01 (f thru 1)

- General - All Systems

  3.8 Power Piping Co., Pipe Hanger Catalog and Load Capacity Data Sheets.

  3.9 Pacific Scientific Co., Mechanical Arrestor Catalog and Load Capacity Data Sheets.

  3.10 National Valve and Manufacturing Co., Basic Engineering Load Capacity Data Sheets.

4.0 Potential Design Impact

1. Individually these items have no significant impact on design based upon:
   - A spot check of the above listed items.
   - The design margin used in the Perry Project.
2. The cumulative effect of the noted oversights could lead to a design deficiency.

5.0 Probable Cause

Design control.

Attachments

A. Observation Record Review

CYGNA

Observation Record Review
Attachment A

Observation No.	PS-00-05	Checklist No.	PS-01, 02, 03	Revision No.	0
PFR No.				Sheet 1 of 2	

	Yes	No
Closed	X	

Extent All 3 Systems

Comments

Further review and discussions with GAI reveal the following:

a. The reference calculation compared the applied load of 4312 lbs to 8900 lbs. the actual allowable should have been 8000 lbs.

b. Per GAI, the original configuration of this support was 12" long with a thickness of 1.1875" and no lugs. Due to constructability concerns, this was revised to the 5-1/2" configuration with lugs. Welded attachment calculations are contained in the A Calculation, which in this case references Calculation P-584, a finite element analysis of the configuration shown on Rev. E of the support drawing. Cygna has not reviewed this analysis due to GAI's detailed attention to this support.

c. For this subsystem, the line is normally cold in the operating mode but the vessel is hot. This creates the maximum differential condition. One analysis (thermal case with hot vessel and hot line) showed a 0.8" displacement at the spring. A second analysis (hot vessel and cold line case) showed a 1.5" displacement at the spring. The true condition during normal operation is somewhere in between. The corresponding spring cold setting for this more realistic condition should be

$$10.8K + \left(\frac{0.8 + 1.5}{2}\right) \times \text{spring constant} = 13.1K.$$

Since spring settings are verified as part of GAI's Phase III pro[illegible] the 11.8K setting on Rev. C of the drawing does not create a safety concern.

d. The calculation reviewed was a preliminary calculation used initially for estimating. Per GAI, the noted discrepancy was picked up by the designer when reviewing final stiffnesses with the analyst in a later revision of the calculation.

Approvals

Originator	C. K. Wong	Date	1-27-84
Project Engineer	[signature]	Date	1/27/84
Project Manager	Ted P. [signature]	Date	1/27/84
CEI Representative	[signature]	Date	2/3/84

Cleveland Electric Illuminating; 83102
Perry Nuclear Power Plant Piping Design Review

Observation Record Review
Attachment A

Observation No.	PS-00-05	Checklist No.	PS-01, 02, 03	Revision No.	0
PFR No.				Sheet 2 of 2	

	Yes	No
Closed	X	
Extent	All 3 Systems	

Comments

e. The loads of 13.9^K and 25.9^K are 150% of the actual loads. Per GAI this was done to provide margin in long lead time hardware at the time supports were designed. This would allow for a substantial variation in load when spring stiffness was included in the later analysis. The actual loadings were used for the design of the support structural steel (consideration of frame weight is addressed in PS-00-06).

f. Per GAI, the W12X40 is a structural member checked in the load confirmation effort by structural engineers.

g. Deleted.

h. Per Table I-6.0 of ASME Subsection NA, Young's modulus varies with temperature from 27.9 ksi at ambient to 27.3 ksi at 330°, which is the accident temperature inside drywell. Since this property is only used for the calculation of support deflection and support stiffness, there is potentially a 2% maximum variation in calculated values. This would have a negligible impact on design.

i. Deleted.

j. Deleted.

k. Per GAI, their stiffness criteria was a guideline established for Class 1 work to aid designers in new designs and minimize iterative cycles between analysis and design. Final stiffnesses are included in the "C" calculation and have been addressed by the analyst.

l. Deleted.

As stated in Section 4.0, individually these items do not have impact upon design. In addition, based on the explanations above, Cygna does not consider the cumulative effect of these items to be a potential problem for the three systems reviewed.

Approvals

Originator	C.K. Wong	Date	1-27-84
Project Engineer	[signature]	Date	1/27/84
Project Manager	[signature]	Date	1/27/84
CEI Representative	[signature]	Date	2/3/84

Cleveland Electric Illuminating; 83102
Perry Nuclear Power Plant Piping Design Review

CYGNA

Observation Record

Observation No.	PS-00-06	Revision No.	0
Checklist No.	PS-01, PS-02 & PS-03 General	Sheet	1 of 1
Originated By	S. Luo	Date	1/3/84
Reviewed By	C. K. Wong	Date	1-3-84

1.0 Description

The design of the supports does not consider the following items:

a. Dead weight of the support itself.

b. Inertial loads due to support self-weight excitation.

2.0 Requirement

Standard industry practice.

3.0 Document Reference

3.1 GAI support design calc. 1N22G01 (B), Rev. 1.
3.2 GAI support design calc. 1B21G08 (B), Rev. 0.
3.3 GAI support design calc. 1E22G04 (B), Rev. 1.

4.0 Potential Design Impact

a. This is critical only for frame-type supports which have a small margin with respect to allowables.

b. This is most critical in the unrestrained direction for frame-type supports where high accelerations must be considered.

In the restrained direction this is only critical when the margin with respect to allowable is small.

Note: "Restrained direction" is defined as the line of action of the support.

5.0 Probable Cause

GAI standard practice.

Attachments

A. Observation Record Review

CYGNA

Observation Record Review
Attachment A

Observation No.	PS-00-06	Checklist No.	PS-01, 02, 03	Revision No.	0
PFR No.				Sheet	1 of 2

	Yes	No
Closed	X	

Extent All 3 Systems

Comments

The GAI standard practice is that the consideration of dead weight and inertial loads due to support self-weight excitation is made at the designer's discretion. During the design process, the designer makes a judgment as to whether these factors are critical to the design and integrates them in his calculations as appropriate. GAI has performed an evaluation of the three systems within the scope of this review to determine the most critical support(s) for the loads of concern. Their determination was that a frame comprised of supports H004 and H009 in subsystem 1N22G01(B) was most critical. This judgement was based on the following three factors:

1. The support frame appears to be flexible in the out-of-plane direction.

2. The frame is attached at two structural points (drywell wall and bio-shield platform steel) which are highly excited.

3. The support frame is located in containment building where the most severe transient loadings are found.

GAI's evaluation was made by analytically determining the natural frequencies in the three orthogonal directions. Once the frequencies were found, the corresponding accelerations were read from the response spectrum curves. The accelerations were applied to the frame mass, resulting in the self-weight inertial loads.

GAI then performed a static analysis combining the out-of-plane inertial loads (in two directions) with in-plane piping loads, in-plane inertial loads, and support dead weight. The resulting stresses for loadings in different directions were added directly. This is conservative since it is unlikely that the maximum inertial loadings would occur simultaneously in three orthogonal directions. Per GAI, the results showed that for this conservatively combined loading case, the stresses were within code allowables.

Approvals

Originator	C. K. Wong	Date	2-7-84
Project Engineer	[signature]	Date	2/7/84
Project Manager	[signature]	Date	2/7/84
CEI Representative	J E Morgan	Date	2-8-84

CYGNA

Observation Record Review
Attachment A

Observation No. PS-00-06	Checklist No. PS-01, 02, 03	Revision No. 0
PFR No.		Sheet 2 of 2

	Yes	No
Closed	X	

Extent All 3 Systems

Comments

Cygna has not reviewed this analysis, and based upon an independent assessment of the supports for the three systems within the scope of this review, Cygna requested GAI to perform a similar evaluation as that described above for support 1N22-H132. The results of this analysis showed that the stress levels are acceptable. However, GAI has decided to install bracing for this support in order to provide additional out-of-plane stability.

Based on the above, this Observation does not have any impact on the design or safety of the MSRV, HPCS, or MSD systems.

Approvals

Originator	C. K. Wong	Date	2-7-84
Project Engineer	[illegible]	Date	2/7/84
Project Manager	Ted T. Whitting	Date	2/7/84
CEI Representative	[illegible]	Date	2-8-84

Observation Record

Observation No.	PS-00-07	Revision No.	0
Checklist No.	PS-01, PS-02 & PS-03 General	Sheet	1 of 2
Originated By	S. Luo / R. BALIGA	Date	1/3/84
Reviewed By	C. K. Wong	Date	1-3-84

1.0 Description

The following items were noted in relation to the setting for springs and snubbers.

- Mainstream Relief Valve System

  a. Deleted.

- High Pressure Core Spray System

  b. Supports MK-1E22-H003 and MK-1E22-H006

  Neither a cold setting calculation nor an indication of the proper normal thermal mode for design was given in the verification calculation reflecting the latest support data (drawing Rev. C).

- Main Steam Drain System

  c. Deleted.

  d. Support MK-1N22-H019

  Incorrect thermal movement was used in calculating the cold load (See Sht. 019.2 of Dwg. S-322-121, Rev. A). Also the normal thermal mode (THN2) displacement was not used.

  e. Supports MK-1N22-H008, H131, H127, H013, H011

  Snubber setting was computed in calculation, but was not specified on the drawing. The drawing indicates "N/A" for setting. Per GAI this instructs installer to set the snubber at midstroke. The actual settings should be:

H008	2.875"	H011	1.25"
H127	2.82"	H131	Max thermal = 2.0156", but no setting was calculated.
H013	0.325"		

CYGNA

Observation Record

Observation No.	PS-00-07	Revision No.	0
Checklist No.	PS-01, PS-02 & PS-03 General	Sheet	2 of 2
Originated By	S. Luo / R. BALIGA	Date	1/3/84
Reviewed By	C.K Wong	Date	1-3-84

- General

  f. There is no indication that bottoming or topping out of springs is checked for combined thermal and dynamic movements. There are no calculations performed combining the displacements due to dynamic loading.

2.0 Requirement

Standard industry practice.

3.0 Document Reference

3.1 GAI support design calc. 1N22G01 (B), Rev. 1.
3.2 GAI support design calc. 1B21G08 (B), Rev. 0.
3.3 GAI support design calc. 1E22G04 (B), Rev. 1.

4.0 Potential Design Impact

Improper settings may result in a spring or snubber bottoming or topping out. This would result in the support not performing its intended function.

5.0 Probable Cause

Minor design/analysis oversights.

Attachments

A. Observation Record Review

CYGNA

Observation Record Review
Attachment A

Observation No. PS-00-07	Checklist No. PS-01, 02, 03	Revision No.	0
PFR No.		Sheet 1 of	2

	Yes	No
Closed	X	

Extent 2 of 3 Systems

Comments

Further review and discussions with GAI indicate the following:

a. Deleted.

b. Appropriate settings are shown on the drawings but not documented in the calculations.

c. Deleted.

d. Per GAI, a value of 0.549" down (from a previous analysis) was used versus the current actual value of 0.387". For the spring rate of 200 lbs/inch, this would change the setting from 390 lbs to 423 lbs. Cygna agrees that this deviation is not sufficient to warrant a drawing revision at this time, pending as-built information.

e. The settings specified on the drawing bill of material are correct for H011, H013 and H127.

Per GAI, for H008, the PPC drawing has this snubber set at mid-stroke. GAI has committed to update the drawing to reflect this setting during the upcoming "cosmetic revision" cycle prior to fuel load.

Regarding H131, the thermal movement exceeds the specified mid-stroke setting by 0.015". However, per GAI, all settings will be reviewed as part of the as-built program prior to fuel load.

Approvals

Originator	C.K. Wong	Date	1-27-84
Project Engineer	[signature]	Date	1/27/84
Project Manager	[signature]	Date	1/27/84
CEI Representative	[signature]	Date	2/3/84

Observation Record Review
Attachment A

CYGNA

Observation No. PS-00-07	Checklist No. PS-01, 02, 03	Revision No. 0
PFR No.		Sheet 2 of 2

	Yes	No
Closed	X	

Extent 2 of 3 Systems

Comments

f. In general, inertial movements are small compared to thermal movements. Spring cans are selected to achieve a center set as much as possible. Per GAI, travel is then restricted to the recommended load range which permits a minimum 1/2" margin on each end to prevent bottoming out. It is also important to note that it is standard design practice to locate springs either adjacent to equipment or near large concentrated masses where they provide constant dead weight support. GAI states that dynamic displacements of 1/2" do not occur at these locations since they could not be tolerated by the piping or supporting equipment.

Based on the above, this Observation does not have any impact on design or safety.

Approvals

Originator	C. K. Wong	Date	1-27-84
Project Engineer	[illegible signature]	Date	1/27/84
Project Manager	Ted T. Wetting	Date	1/27/84
CEI Representative	J E Mayer	Date	2/3/84

Cleveland Electric Illuminating; 83102
Perry Nuclear Power Plant Piping Design Review

Observation Record

Observation No.	PS-01-01	Revision No.	0
Checklist No.	PS-01 MSRV	Sheet	1 of 1
Originated By	C.K. Wong	Date	1-3-84
Reviewed By	[signature]	Date	1/3/84

1.0 Description

For the design of Main Steam Safety Relief system pipe supports, there is no indication that the hydro test load is considered in the design.

2.0 Requirement

All pertinent loading conditions should be considered.

3.0 Reference Documents

GAI support design calculation 1B21G08(B), Rev. 0.

4.0 Potential Design Impact

Some supports may be underdesigned if hydro test load was not considered.

5.0 Probable Cause

Improper assumption that the discharge line does not require hydro test.

Attachments

A. Observation Record Review

CYGNA

Observation Record Review
Attachment A

Observation No. PS-01-01	Checklist No. PS-01	Revision No.	0
PFR No.		Sheet 1 of 1	

	Yes	No
Closed	X	

Extent 1 of 1 Steam Systems

Comments

Further review indicates the following:

a. The rigid supports for this system are designed for an upset load which is larger than 1.9 x deadweight load (hydro-test load).

b. Per GAI, Power Piping Company designs springs and variable supports in accordance with the "Manufacturers Standardization Society" (MSS) Standard Practice SP-58. This practice requires that elements designed for use with hydrostatic test stops be capable of supporting up to two times the normal operating load.

c. The structural support steel associated with variable spring support H062 is sufficient to withstand the additional loading due to hydro-test. Cygna has not reviewed the support detail for variable spring support H468 due to the fact that this is a recently added support which was not part of the Rev. 0 calculation. This support is included in the Rev. 1 calculation which was not within the scope of this review.

Based on the above, this Observation does not have any impact on design or safety.

Approvals			
Originator	C. K. Wong	Date	1-24-84
Project Engineer	[illegible signature]	Date	1/24/84
Project Manager	Ted I. Wittig	Date	1/24/84
CEI Representative	[illegible signature]	Date	2/3/84

Cleveland Electric Illuminating; 83102
Perry Nuclear Power Plant Piping Design Review

Observation Record

Observation No.	PS-02-01	Revision No.	0
Checklist No.	PS-02-H001 HPCS	Sheet	1 of 1
Originated By	C.K. Wong	Date	1-3-84
Reviewed By	[signature]	Date	1/3/84

1.0 Description

The following design oversights were noted for support 1E22-H001:

a. Wrong section properties were used in shear and deflection calculations (Pg. 10.4).

b. Young's modulus "E" has not been adjusted for temperature effect in the stiffness calculation (Pgs. 10.1 and 10.2).

c. Welding between items D and F is overstressed.

d. Dimensions of some items on the support drawings are not clearly defined (e.g. length of item D, and length of weld between F and D).

2.0 Requirement

2.1 ASME B&PV Code, Section III, 1974 with addenda to Winter 1975 Subsection NF.

2.2 Standard Industry Practice.

3.0 Document Reference

3.1 GAI Support Design Calculation 1E22-G04(B), Rev. 1.

3.2 Support drawings for MK-1E22-H001, S-322-701, Sht. 1 and 2, Rev. E.

4.0 Design Impact

Support is not adequate.

5.0 Probable Cause

Design oversight.

Attachments

A. Observation Record Review

Observation Record Review
Attachment A

CYGNA

Observation No. PS-02-01	Checklist No. PS-02	Revision No.	0
PFR No. 02		Sheet 1	of 1

	Yes	No
Closed	X	

Extent 1 of 3 Systems

Comments

a. Per GAI, in April 1983, due to reanalysis, the design loads increased by approximately 50%. This required substitution of a 6" schedule 160 pipe for a previous 5 x 5 x 1/2" tube section. For the shear and deflection calculation, the higher section properties were not used to update the calculation. This is conservative.

b. Per Table I-6.0 of ASME Subsection NA, Young's modulus varies with temperature from 27.9 ksi at ambient to 27.3 ksi at 330°, which is accident temperature inside drywell. Since this property is only used for the calculation of support deflection and support stiffness, there is potentially a 2% maximum variation in calculated values. This would have a negligible impact on design.

c. Due to the potential impact on design and safety associated with the overstressed weld, PFR 02 has been written.

d. Per GAI, dimensions of a minor nature are not always provided on the GAI drawing. The GAI drawing is an engineering drawing which is re-detailed by the fabricator (PPC) for use as a fabrication/installation drawing. In accordance with the GAI fabrication specification SP-527, fabrication drawings are submitted to the engineer (GAI) for approval prior to use for fabrication. Adherence to this specification that the hardware will be properly dimensioned and that there will be no impact on design or safety.

Approvals

Originator	C. K. Wong	Date	1-24-84
Project Engineer	[illegible signature]	Date	1/24/84
Project Manager	Ted F. Witting	Date	1/24/84
CEI Representative	[illegible signature]	Date	2/3/84

Cleveland Electric Illuminating; 83102
Perry Nuclear Power Plant Piping Design Review

CYGNA

Observation Record

Observation No.	PS-02-02	Revision No.	0
Checklist No.	PS-02-H001 & H002 HPCS	Sheet	1 of 1
Originated By	C. K. Wong	Date	1-3-84
Reviewed By	S. Luo	Date	1/3/84

1.0 Description

The Jet loads on supports H001 and H002 are specified in the design specification, but were not included in the support design calculations.

2.0 Requirement

2.1 GAI Design Specification DSP-E22-1-4549-00, Rev. 1 and 2.

2.2 Perry FSAR Amendement No. 3, dated 9/11/83.

3.0 Reference Documents

GAI Support design calculation 1E22-G04(B), Rev. 1.

4.0 Potential Design Impact

Design loads will be increased and may necessitate redesign of the supports.

5.0 Probable Cause

Design oversight.

Attachments

A. Observation Record Review

Observation Record Review
Attachment A

Observation No.	PS-02-02	Checklist No.	PS-02	Revision No.	0
PFR No.				Sheet 1 of 1	

	Yes	No
Closed	X	

Extent 1 of 2 Systems with Jet Loading

Comments

Further review indicates that the jet map drawings are used in conjunction with the design specification to determine which jets strike particular supports. These drawings are continually updated as source shields are added.

Per GAI, as a result of this process, supports 1E22-H001 and H002 are now shielded from all breaks.

Based on the above, this Observation does not have any impact on design or safety.

Approvals

Originator	C. K. Wong	Date	1-24-84
Project Engineer	R. Weinstein	Date	1/24/84
Project Manager	Ted T. Wittig	Date	1/24/84
CEI Representative	J E Morgan	Date	2/3/84

Cleveland Electric Illuminating; 83102
Perry Nuclear Power Plant Piping Design Review

CYGNA

Observation Record

Observation No.	ME-01-01	Revision No.	0
Checklist No.	ME-01 MSSRVS Item #4	Sheet	1 of 1
Originated By	R. W. Hess	Date	12/1/83
Reviewed By	J. Weingart	Date	12/9/83

1.0 Description

Safety relief valve discharge line sizing (flow and pressure drop) calculations could not be located by GAI.

2.0 Requirement

Per the Perry FSAR Section 5.2.2.2.3.3, the discharge line is sized to prevent the backpressure on each safety/relief valve from exceeding 40 percent of the valve inlet pressure. The GE Process Diagram 105D5575 also states that the ASME relieving capacity of the S/RV's only applies when the back pressure at the discharge side of the S/RV's is $\leq$ 40% of the S/RV inlet pressure with a flow rate corresponding to nameplate.

3.0 Reference Documents

3.1 Perry FSAR Amendment #7 (5-27-82), Section 5.2.2

3.2 Nuclear Boiler Specification, 22A4622, Rev. 5

3.3 Nuclear Boiler Data Sheet, 22A4622 AR, Rev. 2

3.4 Process Diagram Nuclear Boiler, 105D5575, Rev. 0

3.5 Design Specification, DSP-B21-1-4549-00, Rev. 2

4.0 Potential Design Impact

Due to the lack of verifiable and documented calculations, the adequacy of the S/RV discharge line size cannot be determined. However, per the Perry Supplemental Safety Evaluation Report #3 Table 6.4, the Perry S/RV discharge line size of 10" is the same as two similar nuclear power plants (Kuosheng and Grand Gulf).

5.0 Probable Cause

Document control.

Attachments

A. Observation Record Review

CYGNA

Observation Record Review
Attachment A

Observation No. ME-01-01	Checklist No. ME-01	Revision No.	0
PFR No.		Sheet 1	of 1

	Yes	No
Closed	X	

Extent 3 of 3 Systems with missing calculations

Comments

GAI submitted portions of piping engineering calculation P203, Rev. 0, dated 1/20/83 as verification that the safety relief valve discharge piping was adequately sized. The original purpose of this calculation was to perform a thermal-hydraulic transient analysis on the MSSRV discharge piping and to generate a hydraulic transient force history for input to the TPIPE time history dynamic analysis. However, the submitted portions of calculation P203 do show that the discharge piping backpressure will be equal to or less than 40% of MSRV inlet pressure at a rated flow of 1.12×10^6 lb/hr. This meets the GE and FSAR requirement for this piping.

Based on the above, this Observation does not have any impact on design or safety.

Approvals

Originator	R. W. Hur	Date	1/16/84
Project Engineer	[signature]	Date	1/16/84
Project Manager	Ted T. Wattig	Date	1/16/84
CEI Representative	E. Mager	Date	1/20/84

Cleveland Electric Illuminating; 83102
Perry Nuclear Power Plant Piping Design Review

CYGNA

Observation Record

Observation No.	ME-01-02	Revision No.	0
Checklist No.	ME-01 MSSRVS, Item No. 3	Sheet	1 of 2
Originated By	R. W. Hess	Date	12/1/83
Reviewed By	N J Weingart	Date	12/9/83

1.0 Description

Vacuum breaker valves F037 and F038 are 6 inch valves with a maximum resistance coefficient of K = 1.6 as specified in GAI Specification SP-639-4549-00 Rev. 1. Per information supplied by the vendor, Anderson, Greenwood and Co., the actual K = 1.408 and the flow area is 0.201 $ft.^2$ This data results in an $A/\sqrt{K}$ factor equal to 0.17 $ft.^2$, rather than the General Electric specified minimum of 0.30 $ft.^2$ for each of these valves. In addition, no documented and verified calculations justifying the size of these valves could be located by GAI.

2.0 Requirement

General Electric Specification 22A4622 Section 4.3.3.5 requires that two parallel vacuum relief valves be provided on each relief valve discharge line to minimize drawing water up into the line due to steam condensation following termination of safety/relief valve operation. General Electric Specification Data Sheet 22A4622AR Section 3.1.20.1.2 states that the vacuum breaker $A/\sqrt{K}$ ratio shall be equal to or greater than 0.30 ft^2. K is the effective loss coefficient of the vacuum breaker and its connecting pipe to the S/RVDL.

3.0 Reference Documents

3.1 Nuclear Boiler Specification, 22A4622, Rev. 5

3.2 Nuclear Boiler Data Sheet, 22A4622AR, Rev. 2

3.3 Specification for Vacuum Breaker, SP-63-4549-00, Rev. 1

3.4 Anderson, Greenwood and Co. Assembly, 6"-300 ANSI, CVIB SPCL Vacuum Breaker Valve N04-2217-530, Rev. D.

CYGNA

Observation Record

Observation No.	ME-01-02	Revision No.	0
Checklist No.	ME-01-MSSRVS, Item No. 3	Sheet	2 of 2
Originated By	R. V. Hur	Date	12/1/83
Reviewed By	[signature]	Date	12/9/83

4.0 Potential Design Impact

Due to the lack of documented and verified calculations, the adequacy of the specified valves cannot be determined. Per the Perry Supplemental Safety Evaluation Report No. 3 Table 6.4, similar plants (Kuosheng and Grand Gulf) have two 10 inch vacuum breaker valves on each SRVDL instead of the 6 inch valves specified for Perry. The Perry SSER 3 Section 6.2.1.8.2 (Pg. 6.3) states, "This criterion ($A/\sqrt{K} = 0.30\ ft^2$) is met by the two 6 inch vacuum breakers at Perry." However, the General Electric Specification Data Sheet 22A4622AR indicates this criteria should be met by each valve and not by the sum of the two valves.

5.0 Probable Cause

Design control.

Attachments

A. Observation Record Review

Observation Record Review
Attachment A

Observation No.	ME-01-02	Checklist No.	ME-01	Revision No.	0
PFR No.				Sheet 1 of 1	

	Yes	No
Closed	X	

Extent 3 of 3 Systems with valve data inconsistent with GE Requirements

Comments

Per the attached GE/GAI telecon of November 2, 1983 (E. Wood, GE, to T. Daugherty, GAI), the $A/\sqrt{K} = 0.30\ ft^2$ criteria in the GE specification is to be interpreted as the total ratio for both vacuum breaker valves. The vacuum breaker design provides $2 \times 0.17\ ft^2 = 0.34\ ft^2$, which satisfies GE's requirements as explained in the referenced telecon.

Based upon this telecon, there is sufficient documentation to justify the sizing of these valves. Accordingly, there is no impact on design or safety.

Approvals

Originator	R. W. Hess	Date	12/6/83
Project Engineer	L J Weinart	Date	12/6/83
Project Manager	T. T. Wittig	Date	12/6/83
CEI Representative	J E Myers	Date	12/16/83

Observation Record

Observation No.	ME-02-01	Revision No.	0
Checklist No.	ME-01 HPCS, Item No. 1	Sheet	1 of 2
Originated By	R. W. Hess	Date	12/1/83
Reviewed By	L. J. Weingart	Date	12/9/83

1.0 Description

There are various inconsistencies between Table 1 of GAI Specification DSP-E22-1-4549-00 Rev. 1 and Rev. 2 and the General Electric Process Diagram 762E455. Specifically:

a. GAI Table 1 defines both design conditions and operating conditions for the HPCS. In one region of the system, the operating conditions (234 psig @ 104°F) exceed the design conditions (100 psig @ 212°F). Specifically, this occurs at locations 16, 17 and 27 for operating mode B.

b. GAI Table 1 lists the pressure above the suppression pool as 15 psig in modes D through J. The GE diagram lists this pressure as 14.7 psia.

c. GAI Table 1 location No. 1.5 pressure is stated to be 36 psig. This is higher than would be achieved by adding the static head of water in the tank to the General Electric stated atmospheric pressure of 14.7 psia in the tank.

d. In GAI Table 1 for modes D through G, the difference in pressure between the source of suction and the reactor vessel does not match the General Electric requirements of 1550 gpm @ 1147 psid and 6110 gpm @ 200 psid.

e. In GAI Table 1, mode H, the pressure at locations No. 16, No. 17, and No. 27 should be the same. Location No. 27 is given as 15 psig while No. 16 and No. 17 are given as 25 psig.

2.0 Requirement

General Electric Specification 22A3131, Data Sheet 22A3131AS and Process Diagram 762E455 are the design basis documents. They provide flow, pressure, and temperature data for which the system must be designed.

CYGNA

Observation Record

Observation No.	ME-02-01	Revision No.	0
Checklist No.	ME-01 HPCS, Item No. 1	Sheet	2 of 2
Originated By	R. V. Hur	Date	12/1/83
Reviewed By	RJWeingart	Date	12/9/83

3.0 Reference Documents

3.1 Design Specification, 22A3131 Rev. 5 HPCS

3.2 HPCS Data Sheet, 22A3131 Rev. 2

3.3 Process Diagram, 762E455 Rev. 6

3.4 Design Specification HPCS, DSP-E22-1-4549-00 Rev. 1

3.5 Design Specification HPCS, DSP-E22-1-4549-00 Rev. 2

4.0 Design Impact

Since the GAI design specification is used for piping and pipe support design, inconsistencies in pressure, temperature, and flow data could cause inaccuracies in this design effort. It is not clear what other design functions (valve sizing, I & C, etc.) use Table 1 data as design input information.

5.0 Probable Cause

Failure to document the resolution of differences between corresponding General Electric and GAI specifications.

Attachments

A. Observation Record Review

CYGNA

Observation Record Review
Attachment A

Observation No.	ME-02-01	Checklist No.	ME-02	Revision No.	0
PFR No.				Sheet 1	of 1

	Yes	No
Closed	X	

Extent 2 of 3 Systems with inconsistencies between GE and GAI data

Comments

Based on the following GAI data and commitments, this Observation does not have any impact on the design or safety of components or systems within the scope of this review.

a. GAI will revise the system design conditions portion of Table 1 in DSP-E22-1-4549-00, Rev. 2, to reflect design conditions that envelop all system operating conditions.

b. GAI will revise the Mode H operating pressure at locations #16 and #17 in Table 1 of DSP-E22-1-4549-00, Rev. 2, to be consistent with location #27, i.e., 15 psig.

c. GAI does not intend to correct any of the other inconsistencies and/or inaccuracies in Table 1 of DSP-E22-1-4549-00, Rev. 2. The GAI reason for not making additional revisions to this table is that the existing data is conservative for use in the design of system piping and pipe supports. As indicated by GAI in the title and Section 1:01 of Specification DSP-E22-1-4549-00, Rev. 2, Table 1 is intended to be used solely by the piping analysis and pipe support design groups. In addition, GAI has stated in various discussions that no other GAI procedures (other than piping procedures) specifically require the use of data in the E22 piping design specification as design input for other system/component design. Based on the fact that the systems review was limited to those items which may affect the piping analysis and that the existing Table 1 data is conservative for this purpose, Cygna concurs that a general revision to the Table is not required at this time.

Approvals

Originator	R. W. Hu	Date	1/18/84
Project Engineer	[signature]	Date	1/18/84
Project Manager	Ted T. Witting	Date	1/19/84
CEI Representative	J. E. Mrz	Date	1/20/84

Cleveland Electric Illuminating; 83102
Perry Nuclear Power Plant Piping Design Review

CYGNA

Observation Record

Observation No.	ME-02-02	Revision No.	0
Checklist No.	ME-02 HPCS Item No. 1	Sheet	1 of 1
Originated By	R. W. Hess	Date	12/1/83
Reviewed By	[signature]	Date	12/9/83

1.0 Description

In GAI Specification DSP-E22-1-4549-00 Table 1, the Mode A pressure drop across valve F010 is given as 522 ft., and the drop across valve F011 is given as 116 ft. These drops are well above the General Electric stated minimum of 62 ft., indicating that the valves are not fully open in mode A. Also, these pressure drops (throttled position) were not used in the flow and orifice sizing calculation for the system.

2.0 Requirement

General Electric Process Diagram 762E455, Note 8, states that a 62 ft. pressure drop is the minimum drop for these valves and that they may be throttled to facilitate the piping arrangement. Note 16 of this process diagram recommends installing orifice RO-D004 to limit flow to 6110 gpm with valves F010 and F011 fully open.

3.0 Reference Documents

3.1 Process Diagram, 762E455, Rev. 6 HPCS

3.2 HPCS Design Specification, DSP-E22-1-4549-00, Rev. 1 and Rev. 2

3.3 Calculations HPCS Line Losses, E22 A/J-CC Dated 2/8/79

4.0 Potential Design Impact

The orifice, RO-D004, was sized based on (1) both F010 ad F011 being fully open and (2) dissipating an excess head of 945.3 ft. If valves F010 and F011 are throttled as indicated in Table 1 to absorb an additional 514 ft. of head [(522 - 62) + (116 - 62)], then the total system pressure drop at 6110 gpm will exceed the available head at this flow.

5.0 Probable Cause

Design control.

Attachments

A. Observation Record Review

CYGNA

Observation Record Review
Attachment A

Observation No. ME-02-02	Checklist No. ME-02	Revision No.	0
PFR No.		Sheet 1 of 1	

	Yes	No
Closed	X	

Extent 1 of 3 Systems with inconsistent use of GE data

Comments

GAI has stated that they will revise Table 1 of Specification DSP-E22-1-4549-00 to indicate a pressure drop of 62 ft through valve F010 and 62 ft through valve F011. In addition, the revised specification will indicate that the remaining excess pump head is dissipated by orifice RO-D004. This is in accordance with the calculation of reference 3.3. GAI also verified in a telecon with Cygna on 11/16/83 that these changes to Table 1 will not affect any other design calculations, drawings or specifications.

Based upon the above GAI statements, this observation does not have any impact on design or safety.

Approvals

Originator	R. W. Hess	Date	12/6/83
Project Engineer	L J Weinmann	Date	12/6/83
Project Manager	T. T. Watling	Date	12/6/83
CEI Representative	J E Mazzola	Date	12/16/83

Cleveland Electric Illuminating; 83102
Perry Nuclear Power Plant Piping Design Review

CYGNA

Observation Record

Observation No.	ME-02-03	Revision No.	0
Checklist No.	ME-02 HPCS Item No. 2	Sheet	1 of 2
Originated By	R. W. Hus	Date	12/1/83
Reviewed By	L J Weingart	Date	12/9/83

1.0 Description

The location and arrangement of some equipment and piping is inconsistent with General Electric and NRC Criteria. Specifically:

a. The HPCS suppression pool suction strainer is not located outside the safety relief valve discharge zone.

b. Valve F023 is located approximately 14 ft. from the containment penetration. It should be located as close as practical to the penetration. Normally a distance of 5 ft. or less is achievable.

c. The length of straight pipe after a valve and prior to flow orifice N007 does not meet the 43 ft. requirement.

2.0 Requirement

a. General Electric Specification 22A3131, Section 4.2.4.6, states that the HPCS suction strainer shall be located away from safety relief valve discharge zones.

b. Both General Electric Specification 22A3131, Section 4.2.3.13 and 10CFR50 Appendix A Criterion 56 require that outside containment isolation valves, such as F023, be located as close to the containment penetration as practical.

c. Per General Electric Specification 21A9505BV, Rev. 1, Section 4.3.1.1 there should be 43 ft. of straight pipe between the outlet of a valve and the inlet of the flow measuring orifice.

3.0 Reference Documents

3.1 Design Specification HPCS, 22A3131, Rev. 5

3.2 General Design Criteria, 10CFR50 Appendix A

3.3 Flow Orifice Assembly HPCS, 21A9505BV

CYGNA

Observation Record

Observation No.	ME-02-03	Revision No.	0
Checklist No.	ME-02 HPCS, Item No. 2	Sheet	2 of 2
Originated By	R. W. Hess	Date	12/1/83
Reviewed By	R J Weingart	Date	12/9/83

3.4 Drawings

3.4.1	HPCS Plans and Sections	D-304-701
3.4.2	HPCS Sections	D-304-702
3.4.3	HPCS Reactor Building El. 620'-6" and 574'-10"	D-304-703
3.4.4	MSSR Piping Inside Reactor Building El. 574'-10" and 599'-9"	D-304-026
3.4.5	Discharge Quencher	767E676 I.C.D
3.4.6	Quencher Arrangement Design Envelope	B-301-734, Rev. J

4.0 Potential Design Impact

a. The location of the HPCS suction strainer within the quencher discharge zone could cause air or steam entrainment in the HPCS pump suction line.

b. The location of F023 away from the containment penetration provides a greater length of nonisolatable piping which could lead to a breach of containment if it failed.

c. The accuracy of flow orifice N007 could be affected by its proximity to the valve located upstream.

5.0 Probable Cause

Design oversight and lack of documentation of design variances.

Attachments

A. Observation Record Review

CYGNA

Observation Record Review
Attachment A

Observation No. ME-02-03	Checklist No. ME-02	Revision No.	0
PFR No.		Sheet 1 of	1

	Yes	No
Closed	X	

Extent 1 of 3 Systems with nonconformance to GE Equipment arrangement requirements

Comments

Based on the following GAI and GE data and documentation, this Observation does not have any impact on design or safety.

a. General Electric approved the location of the HPCS, LPCI, RCIC and RHR suction strainers within the SRV discharge quencher zones in Field Deviation Disposition Request No. KL1-301 approved on 6/6/83. This approval was based on the pump vendor certification that the quantity of ingested air (40% maximum in 1.5 seconds) is acceptable for pump operation.

b. GAI has stated, based upon their review of the piping arrangment, that due to the proximity of other piping and the valve operator size, F023 cannot be located any closer to the containment penetration.

c. GAI has stated that the current piping arrangement will provide the 1% accuracy specified for flow element E22-FE-N007. GE concurrence with the existing piping arrangement was requested by GAI in letter PY-GAI/GEN-2931, dated 12/30/83.

Approvals

Originator	R. W. Hus	Date	1/13/84
Project Engineer	LJ Wainwright	Date	1/13/84
Project Manager	Ted T Wetting	Date	1/16/84
CEI Representative	J E Myers	Date	1/20/84

Cleveland Electric Illuminating; 83102
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CYGNA

Observation Record

Observation No.	ME-02-04	Revision No.	0
Checklist No.	ME-02-HPCS, Items No. 7 and 24	Sheet	1 of 2
Originated By	R. W. Hess	Date	12/1/83
Reviewed By	HJ Wingart	Date	12/9/83

1.0 Description

The vendor print (Rockwell) for valve F005 indicates this valve is a lift check valve with no stem (i.e., no stem leak-off connection) or external operator for remote testing. In addition the pressure and temperatures indicated on the drawing approximately match a 600 lb. class valve. The General Electric data, CEI SAR and GAI P & ID all indicate this valve should be a remotely testable swing check valve with an air operator and stem leak-off connection. In addition, line specification D1-1 recommends valves of this size be 900 lb. class valves.

2.0 Requirement

General Electric Specification 22A3131, Section 4.2.3.3 states that a testable check valve shall be provided in the HPCS discharge line inside the drywell. The General Electric P & ID for the HPCS system, 795E873, indicates this valve has an air operator and stem leakoff connection. 10CFR50 Appendix A criterion 37 requires that the HPCS be designed to permit functional testing of the operability and performance of the active components of the system.

3.0 Reference Documents

3.1 HPCS Design Specification, 22A3131, Rev. 5

3.2 General Design Criteria, 10CFR50 Appendix A

3.3 Amendment No. 3 Section 6.3.2.2.1, Perry FSAR

3.4 Drawings

3.4.1 HPCS P & ID, D-302-701, Rev. G

3.4.2 Piping Design Specification HPCS, D-320-701, Rev. C

3.4.3 HPCS Reactor Building Elevation 620'-6" and 574'-10", D-304-703 Rev. G

3.4.4 HPCS P & ID, 795E873, Rev. 1

3.4.5 Rockwell International Testable Piston Check Valve with indicator (GAI Tag No. RNU-237), D82-24401-18, Rev. C

CYGNA

Observation Record

Observation No.	ME-02-04	Revision No.	0
Checklist No.	ME-02, Items No. 7 and 24	Sheet	2 of 2
Originated By	R. W. Hess	Date	12/1/83
Reviewed By	R J Weingart	Date	12/9/83

3.5 Letter PY-GAI/GEN-1888 Dated 5/18/83, ECCS Testable Check Valves.

3.6 Letter PY-GEN/GAI-2656 Dated 4/25/83, ECCS Testable Check Valves.

4.0 Potential Design Impact

The lift (piston) check valve has a higher flow resistance then the swing check valve and will affect the overall system pressure drop. The method of testing of this valve during normal plant operation is not given in any of the documents reviewed and therefore the design impact cannot be assessed. However, it appears that either a spare or new drywell penetration will be required for the hydraulic test line. ALARA aspects of the testing of this valve should be reviewed, since, per discussion with GAI, personnel performing the test will now be located inside containment but outside the drywell, rather than outside containment. This location may expose test personnel to a higher radiation field.

The use of the Rockwell Valve was approved with comment by General Electric in Reference 3.5 but no NRC approval or FSAR amendment was found.

5.0 Probable Cause

Inadequately documented design changes.

Attachments

A. Observation Record Review

CYGNA

Observation Record Review
Attachment A

Observation No. ME-02-04	Checklist No. ME-02	Revision No.	0
PFR No.		Sheet 1	of 1

	Yes	No
Closed	X	

Extent 3 of 3 Systems with inconsistencies between valve data and GE requirements

Comments

Per GAI, valve E22-F005 is remotely testable by a fluid system which applies pressure to a test fitting on the valve and forces the piston to lift. The test fluid system is currently in preliminary design and is not yet reflected in design documents.

The higher pressure drop through the piston type lift check valve was considered in the revised HPCS calculations (see Observation ME-02-09).

The GAI design condition for this valve was lowered from 1575 psig to 1475 psig at 140°F by ECN 12412-E22-001, Rev. 0, dated 6/17/82. The manufacturer, Rockwell International, in a letter to GAI on 12/1/83, stated that the valve rating can be increased from Class 494 to Class 590 and that they will provide the new documentation by 1/27/84. Rockwell also stated in this letter that a motor operated version of this valve had previously been given a full 900 Class rating with the only exception being the corrosion allowance.

Based on the above, this Observation does not have any impact on design or safety.

Approvals

Originator	R. W. Hu	Date	1/13/84
Project Engineer	[signature]	Date	1/16/84
Project Manager	Ted T. Wittig	Date	1/16/84
CEI Representative	[signature]	Date	1/20/84

Cleveland Electric Illuminating; 83102
Perry Nuclear Power Plant Piping Design Review

Observation Record

Observation No.	ME-02-05	Revision No.	0
Checklist No.	ME-02 HPCS, Items No. 10, 11 and 24	Sheet	1 of 1
Originated By	R. W. Hess	Date	12/1/83
Reviewed By	AJ Weingart	Date	12/9/83

1.0 Description

HPCS system check valve drawings for F002, F016, F024, and F007 do not show any provisions for checking free movement of the valve disc.

2.0 Requirement

General Electric specification 22A313, Rev. 5 Section 4.5.1.4 requires that HPCS check valves be testable to verify free movement of the valve disc.

3.0 Reference Documents

3.1 HPCS design specification, 2A3131, Rev. 5

3.2 Drawings

3.2.1 Valve assembly 16 inch, 900 lb. swing check (Borg Warner) GAI B/M RDQ 217, 81510, Rev. E

3.2.2 DUO-check valve (TRW Mission) GAI B/M ROQ 221, 21140, Rev. A, Sht. 12

4.0 Potential Design Impact

Valve discs should be checked for free movement on a periodic basis to insure that valve is not binding or stuck in the closed position. If valves bind or stick closed, they will increase the overall system pressure drop or reduce the available NPSH to the HPCS pump.

5.0 Probable Cause

Design oversight.

Attachments

A. Observation Record Review

CYGNA

Observation Record Review
Attachment A

Observation No. ME-02-05	Checklist No. ME-02	Revision No.	0
PFR No.		Sheet 1 of 1	

	Yes	No
Closed	X	

Extent 3 of 3 Systems with inconsistencies between valve data and GE requirements

Comments

Per telecon between T.S. Daugherty of GAI and D. Reich and S. Bellows of GE on 12/22/83, the GE requirement that HPCS check valves be testable to verify free movement of the valve disc can be met by system functional testing. It is not GE's intent to require external manually or mechanically actuated operators to verify free movement.

Based on the above, this Observation has no impact on design or safety.

Approvals

Originator	R. W. Hess	Date	1/13/84
Project Engineer	[signature]	Date	1/16/84
Project Manager	Ted T. Wattig	Date	1/16/84
CEI Representative	J. E. Marsha	Date	1/20/84

CYGNA

Observation Record

Observation No.	ME-02-06	Revision No.	0
Checklist No.	ME-02 HPCS Item #17	Sheet	1 of 1
Originated By	R. W. Hu	Date	12/1/83
Reviewed By	L. J. Weingart	Date	12/9/83

1.0 Description

The sizing calculation for pump C-003 minimum flow bypass orifice, RO-D003, is based on a minimum flow of 10 GPM and an assumed head loss of 96 feet. The specification for the pump and its attached "Design Requirement Summary Sheet" list two different minimum flows (i.e., 10 GPM and 15 GPM) for this pump. No sizing or pressure drop calculation could be located for this pump so the 96 feet of head available for orifice sizing could not be verified.

2.0 Requirement

Specification SP-506-4549-00, Rev. VII Bill of Material Sheet 19 lists a minimum required flow of 10 GPM and the attached design requirement summary sheet lists a minimum flow rate (continuous bypass) of 15 gpm. The Perry FSAR Amendment #3 Section 6.3.2.2.5 states that a low flow bypass is provided for this pump to prevent overheating.

3.0 Reference Documents

3.1 Attachment #1 dated 2/8/79, Calculation E22 A-J, CC

3.2 Specification for Fabrication and Delivery of Water Leg Pumps, SP-506-4549, Rev. VII

3.3 Amendment #3 Section 6.3.2.2.5, Perry FSAR

3.4 HPCS Design Specification, 22A3131, Rev. 5

4.0 Potential Design Impact

Dependent on the actual pump minimum flow requirement and available head, orifice RO-D003 may be incorrectly sized.

5.0 Probable Cause

Incomplete and conflicting documentation.

Attachments

A. Observation Record Review

CYGNA

Observation Record Review
Attachment A

Observation No.	ME-02-06	Checklist No.	ME-02	Revision No.	0
PFR No.				Sheet 1 of 1	

	Yes	No
Closed	X	

Extent 2 of 3 Systems with calculation inconsistencies

Comments

GAI located preliminary pump design calculation SP-506-1. This calculation was verified and signed by GAI on 11/17/83 and issued as E22-7, Rev. 0, on 12/27/83. The calculation contains some minor inaccuracies but verifies the capability of pump C003 to meet its design function. The vendor pump curve included with calculation E22-7 shows that the pump shutoff is 100' and not 106' as assumed in the sizing calculation for orifice RO-D003. This reduction in shutoff head will result in a reduced bypass/recirculation flow through orifice RO-D003 and could affect the heat dissipation capacity of the minimum flow bypass loop. GAI will ensure a minimum 10 gpm bypass flow during system performance testing and install a larger size orifice, if required at that time.

Based on the fact that pump C003 is adequate for its intended purpose and that the pump heat dissipation and orifice size adequacy will be verified by GAI in system tests, this Observation is closed.

Approvals

Originator	R. W. Hess	Date	1/13/84
Project Engineer	[signature]	Date	1/16/84
Project Manager	Ted T. Wittig	Date	1/16/84
CEI Representative	[signature]	Date	1/20/84

Cleveland Electric Illuminating; 83102
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Observation Record

Observation No.	ME-02-07	Revision No.	0
Checklist No.	ME-02-HPCS Item #24	Sheet 1 of 1	
Originated By	R. V. Hur	Date	12/1/83
Reviewed By	[signature]	Date	12/9/83

1.0 Description

It is not apparent from the P&ID or piping drawings how valves F001, F010, and F011 will be leak tested. There do not appear to be any drain valves located such that meaningful test results can be obtained.

2.0 Requirement

General Electric Specification 22A3131, Rev. 5 section 4.5.1.7 states that drains shall be provided which will permit leak testing valves F001, F004, F005, F010, and F011. 10CFR50 Appendix A Criterion 37 also requires that the HPCS system be designed to permit periodic pressure testing to assure the structural and leaktight integrity of its components.

3.0 Reference Documents

3.1 HPCS Design Specification, 22A3131, Rev. 5

3.2 General Design Criteria, 10CFR50, Appendix A

3.3 Drawings

3.3.1 HPCS P&ID, D-302-701, Rev. G
3.3.2 HPCS Piping, D-304-701, Rev. M
3.3.3 HPCS Piping, D-304-702, Rev. L
3.3.4 HPCS Piping, D-304-703, Rev. G

4.0 Potential Design Impact

Drains may have to be added to the system piping in order to meet the leak test requirements for these valves.

5.0 Probable Cause

Design oversight.

Attachments

A. Observation Record Review

Observation Record Review
Attachment A

Observation No. ME-02-07	Checklist No. ME-02	Revision No.	0
PFR No.		Sheet 1 of	1

	Yes	No
Closed	X	

Extent 2 of 3 Systems with inconsistencies between GE and GAI data

Comments

GAI has stated that the test method for the subject valves is currently being reviewed by the CEI/NTS (Nuclear Test Section) group. Additional drain valves may be added as a result of this review. This review and any required design document changes will be completed in 1984.

Based on the fact that this item is currently under review by GAI and CEI, this Observation is closed.

Approvals

Originator	R. W. Hess	Date	1/16/84
Project Engineer	[signature]	Date	1/16/84
Project Manager	Ted P. Witting	Date	1/16/84
CEI Representative	[signature]	Date	1/20/84

CYGNA

Observation Record

Observation No.	ME-02-08	Revision No.	0
Checklist No.	ME-02-HPCS	Sheet	1 of 3
Originated By	R. W. Herr	Date	12/1/83
Reviewed By	[signature]	Date	12/9/83

1.0 Description

The following items either lack proper documentation or utilize inconsistent data.

a. HPCS Fill Pump C003 sizing calculations could not be located by GAI. In addition, the specification for this pump (SP-506-4549, Rev. III) contains inconsistencies on pump minimum flow and discharge nozzle size. The discharge nozzle size is also inconsistent between the vendor supplied pump curve and pump drawing.

b. The suppression pool suction strainer pressure drop utilized in all calculations is 1 PSI. Per the strainer specification this is the maximum drop at 8500 G.P.M. and would be lower at lower flow rates. Per the vendor pressure drop calculations, the actual drop thru the strainer at 8500 G.P.M. is 0.42 PSI in the clean condition and 0.60 PSI with the straner 50% plugged. These pressure drops would then have to be adjusted for the lower system flowrates of 7000 G.P.M., 6110 G.P.M. and 1550 G.P.M.

c. Per the Perry FSAR section 6.3.2.2.1 reflief valve F014 has a capactiy of < 10 G.P.M. 10% accumulation with a set pressure of 100 PSIG. The valve data gives the capcity as 16.2 G.P.M.

d. Per the Perry FSAR section 6.3.2.2.1, valve F039 is a thermal relief valve set at 15 P.S.I.D. The valve shown on the P&ID, physicals, and Bill of Material for Perry is a lift check valve with no specified opening pressure.

e. The calculated size of orifice RO-D002 is 6.54" but the Perry Information System (P7837151.S) lists the size as 6.51" The size of this orifice will be affected by inconsistencies in the flow pressure drop calculations with flow to the reactor vessel.

f. The calculated size of orifice RO-D004 is 4.27" but the Perry Inforamtion System (P7837151.S) lists the size as 4.32". In addition, the calculation assumed valves F010 and F011 were fully open whereas specification DSP-E22-1-4549 Table 1 indicates the valves are in a throttled position. This would affect the size of RO-D004.

CYGNA

Observation Record

Observation No.	ME-02-08	Revision No.	0
Checklist No.	ME-02-HPCS	Sheet	2 of 3
Originated By	R. V. Hu	Date	12/1/83
Reviewed By	LJ Weingart	Date	12/9/83

g. The calculated and specified size of orifice RO-D005 is 5.10". However, this size may be affected by inconsistencies in the system pressure drop calculations i.e., strainer loss, valve losses, pump operating point, etc.

h. In calculation E22-1 on HPCS Pump C001 NPSH, an incorrect but conservative value is used for the loss thru the suction strainer and the pump runout flow. Also the specific gravity of water at 212°F is approximately 0.96 not 1.0.

i. In calculation E22A/J-cc on page 13 it is indicated tha the RCIC is operating concurrently with the HPCS. No documentation was found of this operating condition, but the assumption leads to conservative suction losses.

j. Relief Valve F035 is a 900 lb. class valve. However Line Specification DI-2 calls for 1500 lb. class valves in this size.

2.0 Requirement

Good engineering practice requires that design data be well documented and consistent through the design process.

3.0 Reference Documents

3.1 Water Leg Pumps, SP-506-4549-00, Rev. VII

3.2 Suction Line Stainers, SP-529-4549-00, Rev. III

3.3 Mac-Iron Pressure Drop Calculations dated 8/3/76, C.E.I. Job s.O. 52811-3

3.4 Amendment #3 dated 9/11/81, Perry FSAR

3.5 NPSH Calculations, Calculation E22-1 dated 12/10/81

3.6 Line Losses, Calculation E22 A/J-cc dated 2/16/79

3.7 HPCS Restricting Orifices, Attachment #1 to Calculation E22 A.J-cc dated 2/8/79

3.8 Byron Jackson Pump Curve dated 3/22/74 (GAI #4549-20-009-1), PC-741-S-1414

CYGNA

Observation Record

Observation No.	ME-02-08	Revision No.	0
Checklist No.	ME-02-HPCS	Sheet	3 of 3
Originated By	R. W. Hu	Date	12/1/83
Reviewed By	[signature]	Date	12/9/83

3.9 Bingham Pump Curve (INQ #P-249-K) Water Leg Pumps, CA-3201-1

3.10 Perry Information System, P7837151.S dated 9/15/83

3.11 Design Specification HPCS, DSP-E22-4549-00, Rev. 1 and Rev. 2

3.12 Bingham-Willamette Pump Drawing (GAI #4549-21-034-3), E-17409X, dated 9/28/77

3.13 Check Valves Specifications, SP-531-01-4549-00

3.14 Relief Valves Specifications, SP-523-4549

4.0 Potential Design Impact

The noted inconsistencies and lack of documentation could lead to design errors and possibly incorrectly sized components.

5.0 Probable Cause

Design control.

Attachments

A. Observation Record Review

CYGNA

Observation Record Review
Attachment A

Observation No.	ME-02-08	Checklist No.	ME-02	Revision No.	0
PFR No.				Sheet 1 of 2	

	Yes	No
Closed	X	

Extent 3 of 3 Systems with missing calculations and inconsistent data application

Comments

GAI has presented the following resolutions to the noted inconsistencies:

a. The HPCS fill pump calculation E22-7 was located and verified (see Observation ME-02-06). GAI has agreed to revise specification SP-506 to reflect the correct (2") nozzle size.

b. GAI, in the independent HPCS calculations, has used a 1 psi drop at 6110 gpm for the suction strainer and adjusted this pressure drop at other flowrates. This is conservative and acceptable (see ME-02-09).

c. Per GAI memo from J.S. Smith to J. Hickson dated 1/13/84, FSAR pages 6.3-13 and 6.3-14 will be changed to indicate that the capacity of relief valve F014 is less than 20 gpm.

d. Per GAI memo from J.S. Smith to J. Hickson dated 1/13/84, FSAR pages 6.3-13 and 6.3-14 will be changed to indicate that valve F039 is a lift check vavle used for relieving thermally expanded fluid.

e. The HPCS independent calculations by GAI verify the adequacy of the 6.51" size of orifice RO-D002.

f. The HPCS independent calculations by GAI verify the adequacy of the 4.32" size of orifice RO-D004.

g. The HPCS independent calculations by GAI verify the adequacy of the 5.10" size of orifice RO-D005.

Approvals

Originator	R. W. Hess	Date	1/20/84
Project Engineer	[signature]	Date	1/20/84
Project Manager	Ted T. Witting	Date	1/20/84
CEI Representative	J E [signature]	Date	2/3/84

Cleveland Electric Illuminating; 83102
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Observation Record Review
Attachment A

Observation No. ME-02-08	Checklist No. ME-02	Revision No.	0
PFR No.		Sheet 2 of 2	

	Yes	No
Closed	X	

Extent 3 of 3 Systems with missing calculations and inconsistent data application

Comments

h. Based on the fact that the pressure drop thru the strainer used in the calculation is conservative and that the fluid specific gravity has no effect on the end result of the calculation, the calculated NPSH available is acceptable for system operation.

i. The HPCS independent calculations by GAI do not indicate that RCIC is operating concurrently with HPCS. This matches other documentation and is acceptable from a system design standpoint.

j. The 900 lb rating of relief valve F035 meets all system operating pressure and temperature requirements. The line specifications only list recommended ratings for gate, globe and check valves, and do not apply to relief valves.

Based on the above, this Observation has no impact on design or safety.

Approvals

Originator	R. V. Hun	Date	1/20/84
Project Engineer	[signature]	Date	1/20/84
Project Manager	Ted T. Wetting	Date	1/20/84
CEI Representative	J E Meyer	Date	2/3/84

CYGNA

Observation Record

Observation No.	ME-02-09	Revision No.	0
Checklist No.	ME-02-HPCS Item #20, 21, 22, & 23	Sheet	1 of 4
Originated By	R. W. Hus	Date	12/1/83
Reviewed By	DJWingart	Date	12/9/83

1.0 Description

The following items summarize the inconsistencies and inaccuracies noted in GAI Calculation E22-A/J-cc, HPCS Line Losses.

a. The L/D used for valve F005 in all calculations is 135 (for a swing check valve). The valve is actually a lift check for which an L/D of 340 should have been used.

Note: The vendor drawing for this valve indicates that C_v = 1993.

b. The static head used in Modes A & E is based on a condensate tank low water level of 633'-0". However, the worst case flow condition (max. ΔH_s) would be just prior to switching to suppression pool suction. This point is assumed to be at a tank level at the tank suction nozzle top and would add ≈ 10ft. to the ΔH_s. In addition, Drawing D-302-102, Rev. G indicates that the 150,000 gallon reserve in the condensate tank for HPCS is at level 630'-9".

c. In Mode E a suction flow rate of 7800 G.P.M. is used fo calculating suction head loss, but the pump discharge head losses are based on a system discharge flow of 6110 G.P.M. This is inconsistent, but conservative.

d. HPCS pump suction strainer D006 is not included as a head loss in the calculations. If this stainer is just used for startup and then has the element removed for normal operation, this should be stated in the calculation. The physical drawing shows a large assembly for this strainer which may contribute some head loss even if the element is removed.

e. On page 27 of the calcuation, a head loss of 0.4 ft. for valve F001 is added to the total head even though this valve was already included in total system equivalent length and head loss. This is a G.E. suppied valve and the 0.4 ft. drop is specified by G.E. This head loss should be used in lieu of, but not added to the previously calculated loss.

f. The head loss for valve F004 has been added to the total system head loss twice . Once as an equivalent length and once as 1.4 ft., the G.E. specified maximum. In addition, the loss of 1.4 ft. has been added to the 16 inch pipe segment on page 28 rather than the 12 inch segment in which the value is located.

CYGNA

Observation Record

Observation No.	ME-02-09	Revision No.	0
Checklist No.	ME-02-HPCS Item #20, 21, 22, & 23	Sheet	2 of 4
Originated By	R. V. Thu	Date	12/1/83
Reviewed By	L J Weingart	Date	12/9/83

g. In Mode B the suppression pool suction strainer head loss is given as 2.31. ft. on page 18. This is the maximum allowable drop with the strainer 50% plugged at 8500 G.P.M.. For 1550 G.P.M. and 50% blockage, this loss should not exceed

$$2.31 \left(\frac{1550}{8500}\right)^2 = 0.08 \text{ ft.}$$

h. Page 20 of the calculation lists the suppression pool low water elevation as 592'10", but the pump NPSH calcuation E22-1 lists the minimum level as 589'0".

i In Mode C on page 22 of the calculation, the head loss of valve F015 has been added to the system loss twice. The stated loss for this G.E. supplied valve is 0.07 ft. at 6110 G.P.M.

j. Page 23 of the calculation again adds the G.E. stated loss for valve F004 to the toal system loss which already includes valve F004.

k. Page 32 of the calculation again adds the G.E. supplied drop for valve F015 to the total system loss which already includes valve F015.

l. The G.E. stated valve head loss was not used in the calculation of head losses for Mode F on page 23.

m. The pump operating points used in the calculations for the various modes of operation do not appear to match the Byron Jackson Pump Curve Dwg. PC-741-S-1414.

2.0 Requirement

Per the General Electric Process Diagram 762E455 and Specification Data Sheet 22A3131AS, the HPCS Piping System shall be designed to provide 1550 G.P.M. to the reactor vessel with the R.V. pressure 1147 PSI above source suction pressure and 6110 G.P.M. to the reactor vessel with the R.V. pressure 200 PSI above source suction pressure. The system should also limit the flow to the reactor vessel at 14.7 PSIA to 7800 G.P.M. or the tested runout flow of the pump, whichever is lower.

CYGNA

Observation Record

Observation No.	ME-02-09	Revision No.	0
Checklist No.	ME-02-HPCS Item #20, 21, 22, & 23	Sheet	3 of 4
Originated By	R. W. Hus	Date	12/1/83
Reviewed By	LJ Weingart	Date	12/9/83

3.0 Reference Documents

3.1 HPCS Design Specification, 22A313, Rev. 5

3.2 HPCS Design Specification Data Sheet, 22A313, Rev. 5,

3.3 Process diagram HPCS, 762E455, Rev. 6,

3.4 Buryon Jackson Pump Curve (GAI #4549-20-009-1-0), PC-741-S-1414, dated 3/22/74

3.5 HPCS System NPSH, Calculation E22-1 (5/12/81)

3.6 HPCS - Line Losses, Calculation E22-A/J-cc (2/16/79)

3.7 HPCS Restricting Orifices, Calculation E22-A/J-cc Attachment #1 (2/8/79)

3.8 Drawings:

3.8.1 HPCS Piping, D-304-701, Rev. M
3.8.2 HPCS Piping, D-304-702, Rev. L
3.8.3 HPCS Piping, D-304-703, Rev. G
3.8.4 Northeast Main Plant Area, E-303-002, Rev. U
3.8.5 Sections & Details, E-303-016, Rev. H
3.8.6 Auxiliary Plans - Sections & Details, E-303-017, Rev. N
3.8.7 Plans and Details, E-303-002, Rev. F
3.8.8 Condensate Transfer and Storage, D-304-317, Rev. V
3.8.9 Condensate Transfer and Storage, D-304-315, Rev. E
3.8.10 Condensate Transfer and Storage, D-304-315, Rev. F
3.8.11 Condensate Transfer and Storage, D-302-102, Rev. G
3.8.12 HPCS, D-302-701, Rev. G

3.9 Testable Piston Check Valve w/Indicator (HPCS System Valve F005), Rockwell International, Dwg. No. D82-24401-18, Rev. C

4.0 Potential Design Impact

The major design impact of the calculational inaccuracies will be their affect on the sizing of the system orifices. The result of improperly sized orifices may be off-nominal flow to the reactor vessel and/or inaccurate flow testing of the system.

CYGNA

Observation Record

Observation No.	ME-02-09	Revision No.	0
Checklist No.	ME-02-HPCS Item #20, 21, 22, & 23	Sheet	4 of 4
Originated By	R. W. Hess	Date	12/1/83
Reviewed By	[signature]	Date	12/9/83

5.0 Probable Cause

Documentation inconsistencies and minor design oversights.

Attachments

A. Observation Record Review

CYGNA

Observation Record Review
Attachment A

Observation No. ME-02-09	Checklist No. ME-02	Revision No. 0	
PFR No.		Sheet 1 of 1	

	Yes	No
Closed	X	

Extent 2 of 3 Systems with calculation inconsistencies and inaccuracies

Comments

GAI reanalyzed the HPCS system flow and head loss in calculations N22-3, N22-4, N22-5, N22-6 and N22-8. These new calcualtions utilized Tube Turns Piping Engineering Chart 3 data for equivalent lengths of fittings and valves rather than the Crane Technical Paper 410 data which was used in the original calculations. This resulted in lower head losses for fittings and valves in the new calculation. Certain approximations are used in the revised calculations, but they have a negligible affect on the total system head loss. The new calculations indicate that with the specified orifices installed, the system head exceeds requirements for all modes of operation. The adequacy of these calculations and orifice sizes will be confirmed by system performance and pre-operational testing.

Based on the above, the system head losses are acceptable for design and this Observation has no impact on safety.

Approvals

Originator	R. W. Hm	Date	1/18/84
Project Engineer	L J W[illegible]	Date	1/18/84
Project Manager	Ted T. Wittig	Date	1/19/84
CEI Representative	J. E. M[illegible]	Date	1/20/84

Cleveland Electric Illuminating; 83102
Perry Nuclear Power Plant Piping Design Review

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Observation Record

Observation No.	ME-03-01	Revision No.	0
Checklist No.	ME-03 MSDS Item #1	Sheet	1 of 2
Originated By	R. W. Hess	Date	12/1/83
Reviewed By	RJ Weingart	Date	12/9/83

1.0 Description

The following inconsistencies within Table 1 of DSP-B21-1-1-4549 and between Table 1 and the General Electric system data are noted below:

a. The indicated pressure drop in Table 1 from location 4 to 13 for a constant flow of 310 lb/hr varies from 47.7 PSI for mode A to 390 PSI for mode B and 100 PSI for mode E.

b. In mode D of Table 1, the flow between locations 4 and 13 is given as 6,670 lb/hr and the pressure drop is listed as 100 PSI. This is the same pressure drop as given for mode E with a flow of only 310 lb/hr between these two locations.

c. GAI Table 1 indicates a continuous drain flow of 310 lb/hr for modes A, B, and E, i.e., drain valve F033 open. The General Electric Process Data 131 C7911C and Specification 22A4622 indicate that the drain valve F033 only opens at power levels of 50% and below and that the flow rate through the orifice is 2,000 lb/hr.

d. Both Table 1 of the GAI Specification and the GE process data indicate that the drain flowrate between location 13 and 14 in mode C is 50 GPM at 125°F. This drain path consists of two 3/4" valves and approximately 125' of 3/4" pipe which will significantly restrict the actual drain rate. In addition, no pressure drop is indicated across the two drain valves with the 50 GPM flow through them, i.e., 100 PSIA indicated upstream and downstream of the valves.

2.0 Requirement

GE Specification 22A4622, Process Data 131C7911C, and Process Diagram 105D5575 are the design basis documents for the system. They provide flow, pressure, and temperature data for which the system should be designed.

3.0 Reference Documents

3.1 Nuclear Boiler Design Specification, 22A4622, Rev. 5

3.2 Nuclear Boiler Design Specification Data Sheet, 22A4522AR, Rev. 2

CYGNA

Observation Record

Observation No.	ME-03-01	Revision No.	0
Checklist No.	ME-03 MSDS Item #1	Sheet	2 of 2
Originated By	R. W. Hess	Date	12/1/83
Reviewed By	LJ Weingart	Date	12/9/83

3.3 Process Diagram Nuclear Boiler, 105D5575, Rev. 0

3.4 Process Data Nuclear boiler, 131C7911C, Rev. 5

3.5 Design Specification Nuclear Boiler System Piping and Pipe Supports, DSP-B21P1P4549-00, Rev. 2

3.6 Main, Reheat, Extraction, and Miscellaneous Drains P&ID, D-302-131, Rev. D

4.0 Potential Design Impact

Since the GAI design specification is used for piping and pipe support design, inconsistencies in pressure, temperature, and flow data could cause inaccuracies in this design effort. It is not clear what other design functions (valve sizing, I&C, etc.) use Table 1 data as design input information.

5.0 Probable Cause

Failure to document the resolution of differences between the GAI design specification and corresponding GE design data.

Attachments

A. Observation Record Review

Observation Record Review
Attachment A

Observation No.	ME-03-01	Checklist No.	ME-03	Revision No.	0
PFR No.				Sheet	1 of 1

	Yes	No
Closed	X	

Extent 2 of 3 Systems with inconsistencies between GE and GAI data

Comments

GAI has stated that Table 1 of Design Specification DSP-B21-1-1-4549 will be updated to correct the inconsistencies noted in this Observation. Regarding items (c) and (d), GAI has obtained verbal concurrence from GE (reference 10/19/83 telecon between T. Daugherty and J. Hickson of GAI and E. Wood and D. Foster of GE) and has requested written agreement (reference letter PY-GAI/GEN 2964 dated 1/3/84) on the following modes of system operation:

1) Continuous draining through the first MSIV before seat drain at all power levels. The resulting nominal drain rate will be approximately 310 lb/hr in lieu of GE-specified 2000 lb/hr at power levels below 50%.

2) A maintainance drain flowrate of less than 50 gpm to the clean radwaste system.

3) A maintainance drain rate of 50 gpm or greater to the main condenser, if condenser water quality requirements are met.

Based on the above, this Observation has no impact on design or safety.

Approvals

Originator	R. W. Hess	Date	1/18/84
Project Engineer	[signature]	Date	1/18/84
Project Manager	Ted [signature]	Date	1/19/84
CEI Representative	[signature]	Date	1/20/84

CYGNA

Observation Record

Observation No.	ME-03-02	Revision No.	0
Checklist No.	ME-01 MSDS Item #3	Sheet	1 of 1
Originated By	R. V. [illegible]	Date	12/1/83
Reviewed By	[illegible]	Date	12/9/83

1.0 Description

No sizing calculation could be located for restricting orifice RO-D001. Therefore, no documented basis exists for the specified orifice size.

2.0 Requirement

The General Electric Process Data 131C70911 gives the orifice RO-D001 flow conditions as 2000 lb/hr at greater than a 600 psi pressure drop. The G.E. Design Specification 22A4622, Rev. 5 states that a restricting orifice be provided for continuous draining of condensate during operation below 50 percent power level.

3.0 Reference Documents

3.1 Nuclear Boiler Design Specification, 22A4622, Rev. 5,

3.2 Process Data Sheet, 131C7911C, Rev. 5

3.3 Nuclear Boiler Process Diagram, 105D5575, Rev. 0

3.4 Nuclear Boiler Design Specification, DSP-B21-1-4549-00, Rev. 2,

3.5 Perry Information System, P7837151.S Dated 9/15/83,

4.0 Potential Design Impact

Since no sizing calculation or documentation could be located for orifice RO-D001, its adequacy to perform the G.E. specified function could not be verified.

5.0 Probable Cause

Design Control

Attachments

A. Observation Record Review

CYGNA

Observation Record Review
Attachment A

Observation No. ME-03-02	Checklist No. ME-03	Revision No.	0
PFR No.		Sheet 1 of	1

	Yes	No
Closed	X	

Extent 3 of 3 Systems with missing calculations

Comments

GAI has generated a new calculation to verify the sizing of orifice RO-D001. Cygna's review of this calculation, N22-9 dated 11/15/83, verifies that the existing orifice size is adequate for all system flow conditions.

Based on the above, this Observation has no impact on design or safety.

Approvals

Originator	R. W. Hus	Date	1/11/84
Project Engineer	[illegible]	Date	1/11/84
Project Manager	Ted T. Whiting	Date	1/16/84
CEI Representative	J E Mrazek	Date	1/20/84

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Observation Record

Observation No.	ME-03-03	Revision No.	0
Checklist No.	ME-03 MSDS Item #8 and #9	Sheet	1 of 2
Originated By	R. W. Hess	Date	12/1/83
Reviewed By	[signature]	Date	12/9/83

1.0 Description

Calculation N22-3 page 13 is for sizing the 1st MSIV before seat drain line. This calculation does not match the physical piping arrangement and does not include all modes of operation. Specifically.

a. The calculation is for a single 3" pipe from the 1st MSIV to the condesner. The actual piping arrangement consists of four 2" pipes (one from each MSIV) connected to a 3" drain header with a parallel orifice bypass line. The 3" pipe then ties into a 24" header which connects to the condenser.

b. The calculation is based on a flow of 6670 lb/hr. However, the system design specification lists flows of 310 lb/hr and 50 gpm in addition to the 6670 lb/hr. Also, G.E. lists a flow of 2000 lb/hr for low power operation.

c. The calculation does not cover or show flow through valve F033 and RO-D001 or draining through valves F034 and F035.

d. The calculation indicates no elevation difference between valve F016 and F021, whereas the physical piping drawing indicates a difference in elevation of approximately 15' feet.

2.0 Requirement

GE Specification 22A4622 and process data 131C7911C provide the design requirements for the first MSIV before seat drain line. Section 4.6 of the specification states that the system should provide for draining the flooded main steam lines in a reasonable length of time and remove steam condensate generated during heat-up and operation below percent power level. The process data lists a drain flowrate of 50 gpm and an operation below 50 percent power flowrate of 2000 lb/hr.

3.0 Reference Documents

3.1 Nuclear Boiler Design Specification, 22A4522, Rev 5

3.2 Nuclear Boiler Process Specification, 105D5575, Rev 0

Observation Record

Observation No.	ME-03-03	Revision No.	0
Checklist No.	ME-03 MSDS Item #8 and #9	Sheet	2 of 2
Originated By	R. W. Hess	Date	12/1/83
Reviewed By	[signature]	Date	12/9/83

3.3 Nuclear Boiler Process Data, 131C7911C, Rev. 5

3.4 Design Specification Nuclear Boiler, DSP-B21-1-4539-00, Rev. 2

3.5 N22-Line Sizing, Calculation N22-3 (11/7/78)

3.6 Drawings

3.6.1 Piping N22, D-304-501, Rev. E
3.6.2 Piping N22, D-304-122, Rev. G
3.6.3 Piping N22, D-304-304, Rev. E
3.6.4 Piping N22, D-304-304, Rev. D

4.0 Potential Design Impact

The adequacy of the piping system to meet the design requirements cannot be determined based on the calculations presented.

5.0 Probable Cause

Documentation control.

Attachments

A. Observation Record Review

CYGNA

Observation Record Review

Attachment A

Observation No.	ME-03-03	Checklist No.	ME-03	Revision No.	0
PFR No.				Sheet 1 of 1	

	Yes	No
Closed	X	

Extent 2 of 3 Systems with calculation inconsistencies and inaccuracies

Comments

GAI submitted revised calculation N22-3A, dated 1/6/84, to verify the adequacy of the size of the main steam drain piping from the first main steam isolation valve before seat drain to codenser connection 194. This calculation does not address flow through the 1" bypass line, valve F033 and orifice RO-D001 which is the continuous drain path during normal reactor operation. However, calculation N22-9 for verification of the adequacy of orifice RO-D001 indicates that sufficient margin exists in this flowpath to account for the 1" pipe and valve F033 losses.

Based on the above, this observation has no impact on design or safety.

Approvals

Originator	R. W. Hess	Date	1/16/84
Project Engineer	[signature]	Date	1/16/84
Project Manager	Ted F. Dettling	Date	1/18/84
CEI Representative	[signature]	Date	1/20/84

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Observation Record

Observation No.	ME-03-04	Revision No.	0
Checklist No.	M3-03 MSDS Item #10	Sheet	1 of 1
Originated By	R. W. Hus	Date	12/1/83
Reviewed By	RJ Weingart	Date	12/9/83

1.0 Description

Valves F034 and f035 are 3/4" Y pattern globe valves arranged in series with approximately 125 feet of 3/4" pipe attached to the outlet of valve F035. the flowrate specified for this drain is 50 GPM of 125°F water with a pressure upstream of valve F034 of 100 PSIA.

2.0 Requirement

Section 4.6.1 of G.E. Specification 22A4522 states that the main steam line drains shall drain the flooded steam lines in a reasonable length of time. The G.E. process data sheet 131C7911C states that the flowrate for this flowpath snould be 50 G.P.M.

3.0 Reference Documents

3.1 Nuclear Boiler Design Specification, 22A4622, Rev. 5

3.2 Process Data Nuclear Boiler, 131C7911C, Rev. 5

3.3 Main, Reheat Extraction, and Miscellaneous Drains, D-302-121, Rev. D

3.4 Piping N22, D-304-121, Rev. E

3.5 Piping N22, D-304-129, Rev. D

3.6 3/4" Series 1500 Y-Type Globe Valve, Kerotest Dwg. D-9955

4.0 Potential Design Impact

The 3/4" drain size will restrict the drain flowrate to less than 50 GPM and increase the time required to drain the flooded main steam lines.

5.0 Probable Cause

Design oversight.

Attachments

A. Observation Record Review

CYGNA

Observation Record Review
Attachment A

Observation No. ME-03-04	Checklist No. ME-03	Revision No.	0
PFR No.		Sheet 1 of	1

	Yes	No
Closed	X	

Extent 3 of 3 Systems with inconsistencies between valve data and GE requirements

Comments

GAI has discussed the drain flowrate requirement with GE (reference telecon dated 10/19/83 between T. Daugherty and J. Hickson of GAI and E. Wood and D. Foster of GE). The 50 gpm rate stated by GE is a nominal value and higher or lower rates are acceptable. GE has stated that a faster rate can be achieved by draining to the condenser rather than the clean radwaste system as long as water chemistry limits are not exceeded. GAI has requested GE to confirm these discussions in writing (Ref. PY-GAI/GEN-2964, dated 1/3/84).

Based on the above, this Observation has no impact on design or safety.

Approvals

Originator	N. W. Hue	Date	1/13/84
Project Engineer	[signature]	Date	1/16/84
Project Manager	Ted R. Wittig	Date	1/16/84
CEI Representative	[signature]	Date	1/20/84

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Observation Record

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Observation No.	ME-03-05	Revision No.	0
Checklist No.	ME-03 MSDS Item #4 & #5	Sheet	1 of 1
Originated By	R. W. Hess	Date	12/1/83
Reviewed By	L J Weingart	Date	12/9/83

1.0 Description

The closing speed specified for valves F016 and F019 in GAI Specification 521-02-4549-00 and bill of material RNU-202 is "Vendor Standard." The Borg-Warner vendor drawing 81180 states that the valve closing time is 20 seconds maximum. This closing time corresponds to a minimum closing speed of approximately 9 inches per minute for a 3 inch valve.

2.0 Requirement

The GE Nuclear Boiler Design Specification Data Sheet 22A4522AR Section 3.1.17.1 states that valves F016 and F019 shall have a closing speed of at least 12 inches per minute.

3.0 Reference Documents

3.1 Nuclear Boiler Design Specifications 22A4522, Rev. 5

3.2 Nuclear Boiler Data Sheet 22A4522AR, Rev. 2

3.3 2-1/2 inch and Larger Valves SP-521-02-4549-00, Rev. 5

3.4 Valve Assembly, Gate-3 inch, 1,500 C.S. Motor Operated Drawing 81180, Rev. H

4.0 Potential Design Impact

Since the valve minimum closing speed of 12 inches per minute was not specified in the GAI purchase specification and the vendor drawing only indicates a maximum closing time of 20 seconds, it cannot be determined if the valve meets the GE criteria.

5.0 Probable Cause

Design control.

Attachments

A. Observation Record Review

CYGNA

Observation Record Review
Attachment A

Observation No. ME-03-05	Checklist No. ME-03	Revision No.	0
PFR No.		Sheet 1 of 1	

	Yes	No
Closed	✓	

Extent 3 of 3 Systems with inconsistencies between valve data and GE requirements

Comments

GAI has received verbal concurrance from GE (Ref. telecon PY-GAI/GEN-2903T between T. Daugherty of GAI and E. Wood of GE, dated 11/4/83) and has requested written confirmation (Ref. telecon PY-GAI/GEN-2964, dated 1/3/84) of the acceptability of the closing speed of valves B21-F016 and B21-F019, which is slower than the GE requirement. Per memo T. Daugherty to M. Stewart dated 12/2/83, GAI is initiating an SAR change to Table 6.2-32 to reflect the 18.5 second closing time of these valves.

Based on the above, this Observation has no impact on design or safety.

Approvals

Originator	R. W. Hess	Date	1/16/84
Project Engineer	[illegible]	Date	1/16/84
Project Manager	Ted T. Watling	Date	1/18/84
CEI Representative	F. E. Meyer	Date	1/20/84

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Potential Finding Report

Potential Finding Report No. PFR-01		**Revision No.**	0
Observation No.	PS-00-03	**Sheet** 1 **of**	3

Description

During the course of performing further review to explain inconsistencies between input loads and output combination values for the MSRV system, GAI discovered a bug in the "M093" program. This occurs when considering the negative jet impingement loads in the Emergency load combinations. A value of zerc is always used in this situation because the program selects the maximum value from the available range of values. For negative loads the available range includes zero, which causes the program to select zero as the maximum, rather than the peak load.

Requirement

Cygna Review Criteria DC-2, Rev. 0, Sect. 4.3, which requires jet impingement loadings to be properly combined for the Emergency load combinations.

Reference Documents

1. GAI Piping Analysis 1B21G08A, Rev. 2, Run No. JOHNVXW, dated 1/12/83
2. Computer program M093, Run No. J301, dated 2/23/83
3. GAI Form QAD 600, Serial No. 084, dated 1/10/84

Extent

Isolated	Extensive X	Other (Specify)

This finding affects all supports in systems which consider jet impingement loads and which use computer program M093 to determine support design loads.

Potential Finding Report

Potential Finding Report No. PFR-01		Revision No.	1
Observation No.	PS 00-03	Sheet 2 of 3	

Potential Design Impact

Situations may result where support stresses exceed Code allowables for emergency load combinations which include negative jet impingement loads.

Probable Root Cause

Computer programming error.

Potential Safety Impact

Exceeding Code allowables may result in failure at a support which, in turn, may impede a safety system from performing its intended function.

Potential Finding Report

Potential Finding Report No. PFR-01		Revision No.	0
Observation No.	PS-00-03	Sheet 3 of	3

Classification

	Yes	No
Closed	X	
Isolated		X

Comments

GAI has issued their QAD Form 600, Serial No. 084, for a possible reportable event. Issuance of this form, in accordance with Appendix E of the GAI NQAM, assures that this finding will be tracked to a satisfactory closure such that there will be no impact on the safety of the Perry Nuclear Power Plant.

Approvals

Originator	C. K. Wong	Date	1-27-84
Project Engineer	[illegible]	Date	1/27/84
Project Manager	T.T. Wittig	Date	1/27/84
CEI Representative	[illegible]	Date	2/3/84

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Potential Finding Report

Potential Finding Report No. PFR-02	Revision No.		0
Observation No. PS-02-01	Sheet 1	of	3

Description

The weld between items D and F on support 1E22-H001 is overstressed.

Requirement

ASME B&PV Code, Section III, 1974 with Addenda to Winter 1975, Subsection NF.

Reference Documents

1. GAI Support Design Calculation 1E22-G04(B), Rev. 1
3. GAI Drawing S-322-701, Shts. 1 and 2, Rev. E

Extent

Isolated	X	Extensive	Other (Specify)

This overstress condition at a weld was identified on only one support of the forty-four reviewed.

Potential Finding Report

Potential Finding Report No. PFR-02	Revision No. 1
Observation No. PS-02-01	Sheet 2 of 3

Potential Design Impact

The support is not adequate to withstand the applied loads.

Probable Root Cause

Isolated design oversight. The designer used an incorrect moment arm in the calculation.

Potential Safety Impact

The overstress condition could lead to failure of this support which, in turn, could potentially result in the HPCS system not performing its intended safety function.

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Potential Finding Report

Potential Finding Report No. PFR-02		Revision No.	0
Observation No.	PS-02-01	Sheet 3 of	3

Classification

	Yes	No
Closed	X	
Isolated	X	

Comments

GAI is preparing an ECN to modify this support and correct the deficiency. An additional connection to the bio-shield wall will serve to reduce the excessive moment. Incorporation of this modification will ensure that the weld for this support will not be subject to a potential overstressed condition. Therefore, there is no impact on safety for the Perry Nuclear Power Plant.

Approvals

Originator	C. K. Wong	Date	1-27-84
Project Engineer	L.J. Weinmant	Date	1/27/84
Project Manager	J.T. Wilting	Date	1/27/84
CEI Representative	J.E. Mizzo	Date	2/4/84

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