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Docket No. 50-275
Diablo Canyon Unit 1
License No. DPR-76

Gentlemen:

During the January 31, 1984 NRC public meeting, at PG&E regarding allegations at Diablo Canyon, issues were raised that relate to the IDVP verification of Diablo Canyon small bore piping and supports. Enclosed please find a discussion of these issues. The discussion is intended to clarify the relationship between the NRC issues and the IDVP verification. It includes an amplification of the methods and rationale employed by the IDVP.

If you have any questions please let me know.

Yours truly,

James Sar Leung /for

Robert L. Cloud

Enclosure

cc: R. Fray
R. Reedy
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RLC/act 8402070375

Robert L. Cloud and Associates, Inc.

RLCA

RLCA Response to NRC Concerns of January 31, 1984

RLCA Response to NRC Concerns of January 31, 1984

APPENDICES

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B. NRC Presentation - Dr. Hartzman

C. Excerpts from IDVP Phase I Engineering Program Plan Rev. 0

D. Excerpts from RLCA ITR #30, Revision 0

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1.0 INTRODUCTION

On January 31, 1984, the staff of the Nuclear Regulatory Commission presented a number of concerns in the area of small bore piping to the Diablo Canyon Project (DCP), Independent Design Verification Program (IDVP), Joint Intervenors, Press and Public. These concerns resulted from the NRC investigation of recent allegations concerning the quality of work at Diablo Canyon. This followed the Atomic Safety and Licensing Appeal Board hearings and two years of reanalysis and independent verification at Diablo Canyon.

Since the work scope of Robert L. Cloud Associates, Inc. (RLCA), a member of the IDVP, encompassed most of the technical and several of the non-technical issues, a response to these concerns is provided herein from the viewpoint of the IDVP. In many respects, the NRC approach of reviewing the design process and calculations, noting differences and errors, and establishing plant wide conclusions parallels the verification performed by RLCA. The purpose of this response is to show the relationship between the NRC concerns and the IDVP work.

From its inception as the first independent nuclear plant verification, the IDVP has operated under detailed, widely discussed, and NRC approved plans and procedures. In addition to reporting separately to the DCP and NRC, the work of the IDVP was subject to peer review by Teledyne Engineering Services (IDVP Program Manager), and heavily audited by the NRC staff together with their consultants from Brookhaven National Laboratory.

Several of the NRC concerns involve the scope, sampling and acceptance criteria applied by the IDVP. As noted above, these areas were widely discussed, documented in program plans and procedures, and approved by the NRC.

First, the scope of the IDVP did not include the verification of baseplate design or anchor bolt allowables nor ALARA considerations. In addition, the focus of the IDVP was on satisfaction of licensing safety criteria rather than optimality or efficiency of plant design. The IDVP verification of baseplate design and anchor bolt allowables is clearly excluded in Appendix J.

Within the entire body of IDVP material (prior to November, 1983), including reports, NRC approved program plans and procedures, meeting transcripts and minutes, and correspondence, there is no mention of support/snubber optimization or ALARA considerations since these are not specific safety issues. There were other aspects of the design that were safety issues, for example heavy loads, that were not included in the IDVP. These types of programs were not and were never proposed, by any of the parties to the Diablo Canyon proceedings, to be in the IDVP scope. Rather, the IDVP was understood to be a verification of design approach and as-built conditions against plant licensing criteria.

Second, the IDVP was initiated and executed as a sampling program. The approximate size of the small bore sample was clearly given in the program plan (Appendix C) and was approved by the NRC. The IDVP verification of the DCP Corrective Action Program was also based on a sample size clearly given in Interim Technical Reports (ITRs) #8 and #35 (Appendices F and G). These sample sizes along with the verification acceptance criteria were discussed in open meetings prior to finalization of the ITRs. For the verification of the DCP corrective action, the acceptance criteria were as follows (Appendix G, page 5):

> Differences will be noted by the IDVP and evaluated as to source and significance. If it is judged that the source indicates a possible generic concern, or if the final design does not meet the licensing criteria, an Open Item Report will be issued.

Using the example of small bore piping, ITR #61, page 59 (Appendix I), shows that three EOIs were issued. These EOIs note four generic concerns. These generic concerns were based upon trends and patterns observed in the noted errors and differences. In all cases, the verification of the corrective action small bore piping demonstrated that licensing criteria were met.

Each generic concern was resolved by additional sampling. The generic concerns were stress intensification factors (SIFs), valve modeling, and postulated high energy line break(HELB) locations, or by verification of additional DCP corrective action as with vents and drains. This additional sampling in response to differences and errors found in the work is discussed herein in Sections 2.3.b. and 2.3.c. In summary, the specified IDVP sampling program for small bore piping was executed, no licensing criteria violations were found, and generic concerns were resolved through further verification.

On the sections to follow, the NRC concerns that involve RLCA are discussed. Appendices are also provided that show that most of the difference/error types discussed by the NRC were previously documented by RLCA. The appendices provide insight into the relative significance of the issues, and illustrate rationale used to arrive at IDVP plant wide conclusions.

2.0 RESPONSES TO NRC QUESTIONS - MR. YIN'S PRESENTATION

2.1 QUESTION #1 - SMALL BORE PROGRAM

Not applicable.

2.2 QUESTION #2 - FILE 44 REVIEW

Staff Question #2: "Why did the IDVP review not include the adequacy of File 44 span rules and implementation, and PGandE "qualification by sample" methodology?"

Response:

First, the IDVP did review the original File 44 span rules and their implementation. As noted in Interim Technical Report (ITR) #30, Revision 0, issued by RLCA on 1/12/83 (Appendix I), this area of plant qualification was found to be generally acceptable with noted concerns. The DCP corrective action not only addressed the original IDVP concerns (ITR #61, pages 51 - 53 Appendix I), but provided additional assurance that the small bore piping met plant criteria.

Second, the IDVP did review the DCP "qualification by sample" methodology. As explained fully in Section 2.3.c. herein, RLCA did verify the methodology and implementation of both the generic and sample programs. In particular, these involved a sampling of small bore analyses with all concerns examined on a plant wide basis.

In order to further respond to this NRC issue, the history of small bore design at Diablo Canyon together with the history of the IDVP review is examined.

DCNPP Pre 11/30/81: Small bore piping was qualified by either computer analysis or application of span rules (File 44).

IDVP Review: As specified in the IDVP Phase I Engineering Program (DCNPP-IDVP-PP-01 Revision 0), both types of small bore qualifications were examined by independent analysis. In particular, the specification for independent analysis of the span rule piping (File 44) is given on pages 25 and 26 (Appendix C).

IDVP Results: The results of the IDVP independent analyses are presented in ITR #30. This ITR (page 33) notes that the span "...rules generally satisfied the licensing criteria and that the small bore piping was installed in accordance with these span rules..." Generic and specific concerns (along with three items) were also noted for inclusion in the DCP Corrective Action Program.

DCNPP-Post 11/30/81 (Corrective Action Program): The Corrective Action Program for small bore piping and supports was conducted through two mechanisms which were Generic Program and Sampling Program.

Computer analyses were employed to provide qualification for the majority of small bore piping. In particular, these analyses were used to qualify hot piping, SAM/TAM* and code breaks. The original small bore span rules (File 44) were revised (DCM M-40) and applied to a limited amount of cold piping.

As described in the PGandE Phase I Final Report (10/11/83) the Generic and Sampling Programs, using both computer analyses and M-40 span rules, provided for the qualification of all Design Class 1 small bore piping at DCNPP-1.

IDVP Review: As specified in ITR #8: Verification Program for PGandE Corrective Action, Revision 0, issued by RLCA on 10/5/82, and ITR #35: Verification Plan for Diablo Canyon Project Activities Revision 0 issued by RLCA on 4/1/83, both small bore computer analyses and span rules were examined (Appendices F and G).

* SAM - Seismic Anchor Motion
TAM - Thermal Anchor Motion

An illustrative example of the IDVP review is the area of vents and drains. In accordance with ITRs #8 and #35, the IDVP verified both the design approach and actual calculations. An EOI was issued to document an error in the design approach. The dynamic amplification factor of 1.5 to account for run pipe flexibility was shown to be unconservative in several cases. In response to this EOI, the DCP performed further plantwide corrective action which was verified by the IDVP through additional sampling.

IDVP Results: The results of the IDVP review of the DCP small bore corrective action are presented in ITR #60: Large and Small Bore Pipe Supports, Revision 1, issued by RLCA on 10/3/83 and ITR #61: Small Bore Piping, Revision 1, issued by RLCA on 10/2/83. ITR #61 discusses the M-40 span rules and concludes (page 60) "...that the span rules, while not conservative for all theoretical configurations, were applied only to a limited scope of small bore piping. For this limited application, the span rules were adequate and met licensing criteria."

With regard to the piping not directly analyzed in the DCP Corrective Action Program, the ITR states (page 54): "...the DCP sampling methodology (generic and sample reviews and the size of the DCP sample) were sufficient to substantiate the general DCP conclusions regarding the adequacy of the Design Class 1 small bore piping..."

As noted above, RLCA did review the adequacy and implementation of the File 44 span rules and DCP sample methodology. While concerns were noted in the review of the File 44 piping, these were addressed by the corrective action program and verified by RLCA. Following resolution of these concerns, the IDVP concluded that the small bore piping satisfied the plant licensing criteria.

2.3 QUESTION #3

2.3.a. Support Interaction

Staff Question #3a: "Why were large bore snubber/rigid restraint, rigid/rigid restraint, rigid/rigid restraint interaction, and snubber ALARA problems not reviewed?"

Response:

The IDVP verified all significant aspects of the piping support systems. The adequacy for placement of supports were reviewed as part of the IDVP verification of the piping. This included verifying that supports located close together and interacting with each other would perform as represented in the piping analyses. For example, the IDVP checked the gaps for all supports, including those close to each other, and found them to be within acceptable tolerances.

The purpose of the IDVP was to verify the adequacy of the DCP support designs related to plant licensing safety criteria. It was not the purpose of the IDVP to evaluate piping support schemes for the most efficient use and placement of supports, or for the optimal design of those supports. For example, if a support were added by the DCP, the IDVP did not attempt to justify the need for adding the support or determine if a rigid support might be more appropriate than a snubber.

The following are specific examples of instances where the IDVP addressed supports that were located close together and interacted with each other:

1. Two vertical rigid restraints were located at each end of an elbow close to a nozzle. These supports appeared to be required to reduce the moment at the nozzle.

   - IDVP checked clearances on support drawing
   - IDVP checked clearances via field verification
   - IDVP determined a snug fit of supports to pipe - supports will perform as represented in piping analysis.

2. Axial snubber was located close to an anchor. The IDVP determined that the relative motion between the anchor and the snubber during a seismic event would not be sufficient to activate the snubber. However, the loads on the snubber were low and, if these loads acted on the anchor, the increase would be insignificant. It appeared to the IDVP that use of this snubber did not reflect optimal design, as far as the specific revision of the analysis was concerned. However, optimization of supports was not in the scope of the IDVP.

The NRC raised a question regarding snubber travel before lock-up (deadband). This issue was not specifically part of the IDVP program. It is noted that snubber deadband is a second order effect, and it is not normal industry practice to evaluate this effect for production piping.

The IDVP found no evidence to indicate a DCP practice of locating a new support close to an existing support for the purpose of reducing the loads on that support, thus allowing it to be more easily qualified as a sample support.

The last part of the NRC question raised concern about snubber ALARA problems. ALARA was not considered to be a specific safety issue, as such, and was not included in the scope of the IDVP.

2.3.b. Frequency of Errors

Staff Question #3b: "In conjunction with the large amount of computational errors identified by NRC during the small bore support review and the ITR's own finding of similar problems, why was Cloud small bore review concluded that IDVP was acceptable without additional sample review?"

Response:

The IDVP found examples of modeling discrepancies and computational errors in their review of DCP analysis. These were noted and evaluated in the individual IDVP review packages and summarized in ITR #60 on large and small bore pipe supports.

The IDVP evaluation of a modeling discrepancy or computational error involved an assessment of its impact on the overall design adequacy of the specific support. The IDVP tracked the types of problems it found to identify any possible generic concerns that may have had more frequent occurance. The basis for the IDVP reviews was to verify the overall adequacy of the support designs related to plant licensing safety criteria. If additional information or clarification was required to fully evaluate the impact of a discrepancy or error, a Request for Information (RFI) was issued to the DCP.

In cases where the IDVP judged that the source of a discrepancy or error indicated a possible generic concern, or that it had a significant impact on the overall adequacy of a particular support design, an Error or Open Item Report (EOI) was issued. In response to the EOI, the DCP provided additional justification, provided more refined or revised analyses, or instituted additional corrective action.

It is noted that this process of assessing the impact of DCP discrepancies and errors and determining generic concerns fully complied with IDVP acceptance criteria. The IDVP acceptance criteria was presented in the IDVP program plans and procedures, and ITRs #8 and #35.

ITR #60, page 40, (Appendix H) describes four EOIs that were issued as a result of the IDVP verification of supports. The areas of concern and their respective resolutions for the four EOIs were the following:

- Support fundamental frequency (or equivalent stress criteria) in the unrestrained direction was not addressed.

  The DCP revised the analysis to show that all stresses from loads in the unrestrained directions met allowables.

- A weld between a pipe lug attachment and supporting steel was incorrectly analyzed using an erroneous (but conservative) weld moment of inertia.

  It was shown by the DCP that the weld stress met allowables when an accurate moment of inertia and weld section were used.

- Shear lugs and the welds attaching them to the process pipe were not evaluated in two support designs.

  The IDVP determined that this item was a departure from DCP Procedures, nor an Error. The Stresses in the shear lugs and attachment welds were determined by the IDVP to be low by engineering judgment.

- The analysis of a support incorrectly calculated a deflection and compared it to an erroneous allowable. The DCP deflection corresponded to a frequency < 20 Hz.

  The DCP revised the analysis, and the IDVP confirmed that the frequency criteria was then met.

As indicated above, the four EOIs were fully resolved by the IDVP. There were no support modifications resulting from these EOIs. Also, these EOIs together with all other differences were examined and not found to raise generic concerns. In this manner, then, the IDVP resolved the discrepancies and errors and determined that supports reviewed in its verification program were adequately designed and met all licensing safety criteria.

The supports selected by the IDVP represented an appropriate sample of support types, plant locations, pipe sizes, and complexity of design. Based on the IDVP evaluation and results of the initial engineering review sample, an additional completion sample was selected by the IDVP. The size of this additional sample was consistent with the types, frequency, and significance of the DCP discrepancies and errors. The IDVP engineering and completion samples are discussed further in the response to Question 3c.

2.3.c. Sample Size

Staff Question #3c: "How can Cloud conclude that the "Corrective Action" was acceptable based on such small sample size review, and with large amount of errors being identified?"

Response:

It is noted that Questions 3b and 3c are very similar in nature. This response discusses the IDVP sampling methodology and size. The response to Question 3b deals more with IDVP resolution of DCP modeling discrepancies and computational errors.

The size of the initial IDVP sample, as noted by the NRC, may seem small as compared to total support numbers for the plant. The significance of the IDVP sampling approach is in the representative nature of the sample and its coverage of all areas of the DCP Corrective Action Program.

More specifically, the DCP Corrective Action Program for small bore supports was driven by design issues included in, and categorized by, either a sample or generic program. Table 1 presents a brief description of the DCP sample and generic programs.

The DCP sampling program included all supports on a 20 line sample of worst case seismic loadings and a 10 line sample of hot piping. A minimum of 5 examples of each design issued was reviewed by the DCP.

The generic program addressed those designs for which previous DCP reviews had indicated generic issues with a potential for physical modifications to meet licensing safety criteria.

The DCP methodology was such that it was possible for an item to be initially reviewed with the DCP sample program and subsequently be transferred to the generic program. An example of this was a specific tee shoe that was reviewed as part of the sample program. Initial DCP calculations showed that criteria were not met. This support became part of the generic program; generic calculations were performed. Tee shoes were load rated and all tee shoes were reviewed by the DCP.

It should be noted that, in addition to these support design issues, all hot small bore piping was computer analyzed by the DCP. The IDVP selected small bore support designs from both the DCP sampling and generic program areas. The IDVP sample supports were on piping being verified by the IDVP and/or observed at the site during IDVP field verification efforts, and were listed on DCP calculation logs.

The IDVP performed detailed engineering reviews on 8 small bore designs. Modeling discrepancies and computational errors were noted along with any trends related to possible generic concerns.

The IDVP expanded its sample of reviews and selected an additional 11 small bore support designs for the purposes of completion reviews. The completion reviews not only addressed current (June 30, 1983 or later) loading inputs, interface data, and criteria, but also they included an overall assessment of the support design adequacy. This assessment included any problem areas that appeared as trends in the prior engineering reviews.

Therefore, as described above, the IDVP did select appropriate samples of small bore support designs. Upon review of these designs, the IDVP identified certain descrepancies and errors, evaluated their impact, and expanded its sample. This allowed the IDVP to insure that, on a plantwide basis, the same conclusions regarding design adequacy and plant safety were valid. Additional considerations made by the IDVP regarding the size of its sample include the following:

- o Standard DCP design methodology and procedures were used.

- o The supports were designed by one design organization.

- Many support designs are "typical designs" and are used at numerous locations throughout the plant.

- Small bore supports are constructed of standard structural stock materials; designs incorporate smaller pipe loads and thus the design adequacy is more tolerant to computational errors.

These considerations further substantiate that the size of the IDVP sample was appropriate for the IDVP conclusions of plantwide adequacy of small bore pipe supports.

The IDVP concludes that the DCP design approach and its application satisfied all plant safety criteria at the time of its review and that small bore pipe supports in the plant continue to satisfy this criteria.

TABLE 1. DCP PROGRAM FOR SMALL BORE PIPING AND SUPPORTS - DESIGN ISSUES*

PIPING	SUPPORTS
SAMPLING PROGRAM As-Built Accuracy (1) Revised Spectra (1) Concentrated Masses (1) Pipe Insulation Weight (1) Overspans (> Span Rules) (1) Equip. & Bldg. SAM/TAM (1) Thermal Analyses (2) Anchor & Equip. Loads (3) Integral Valve Bypass Vents and Drains	SAMPLING PROGRAM As-Built Accuracy (1)(7) Revised Spectra (1)(7) Concentrated Masses (1)(7) Pipe Insulation Weight (1)(7) Overspans (> Span Rules) (1)(7) Equip. & Bldg. SAM/TAM (1)(7) Thermal Loads (2)
GENERIC PROGRAM Large Bore Pipe SAM/TAM Design Class Change (Code Boundaries) (4) Previously Analyzed by Computer (5) Hot Piping Previously Designed by Span Rules (6)	GENERIC PROGRAM Large Bore Pipe SAM/TAM (8) Design Class Change (Code Boundaries) (4) Standard Support Details (9) Lugs & Local Pipe Stress

* These Design Issues are consistent with PGandE Phase I report and IDVP ITRs 60 and 61.

Notes: (See following page.)

<u>Notes for Table 1</u>

DCP Program for Small Bore Piping and Supports - Design Issues

1. 20 line sample based on worst case seismic loadings (e.g., flexible slabs, high elevation, etc.).

2. Selection of lines with temperatures > 350°F; 10 isometric drawings (13 analyses)

3. Loads required for equipment that was upgraded to Design Class 1.

4. Design Class 1 piping protected from Design Class 2 piping (nonsafety-related) through use of anchor or one axial and two bilateral supports. Code break supports on Design Class 2 side were qualified as Class 1 supports.

5. Includes all seismic and associated thermal analyses.

6. Maximum operating temperatures > span rule limitations (165°F stainless steel; 200°F carbon steel).

7. A minimum of 5 examples of each issue (6) were reviewed by the DCP.

8. Supports providing the first restraint in each direction on a S.B. pipe from its attachment to a L.B. pipe.

9. Maximum recommended loads were developed; includes tee shoes.

2.4 Snubber/Restraint Interaction

Fourteen snubbers are tabulated by the NRC and examined as a representative worst case sample. For each of the analyses, the DCP was requested by the NRC to analyze the piping without the subject snubbers in place. Based upon these results, conclusions were drawn as to the need for the snubbers with respect to thermal movements and pipe and support loads. In addition, seismic movements were compared to the snubber lock-up distance to judge activization.

Of these, seven involve analyses included in the IDVP verification sample as listed below:

Snubber #	DCP Analysis	Current Rev.	Rev. Reviewed by IDVP
16/47 SL	2-105	2	0
16/49 SL	2-105	2	0
16/63 SL	4-102	4	1
16/67 SL	8-117	4	2
16/79 SL	8-116	2	1
16/77 SL	4-102	4	1
16/29 SL	4-102	4	1

The tabulation presented in Table 2 is discussed in relation to the NRC results. It is noted, however, that the NRC results involve later analysis revisions where the support schemes, spectra, etc. have changed. In particular, initial DCP analyses were performed using conservative preliminary seismic inputs and later refined to accomodate revised spectra and operating modes.

The first two snubbers, 16/47SL and 16/49SL, are attached to valve operators and were shown by the NRC to have adequate seismic movement to activate yet small enough thermal movement to allow for a rigid restraint. In these cases, the issue is snubber design optimization and ALARA which were both outside of the IDVP scope.

The third snubber, 16/63SL, was shown by the NRC to be justified on the basis of thermal loads yet have inadequate seismic movement to activate. Revision 1 of this analysis, versus Revision 4 reviewed by the NRC, shows the snubber to be 9.5 and 15.0 feet from the adjacent supports. For a 12 inch pipe, this spacing was considered to be appropriate.

TABLE 2

Snubber/Restraint Interaction

		Support Loads (lbs) DE	DDE	HE	Distance to Snubber (ft)
1.	16/477 SL (Z-direction) 3" pipe - valve support	171	342	357	
	Adjacent Supports				
	585/37A	12	24	121	2.0
	5/40 R	91	182	332	3.5
2.	16/49 SL (Z-direction) 3" pipe - valve support	172	345	360	
	Adjacent Supports				
	585/37A	13	26	72	2.0
	585/139R	85	170	211	3.5
3.	16/63SL (X-direction) 12" pipe	5030	9675	8007	
	Adjacent Supports				
	Penetration 13	6511	12937	11911	15.0
	5/5R	5675	11270	9260	9.5
4.	16/67SL (Y-direction) 8" pipe	247	493	2834	
	Adjacent supports				
	585/33A	227	454	888	6.5
	585/32R	378	756	5226	2.0

5. 16/79SL
6. 16/77SL
7. 16/29SL

These snubbers were added to the systems after the IDVP reviewed the analyses, i.e., in a later analysis revision.

The last snubber, 16/67SL, was shown by the NRC not to be required on the basis of small thermal movements and acceptable pipe and support loads. These two issues of snubber design optimization and ALARA were outside the IDVP scope.

The NRC also found that two of the seismic movements, DE and DDE, were inadequate to activate the snubber. The Hosgri seismic movements, however, were sufficient to activate the snubber. Revision 2 of this analysis, versus Revision 4 reviewed by the NRC, shows the snubber to be 2.0 and 6.5 feet from the adjacent supports. A review of the restraint loads show that the controlling Hosgri loads are 2 to 10 times those for the DE and DDE. On an engineering basis, the design of the supports would be governed by the Hosgri and, therefore, this installation is acceptable.

Two additional items are noted. First, this piping was analyzed to severe local slab vertical spectra, including a peak above 25g. For this 8" piping, use of four vertical seismic restraints between two anchors for 69 linear feet of pipe would be considered appropriate. Second, the IDVP verification of this analysis was specific, not overall, and included only SIFs, field as-builts, valves, spectra and input loadings. However, if the snubber had been evaluated, it would have been found acceptable for the reasons stated above.

As discussed in Section 2.3.a. herein, the issues of support optimization and ALARA were not in the IDVP scope. The remaining NRC concern with snubber travel before lock-up, while not specifically part of the IDVP program, was discussed above. Evaluation of this second order effect is not normal industry practice. As shown by the two examples in Section 2.3.a. herein, the IDVP did question effectiveness of closely spaced supports. Therefore, it is the IDVP judgment that the DCP support schemes adequately support the piping in the plant as represented in the piping analyses and support designs.

2.5 Proposed Violations

Not applicable.

3.0 RESPONSES TO NRC QUESTIONS - MARK HARTZMAN PRESENTATION

3.1 NON-TECHNICAL ISSUES

Six non-technical issues were presented by the NRC (see Appendix B). The one item that ivolves RLCA, number 6 - small bore program, is fully discussed in Section 2.26.

3.2 TECHNICAL ISSUES

Fourteen technical issues were presented by the NRC (see Appendix B). RLCA responses to these concerns are given below.

1. Improper Code Break Design (88, 55, 86).

   As indicated in ITR #61, seven of the twelve engineering samples involved code break design (7-301 Rev. 0, 8-305 Rev. 0, 8-306 Rev. 0, 3-303H Rev. 3, 6-301H Rev. 3, 9-327H Rev. 2, and 19-307H Rev. 2).

   In each of these analyses, the code break design (identification number, modelling and load tabulation) was found to be acceptable. Additionally, the DCP methodology outlined for both the computer and M-40 analyses was verified.

2. Different Penetration Stiffnesses in Static and Dynamic Analysis (79, 55).

   o This item was stated to have been fully resolved.

3. Modeling of Rigid Support Gaps in Small Bore Piping Thermal Stress Analysis (79, 55).

   The IDVP noted instances of rigid support gaps being modeled in the DCP piping thermal analyses. This practice, although not routine in the industry, is an acceptable method of accounting for the additional system flexibility due to rigid support gaps. It is recognized that appropriate engineering judgment should be applied to address the repeatability of the pipe thermal movements. However, this engineering practice is considered to be consistent with evaluation of pipe thermal stresses in terms of secondary stress range. Also, thermal loads on supports in the region of analysis support gaps redistribute to an equilibrium condition upon pipe shakedown.

4. Different Stiffness for the Same Rigid Supports in Static and Dynamic Piping Analysis (55, 88).

   o This was not used in the IDVP samples.

5. Calculational Errors and Modeling Deficiencies in Support Design Packages (NRC Staff).

   o This item is fully discussed in Section 2.2.b.

6. Placement of New Restraints Adjacent to Old Restraints to Qualify the Old Restraints (88).

   o This item is fully discussed in Section 2.2.a.

7. Snubbers Located Adjacent to Rigid Restraints. Inoperative During Dynamic Loading (79).

   o This item is fully discussed in Section 2.2.a.

8. Improper Resolution of Pipe Interface (89).

   o The details of this NRC action item have not been disclosed to the IDVP.

9. Calculation of Maximum Support Load Carrying Capacity (79, 88).

   o The details of this NRC action item have not been disclosed to the IDVP.

10. Assumption of Joint Release for Rigid Connection (88).

   o The details of this NRC action item have not been disclosed to the IDVP.

11. U-Bolt Allowables Used by the DCP are Incorrect. U-Bolt Interaction Equation Unconservative (85).

   o The verification of U-bolt allowables was outside of the IDVP scope.

12. Unbraced Angle-Section Steel Members Exceed AISC Stress Allowables (95).

   o The details of this NRC action item have not been disclosed to the IDVP.

13. Drain Line Support Bracket Bolted to the Floor With Only One Bolt (78).

   o This item was stated to have been fully resolved.

14. Calculation of Fundamental Frequency (NRC Staff).

   o The details of this NRC action item have not been disclosed to the IDVP.

Diablo Canyon 1

Licensee

NRC Review of S/B Piping Design Verification Program

Piping Analysis	Support Calculation	Hardware Change
1. Total pipe footage based on summation of average measusurement on piping iso. 43,000'	1. Total estimated number of supports 3,715	
2. Total ME-101 computer analyses 25,000'	2 & 3. Total pipe supports evaluated: a. Detailed analysis 1,800 b. Prequalified std. supports 415 Total: 2,215	2 & 3. Total support modifi[cation] including addition deletion, and component upgrade 1380, or $\frac{1380}{2215}$ = 62.[illegible]
3. Total M-40 hand calculations 3,000'		
4. Total File 44 cookbook type analysis that was without design documentation, and was not verified by PG&E 15,000' or 34.9% of total S/B piping	4. Total pipe supports that had not been re-analyzed; 1500 or 40.4% of total S/B supports	4. None

Diablo Canyon 1

NRC Concerns after review of licensee S/B piping Desig
Verification Program Implementation

1. The justification of 15,000' S/B pipe, and the associa 1500 safety related supports w/o further evaluation was based on sample piping analyses of 5000 of pipe using ME-101 computer program.

Among the 5000' pipe

1,000' hot pipe	4,000' cold pipe
Thermal - MEL 40	600' - PIPSD
Seismic - PIPSD	3,400' - File 44

19 ME-101 Analyses performed on the 5000' pipe

10 ME-101 included:	9 ME-101 included:
4 active valves	Pure File 44 ?
4 Code breakes	
5 SAM/TAMs	

a. How many feet of pure File 44 piping was analy to determine that no further evaluation was nece

b. Among the 62.3% hardware modification, how many supports were installed on piping originally anal by File 44 procedure?

The staff acceptance of PG&E, "Phase I Final Report Design Verification Program, DCPP", Rev. 2, dated 6/20/83 is contingent upon licensee responses to the above concerns.

2. Robert L. Cloud and Associates, Inc., Interim Technical Report (ITR) No. 61, "Diablo Canyon Unit 1 IDVP Verification of Corrective Action — Small Bore Piping", Rev. 1, dated 10/2/83.

The ITR reviewed: 8 ME-101 computer analyses
4 M-40 hand calculations.

The staff questions why the review did not inclu[de] the adequacy of File 44 span rule and its implementation, and PG&E "qualification by sample" methodology?

3. Cloud ITR No. 60, "Diablo Canyon Unit [1] IDVP Review of Corrective Action Large and Sma[ll] Bore Pipe Supports", Rev. 1, dated 10/3/83.

In the areas of engineering review, the ITR
(2

reviewed: 22 Large Bore Supports
8 Small Bore supports

The staff questions:

a. Why were L/B snubber / rigid restraint ; rigid rigid restraint ; rigid restr. / rigid restr. interaction ; and snubber ALARA problems not reviewed?

b. In conjunction with the large amount of computation errors identified by NRC during the S/B support rev. and the ITR's own finding of similar problems, why was Cloud S/B review concluded that IDVP was acceptable without additional sample review

c. How can Cloud conclude that the "Corrective Action" was acceptable based on such small* sample size review, and with large amount of errors being identified.

* 8/3,715 = 0.22 % Total piping populati
8/2,215 = 0.36 % Total IDVP evaluat
8/1,800 = 0.44 % IDVP W/ documentat

Diablo Canyon -1

Large Bore Pipe Snubber / Rigid Restraint Interaction Evaluation

ffected ubber No.	Designed by	Snubber Type and size	Analysis No. (Bechtel Calculations)	Thermal Mvt. @ Snubber Location (in)	Seismic Mvt. w/o Snubber modeled in analysis			Test Data - Snubber lock up and develop load (in)	% increase (+) or decrease (-) @ rigid restr. or pipe stress	Design Evaluation		
					HOS (in)	DDE (in)	DE (in)			Justified per thermal mvt.	Justified per pipe stress and support loads	Operable during seismic event
-25SL	PG&E	PSA-3	4-135/2	.008	.013	.002	.001	.0625	+ 16 (DE) + 2.14 (HOS)	NO	NO	NO
-33SL	Bechtel	PSA-1	8-109/2	.019	.159	.132	.066	.020	*	NO	N/A	YES
-32 SL	Bechtel	PSA-1	8-109/2	.011	.131	.112	.056	.020	*	NO	N/A	YES
6-47SL	Bechtel	PSA-1/2	2-105/2	.0184	.376	.180	.090	.0375	*	NO	N/A	YES
6-49SL	Bechtel	PSA-1/2	2-105/2	.0184	.298	.126	.063	.0375	*	NO	N/A	YES
6-63 SL	Bechtel	PSA-10	4-102/4	.306	.169	.042	.021	.052		YES		NO
16-67SL	Bechtel	PSA-1	8-117/4	.003	.099	.002	.001	.021	+ 11.6 (DE) − 37.6 (HOS)	NO	NO	NO
16-79SL	Bechtel	A/D-71	8-116/2	.050	.011	.008	.004	.031	+ 6.8 (DE) + 29.1 (HOS)	NO	NO	NO
16-68 SL	Bechtel	PSA-1	8-118/2	.005	.010	.002	.001	.020	− 4.9 (DE) + 9.9 (HOS)	NO	NO	NO

* Snubber installed on valve operator for valve

Diablo Canyon # 1

Large Bore Pipe Snubber / Rigid Restraint Interaction Evaluation

Affected Snubber No.	Designed by	Snubber Type and Size	Analysis No. (Bechtel Calculations)	Thermal Mvt. @ Snubber Location (in)	Seismic Mvt. w/o Snubber modeled in analysis			Test Data - Snubber lock up and develop load (in)	% increase (+) or decrease (-) @ rigid restr. or pipe stress	Design Evaluation		
					HOS (in)	DDE (in)	DE (in)			Justified per thermal mvt.	Justified per pipe stress and suppt loads	Operable during seismic event
15-63 SL (a pair)	Bechtel	A/D-501	8-110/4	.019	.108	.030	.015	.051	+28.5 (DE) +39.3 (HOS)	NO	NO	NO
16-77 SL (HORI)	Bechtel	PSA-3	4-102/4	.043	.253	.162	.081	.0625	+312 (HOS) Stress @ Pene. No 11	NO	NO	YES
16-29 SL (vert.)	Bechtel	A/D-5500	4-102/4	.191	.030	.018	.009	.0585		YES	NO	NO
16-80 SL	Bechtel	PSA-1/2	8-118/2	.003	Not Run			.0375	*	NO	N/A	?
16-81 SL	Bechtel	PSA-1/2	8-118/2	.003	Not Run			.0375	*	NO	N/A	?

* Snubber installed on valve operator for

55

Diablo Canyon 1

L/B Pipe Snubber / Rigid Restraint Interaction Evaluation Result

Pipe Snubbers

1. Those that will not function per design during seismic event 8/9, or 89%.
2. Those that can be replaced by rigid restraints w/o caus piping thermal stress problem: 7/9, or 78%.
3. Those that can be removed w/o causing piping stres or support load exceeding design limit: 8/8, or 100
4. Max. rigid restraint loading change due to inopera snubbers next to it: +39.3%; -37.6%.
5. There will be significant pipe anchor stress increase if near by snubbers failed to function as required.
6. It is possible that snubber is required because of large thermal piping movements, but will not be operabl during seismic event.

Valve Snubbers

1. Those that will function per design during seism event: 4/4, or 100%.
2. Those that can be replaced by rigid restraints w/ causing piping thermal stress problem: 6/6, or 100%.

1.

Diablo Canyon 1

Proposed Violation Item Assessment

Item No.	Item Description	Against 10CFR 50 Appendix B, Criterion	Findings observed during: Followup Allegation No.	Findings observed during: NRC overv
1.	The site small bore piping design group personnel authority and duties were not established and delineated in writing.	I	--	V
2.	There has been inadequate program provisions for personnel indoctrination and training. The S/B pipe support engineers were not familiar with important elements in both licensee QA and technical programs.	II	82	--
3.	S/B QA program deficiencies and design nonconformances had not been identified and corrected promptly.	XVI	84	--
4.	Defective document control system observed at S/B design groups:	VI		
	a. Design procedures out-of-date.		79	V
	b. Use of Inter-office memorandum in lieu of work procedures.		79	V

Diablo Canyon 1

Proposed Violation Item Assessment

Item No.	Item Description	Against 10CFR 50 Appendix B, Criterion	Findings observed during: Followup Allegation, No.	NRC over
	c. Procedure listings out-of-date.		79	✓
5.	Inadequate Design Procedures:	V		
	a. Design change request		--	✓
	b. piping movements within rigid restraint gaps		88	–
	c. Use of out-side reference and data.		84 79	–
6.	Fail to follow procedures:	V		
	a. S/B support calculation input checking		--	✓
	b. personnel training		82	–
7.	Inadequate Design Control:	III		
	a. Design criteria conflict in controlling pipe restraint structural frequencies.		--	✓

Diablo Canyon 1

Proposed Violation Item Assessment

Item No.	Item Description	Against 10CFR 50 Appendix B, Criterion	Findings observed during Followup Allegation, No.	Findings observed during NR over
	b. Extensive errors that had been identified in both preliminary and final support calculations.		--	✓
	c. Lack of program provision to verify telephone provided preliminary design information.		--	✓
	d. Lack of design consideration of synchronizing loading between closely spaced rigid/rigid restraints, and rigid restraint/anchor.		88	✓
	e. Snubbers were made inoperable by placing them in close proximity with rigid restraints and anchors.		--	✓
	f. Lack of design ALARA consideration for snubbers.		--	✓

Diablo Canyon 1

Proposed Violation Item Assessment

Item No.	Item Description	Against 10CFR 50 Appendix B, Criterion	Findings observed during	
			Followup Allegation, No.	NR over
8.	Inadequate Licensee technical QA audits and surveillances to identify and correct the many design control and program deficiencies revealed during this inspection/investigation.	XVIII	--	✓

SUMMARY OF ISSUES

I. NON TECHNICAL ISSUES

1. Altered Current Documentation (55, 87, 79).

2. Destroyed Documentation (87).

3. Inadequate Training and Indoctrination of Personnel (82, 79).

4. Defective Document Control System (79, 55).

5. Individual Fired for Whistle Blowing (81).

6. Small Bore Piping Verification Program (NRC Staff)

II. TECHNICAL ISSUES

1. Improper Code Break Design (88, 55, 86).

2. Different Penetration Stiffnesses in Static and Dynamic Analysis (79, 55)

3. Modeling of Rigid Support Gaps in Small Bore Piping Thermal Stress Analysis (79, 55).

4. Different Stiffness for the Same Rigid Supports in Static and Dynamic Piping Analysis (55, 88).

5. Calculational Errors and Modeling Deficiencies in Support Design Packages (NRC Staff).

6. Placement of New Restraints Adjacent to Old Restraints to Qualify the Old Restraints (88).

7. Snubbers Located Adjacent to Rigid Restraints, Inoperative During Dynamic Loading (79).

8. Improper Resolution of Pipe Interface (89).

9. Calculation of Maximum Support Load Carrying Capacity (79, 88).

10. Assumption of Joint Release for Rigid Connection (88).

11. U-Bolt Allowables Used by the DCP are Incorrect. U-Bolt Interaction Equation Unconservative (85).

12. Unbraced Angle-Section Steel Members Exceed AISC Stress Allowables (95).

13. Drain Line Support Bracket Bolted to the Floor With Only One Bolt (78).

14. Calculation of Fundamental Frequency (NRC Staff).

As of Dec 12, 1983

SHT...

[redacted]

ONSITE ENGINEERING SMALL BORE PIPE SUPPORT CALCULATION LOG UNIT 1

DESIGN CALC. NO.	CALC. REV.	HANGER NO.	REV	CALC. STATUS PRELIM	CALC. STATUS FINAL	CALC. STATUS SUPER	PREPARER DATE	CHECKER DATE	APPROVAL DATE	REMARKS
[redacted]										
		0181-21								Active VALUE 8142. NOT LISTED
MP-982		0181-24	2	✓			M. SHOKHET 2-3-83	R. COLO 2-8-83	3-5-83	
		0181-25								SEE ANALYSIS 8-331 DELETED
		0181-26								SEE ANALYSIS 8-331
		0181-34								Active VALUE 8142. NOT LISTED
		0181-75								SEE ANALYSIS 8-331 DELETED
MP-947		0181-81	2	✓			G.R. SHAH 2-1-83	R. COLO 2-3-83	3-5-83	
MP-948		0181-84	0	✓			G.R. SHAH 2-1-83	M. BRAHMBHATT 2-4-83	3-5-83	
		0181-85								SEE ANALYSIS 3-118 DELETED
MP-952		2182-80	0	✓			N. PATEL 1-31-83	A. GHOSE 2-1-83	3-5-83	
		2182-97								THERMAL SHAKLE
		2182-98								
		2182-99								
MP-954		2183-23	3	✓			M. KOULRAMENI 1-21-83	M. BRAHMBHATT 2-1-83	3-5-83	
		[illegible]								THERMAL SHAKLE

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1-1

As of Dec. 12, 1983

ONSITE ENGINEERING SMALL BORE PIPE SUPPORT CALCULATION LOG

DESIGN CALC. NO.	CALC. REV.	HANGER NO.	HANGER REV.	CALC. STATUS PRELIM	CALC. STATUS FINAL	CALC. STATUS SUPERSEDED	PREPARER DATE	CHECKER DATE	APPROVAL DATE	REMARKS
MP-986	2	2180-36	0				P.V. SISON 12-15-82	V. Chiang 12-26-82	1-6-83	
MP-987	1	2155-257	3				A. GHOSE 1-3-83	D.N. Patel 1-4-83	1-10-83	
[redacted]										
MP-989	1	85-38	2				E. RECINELLA 2-2-83	M. BRAHMBHATT 2-8-83	3-1-83	
MP-990	2	2-159	1				M. KEWALRAMANI 12-6-82	A. Ghose 12-27-82	1-15-83	
MP-991	0	2183-37	0				G. MEHTA 2-8-83	F. Santotomi 2-8-83	2-20-83	
MP-992	0	2-167	0				N. PATEL 12-10-82	M. Kewalramani 12-11-82	1-10-83	
MP-993	1	2-137	3				N. PATEL 12-9-83	M. Kewalramani 12-15-82	1-10-83	
MP-994	0	2-164	0				R. AMIN 12-16-82	E. RECINELLA 12-16-82	1-10-83	
MP-995	0	2-166	0				R. AMIN 12-16-82	E. RECINELLA 12-16-82	1-15-83	
MP-996	1	42-3	1				M. KEWALRAMANI 1-14-83	A. Ghose 1-15-83	3-3-83	
MP-997	1	2182-30	4				M. SIDDIQUE 2-12-83	A. Ghose 2-14-83	3-5-83	
MP-998	0	47-61	0				N. PATEL 1-24-83	M. KEWALRAMANI 1-26-83	2-10-83	
MP-999	1	2169-13	1				P.V. SISON 2-11-83	Nalin Patel 2-14-83	3-5-83	
MP-1000	1	2169-14	1				P.V. SISON 2-11-83	Nalin Patel 2-14-83	3-5-83	
MP-1101	1	2169-28	0				P.V. SISON 2-11-83	Nalin Patel 2-14-83	3-5-83	
MP-1102	1	[illegible]	[illegible]				P.V. SISON	Nalin Patel		

As of Dec 12, 1983

SHEET 60

...SITE ENGINEERING SMALL BORE PIPE SUPPORT CALCULATION LOG UNIT ___

DESIGN CALC. NO.	CALC. REV.	HANGER NO.	HANGER REV.	CALC. STATUS PRELIM	CALC. STATUS FINAL	CALC. STATUS SUPERSEDED	PREPARER DATE	CHECKER DATE	APPROVAL DATE	REMARKS
MP-986	3	2180-36	1		✓		A. GHOSE 9-12-83	B.C. PATEL 9-13-83	9-16-83	
MP-987	3	2155-257	4		✓		M. SHOIKHET 11-7-83	M. SIDDIQUE 11-7-83	11-10-83	
[redacted]										
MP-989	4	85-38	3		✓		B.C. PATEL 9-12-83	V. GHIYA 9-12-83	8-16-83	
MP-990	3	2-159			✓		W. GUADALUPE 6-23-83	M. BRAHMBHATT 6-24-83	6-30-83	
MP-991	2	2183-37	2		✓		H. SINGH 8-29-83	R. RAMPELL 8-29-83.	9-9-83	
MP-992	2	2-167	2		✓		O. ONGTENGCO 10-4-83	R. RAMPELL 10-5-83	10-13-83	
MP-993		2-137								
MP-994	4	2-164	2		✓		A. GHOSE 11-09-83	G.R. SHAH 11-09-83	11-12-83	
MP-995	4	2-166	2		✓		B.C. PATEL 10-28-83	A. GHOSE 10-28-83	11-2-83	
MP-996	4	42-3	3		✓		J. LIM 9-8-83.	O. ONGTENGCO 9-9-83.	9-13-83.	
MP-997		2182-30								
MP-998	2	47-61	1		✓		H. SINGH 8-3-83	M. NAIM 8-3-83	8-5-83	
MP-999		2169-13								
MP-1000		2169-14								
MP-1101		2169-28								

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As of Dec. 12, 1983

SHEET 57

ONSITE ENGINEERING SMALL BORE PIPE SUPPORT CALCULATION LOG UNIT 1

DESIGN CALC. NO.	CALC. REV.	HANGER NO.	HANGER REV.	CALC. STATUS PRELIM	FINAL	SUPERSEDED	PREPARER DATE	CHECKER DATE	APPROVAL DATE	REMARKS
MP-935	0	47-60	0	✓			N. PATEL 1-12-83	G.R. Shah 1-17-83	2-11-83	
MP-936	1	100-133	4	✓			R. COLO 1-26-83	N. Patel 2-8-83	3-6-83	
MP-937	0	47-58	2	✓			N. PATEL 1-12-83	G. Shah 1-18-83	2-11-83	COPIED FROM ORIGINAL P&F FILE RECORD FILE 10/7A 12-8-83
MP-938	2	2182-98	4	✓			G. MEHTA 12-11-82	F. Maleknia 12-11-82	2-10-83	
MP-939	1	100-101	0	✓			E. RECINELLA 1-31-83	R. Amin 2-1-83	3-5-83	
MP-940	1	100-18	3	✓			E. RECINELLA 1-27-83	R. Amin 2-1-83	3-5-83	
MP-941	0	66-49	0	✓			F. MALEKNIA 1-21-83	R. AMIN 1-22-83	3-5-83	
MP-942	1	99-20	3	✓			M. SHOKHET 1-25-83	M. Siddique 12-2-83	2-20-83	
MP-943	1	66-27	2	✓			P. V. SISON 1-31-83	F. Santotome 2-1-83	3-5-83	
[redacted]										
MP-945	1	100-121	0	✓			E. RECINELLA 2-1-83	M. Brahmbhatt 2-8-83	4-3-83	
MP-946	0	2151-232	0	✓			C. STOKES 12-17-82	Kunisamani 12-18-82	1-10-82	
[redacted]	1	181-81	0	✓			G.R. SHAH 2-1-83	R. Colo 2-3-83	3-5-83	
[redacted]	1	181-84		✓			G.R. SHAH 2-1-83	M. Brahmbhatt 2-4-83	3-5-83	
MP-949	0	2155-262	0	✓			B.R. PATEL 11-17-82	Sandarai 11-18-82	1-15-83	
MP-950	0	54-61	0	✓			J.V. MEGHANI 12-6-82	F. Maleknia 12-7-82	1-15-83	
MP-9[illegible]	1			✓			G. MEHTA	M. Siddique		

B-7

TABLE

SMALL BORE SUPPORT CALC. PACKAGES

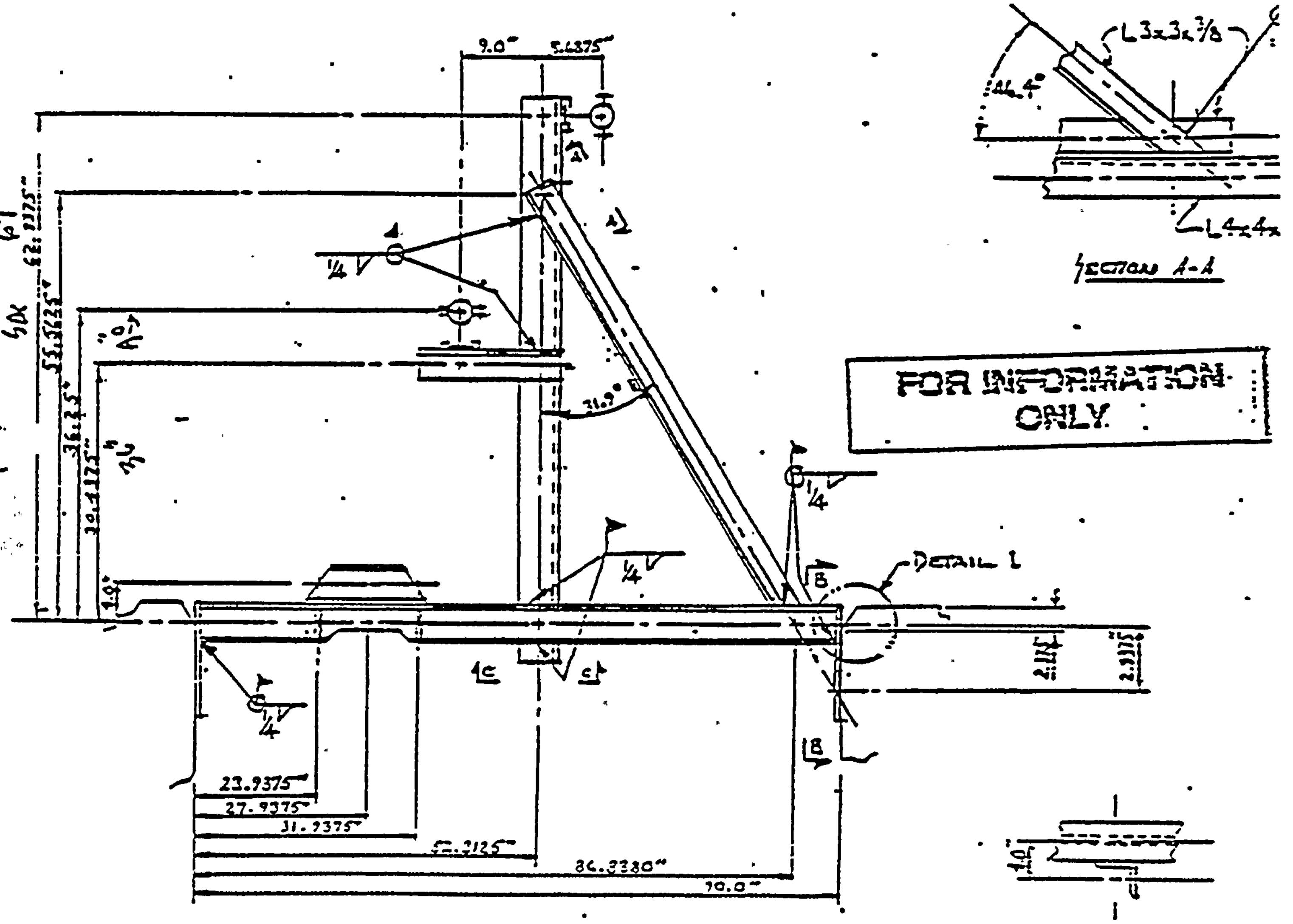
(as of December 8, 1983)

NO.	CALC.	SUPPORT	COMMENT
1	MP 072	2171-16	Design Deficiency, QA Deficiency
2	MP 345	2182-74	OK
3	MP 357	2182-91	OK
4	MP 951	100-111	Deficiency (Review Not Complete). more problems expected
5	MP 955	99-201	Calc. Deficiency. QA Deficiency.
6	MP 983	99-11	Design Deficiency.
7	MP 988	100-132	Modeling Deficiency. Calc. Errors. QA Deficiency.
8	MP 397	H21-226	OK
9	MP 465	002-170	QA Deficiency.
10	MP 942	99-20	Calc. Deficiency. Calc. Error.
11	MP 1621	2156-200	Calc. Error. Design Deficiency.
12	MP 1691	97-90	QA Deficiency.

Problems are:
1. Only one signature

Problems with 9 out of 12

SEQ IMP-### REV 5
SH 7 OF 37

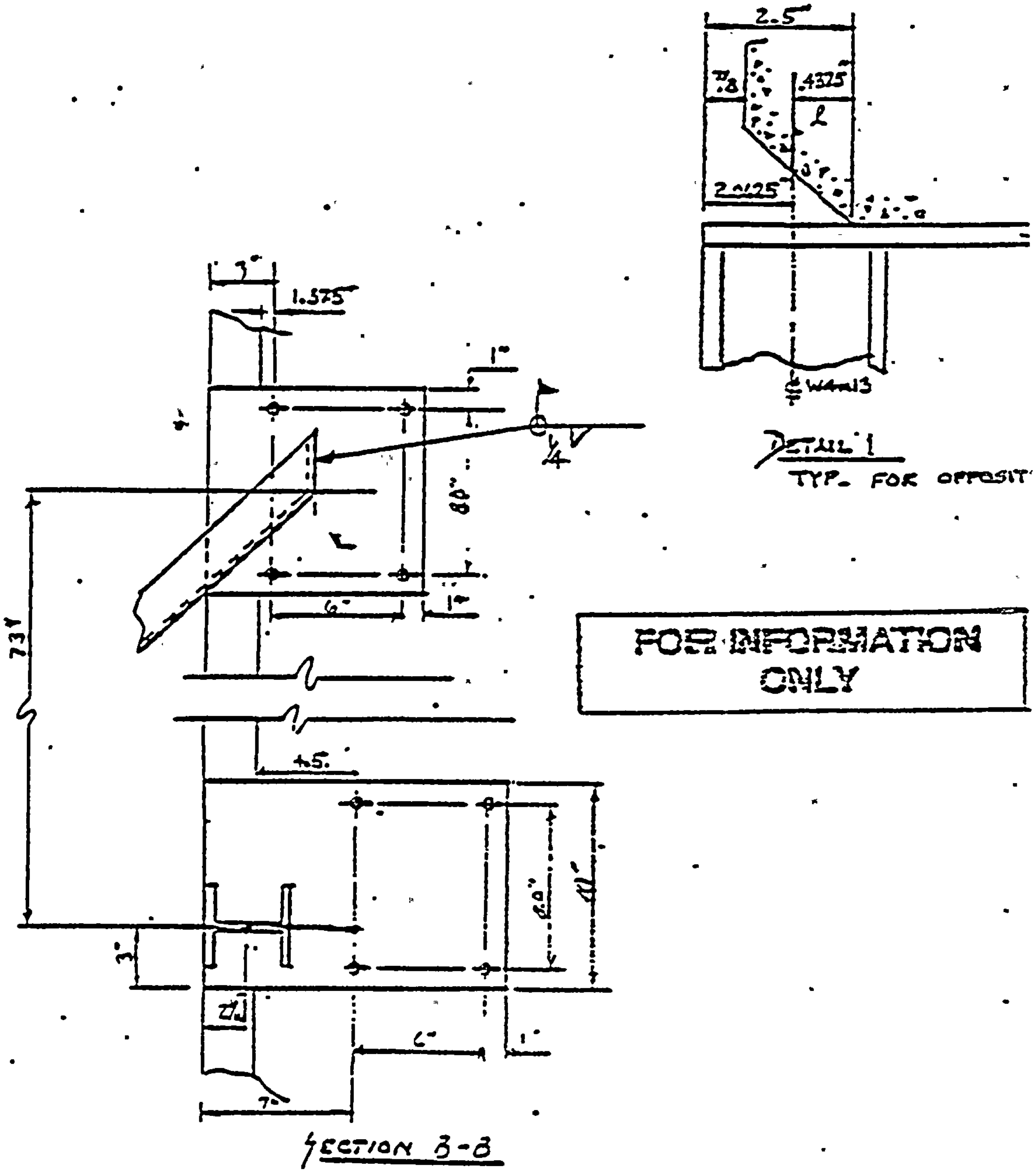


FOR INFORMATION ONLY

PLAN VIEW

NOTE: THIS SKETCH REFLECTS AS BUILT CONDITION PER WALKDOWN ON 1-31-83 & 2-2-83

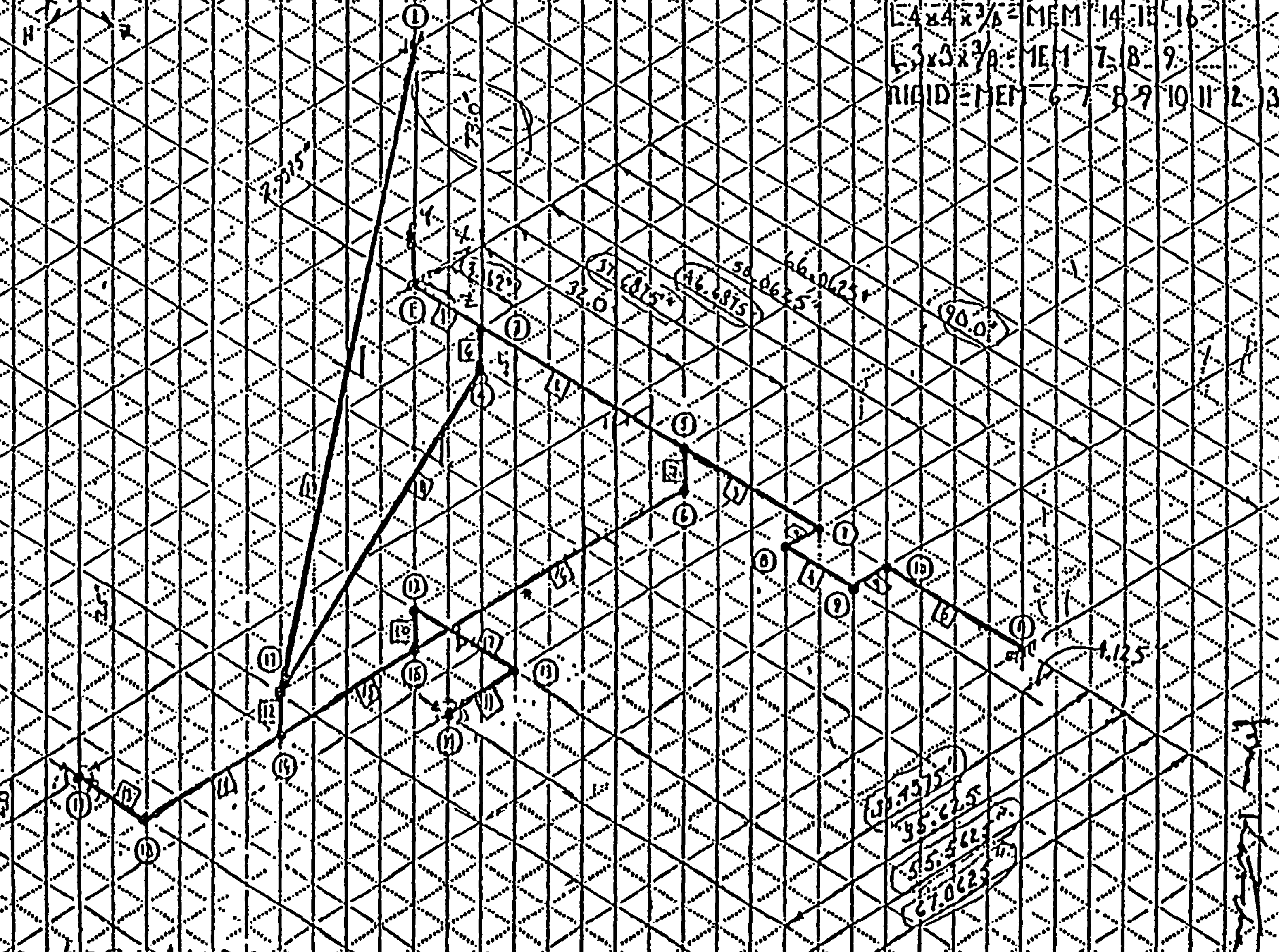
SEE MP-488 REV 5
SH 3



FOR INFORMATION ONLY

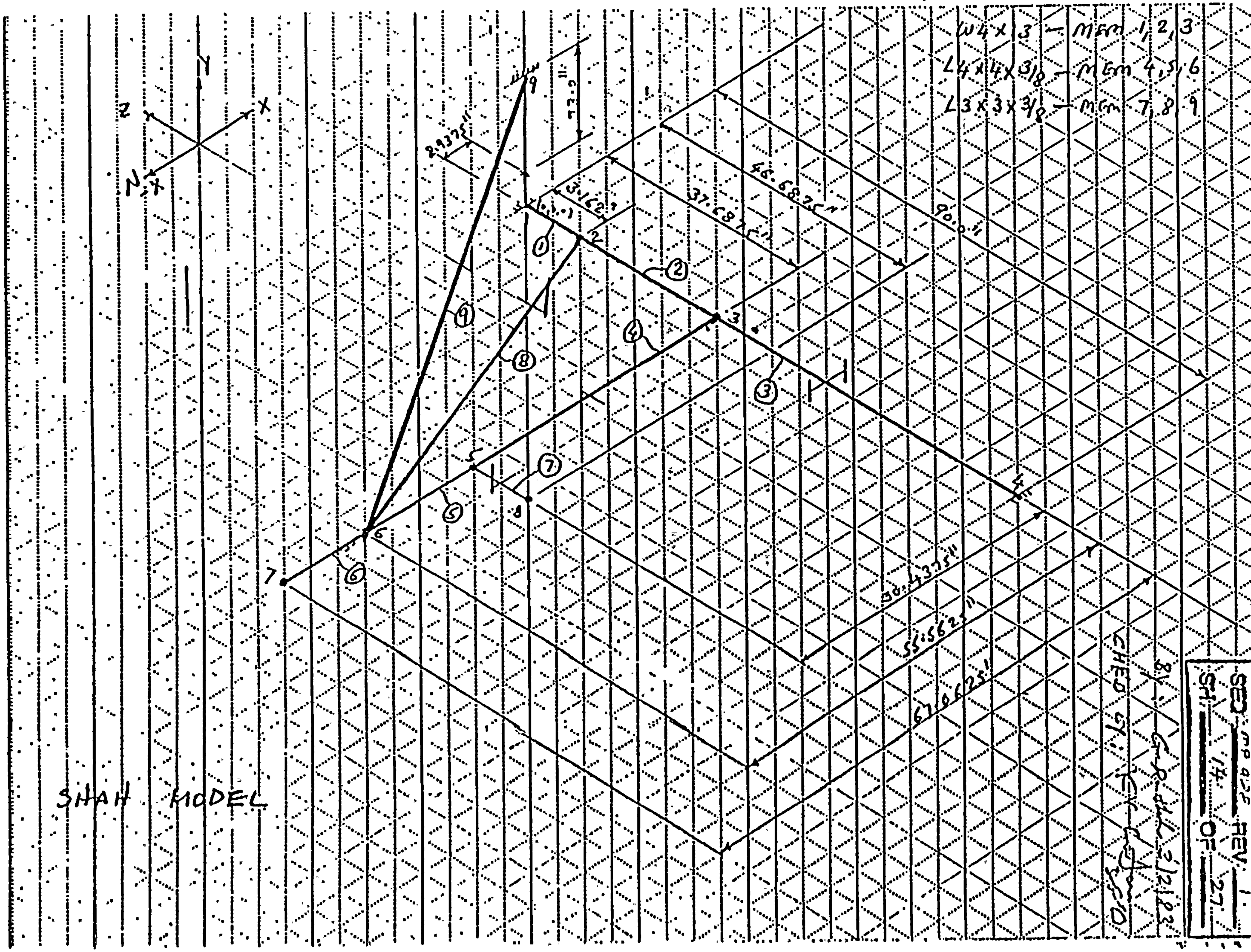
NOTE: THIS SKETCH REFLECTS AS BUILT CONDITION PER WALKDOWN ON

W4x13 = MEM. 1-2 3 4 5.
L4x4x3/8 = MEM 14 15 16
L3x3x3/8 = MEM 7 8 9
RIGID = MEM 6 7 8 9 10 11 12 13



KATCHER MODEL

SEC MP986 REV 1
SH. 11 OF 34


W4 x 13 - MEM 1, 2, 3
L4 x 4 x 3/8 - MEM 4, 5, 6
L3 x 3 x 3/8 - MEM 7, 8, 9
Y
X
Z
N, X
46.6875"
37.6875"
90.0"
3.1625"
2.9375"
30.4375"
55.5625"
67.0625"
SHAH MODEL
BY G.R. 2/2/83
CHKD BY
SEQ MP 9.2.E REV 1
SH 14 OF 27

PACIFIC GAS AND ELECTRIC COMPANY

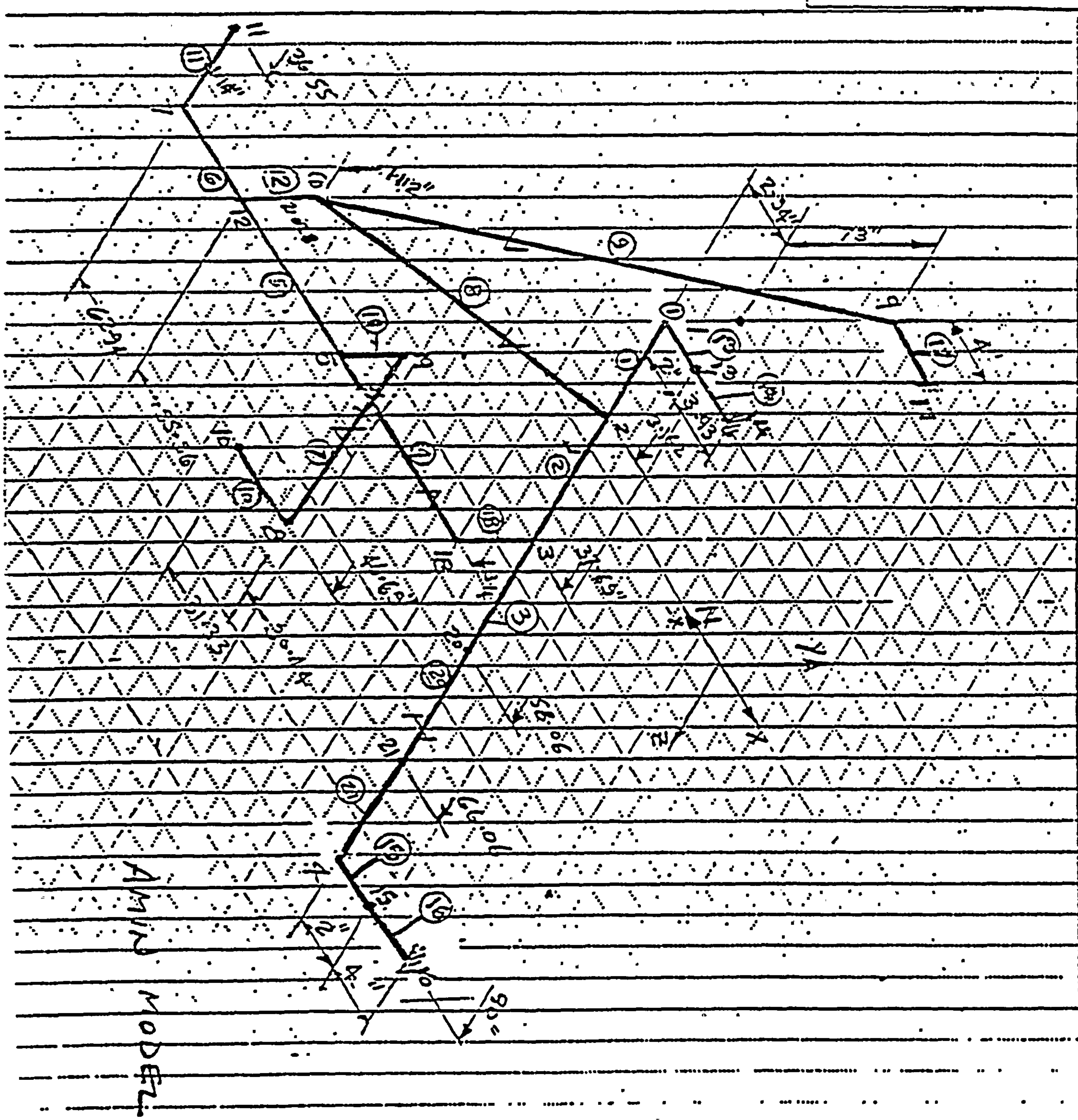
HGR. NO 100-132 ISO. H-8-305

DIABLO CANYON UNIT-1

MADE BY: R. A. DATE 1-8-84

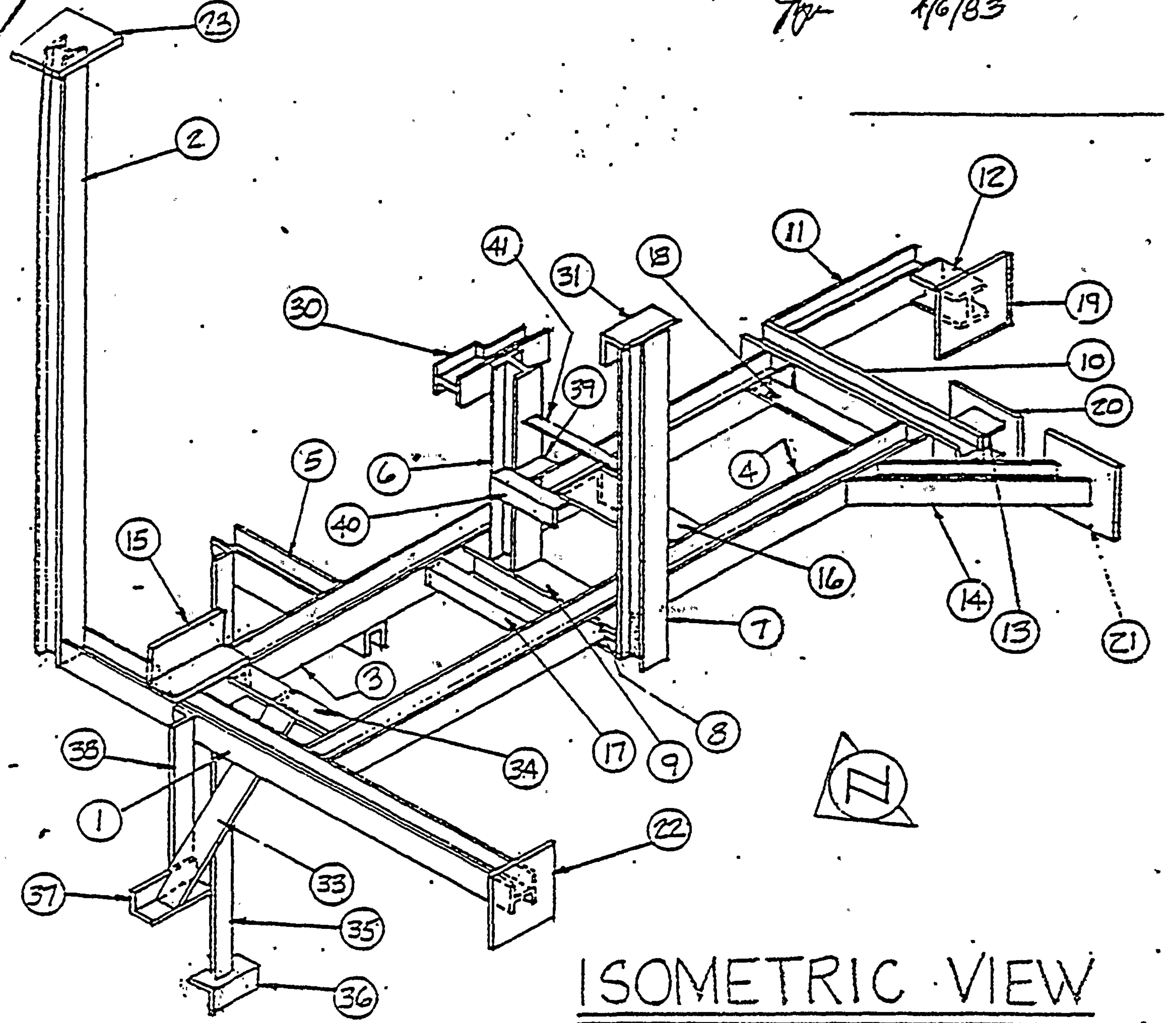
SEQ MP-988 REV 5

SH 24 OF 37



MP-98

SMALL BORE DRAWING
ACCEPTED
BY SBP | DATE 2/24/83
7/6/83



ISOMETRIC VIEW

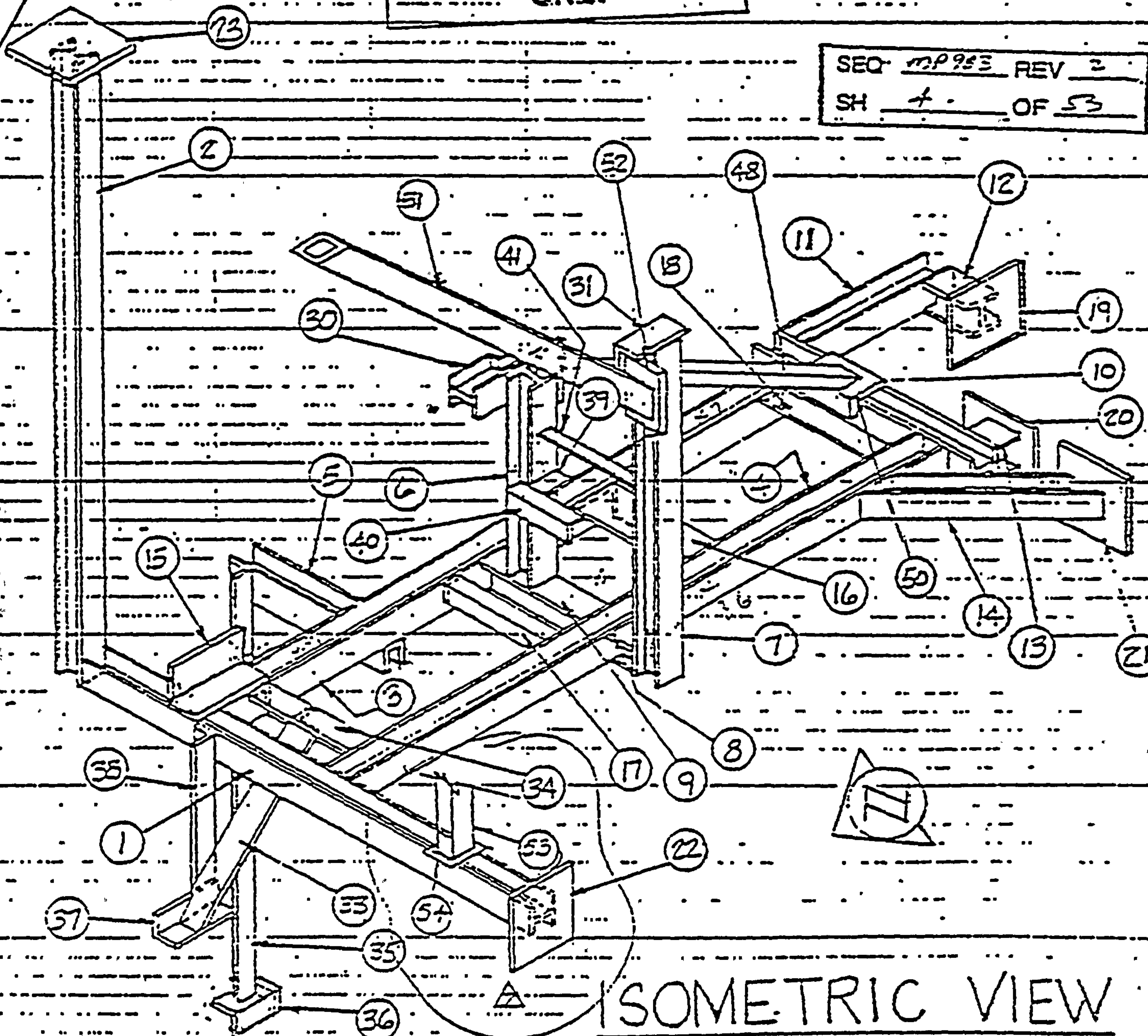
UNLESS OTHERWISE SPECIFIED	REF. DWG. 500099 SYS. 8/9	PIPE SUPPORT
~~[illegible]~~	CLASS 1 UNIT 1 AREA K	
	ELEV 100' DESIGN PUJARI / LAS	DWG. No. 99-11 REV. No. 6
	ISO MULTI. DATE 2-16-83	(17) SHT 1 OF 17

B-15

SMALL BORE DRAWING
ACCEPTED
BY S8Pujari DATE 5/19/83

FOR INFORMATION ONLY

SEQ MP983 REV 2
SH 4 OF 53



ISOMETRIC VIEW

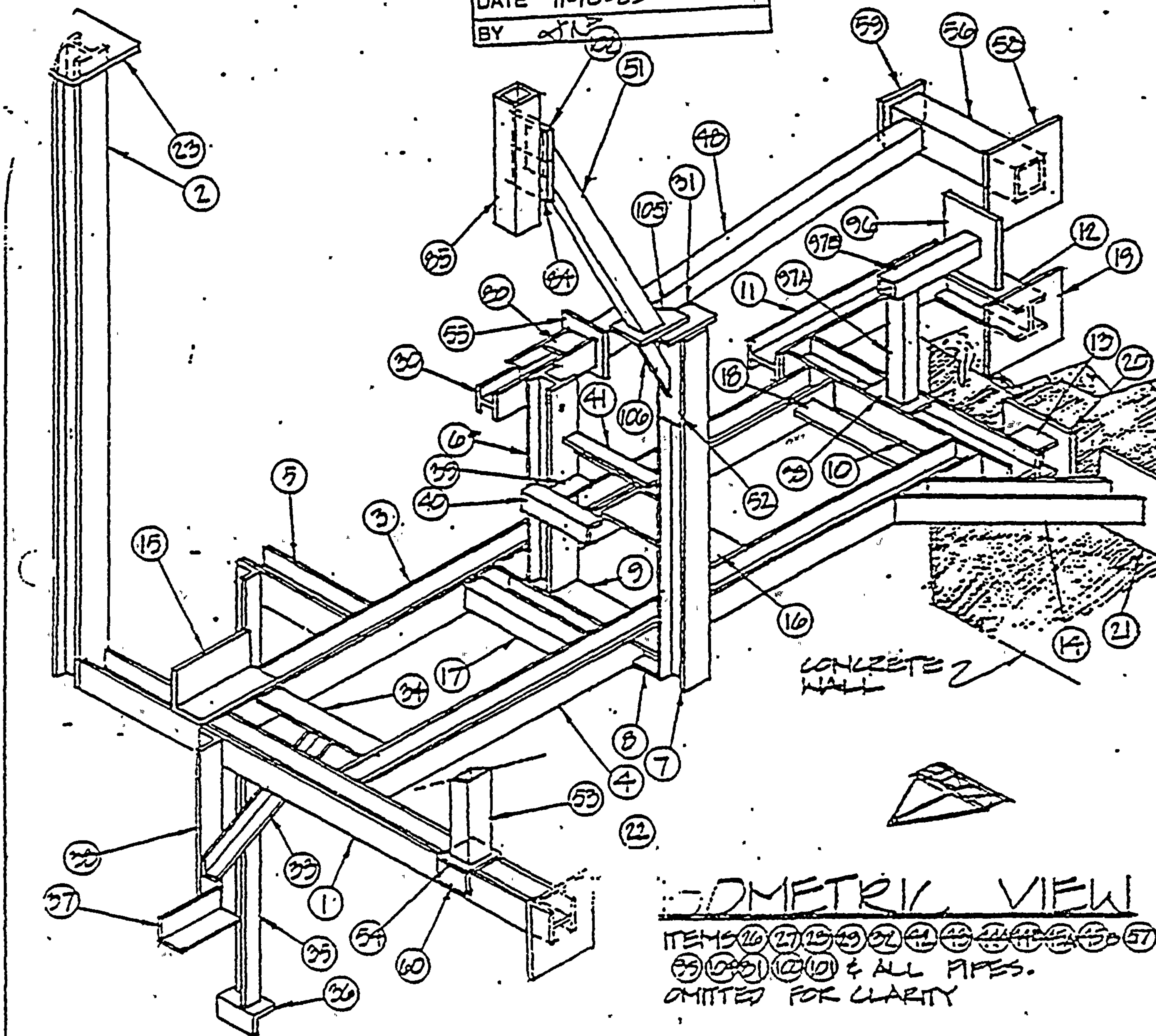
UNLESS OTHERWISE SPECIFIED	REF. DWG. 500049 SYS 8/9	PIPE SUPPOR
	CLASS 1 UNIT 1 AREA. K	
	ELEV 100' DESIGN PUJARI / LLS	DWG. No. 99-11 REV. No. -
	ISO MULT. DATE 2-16-83	(17) BILAT SHT 1 OF 2

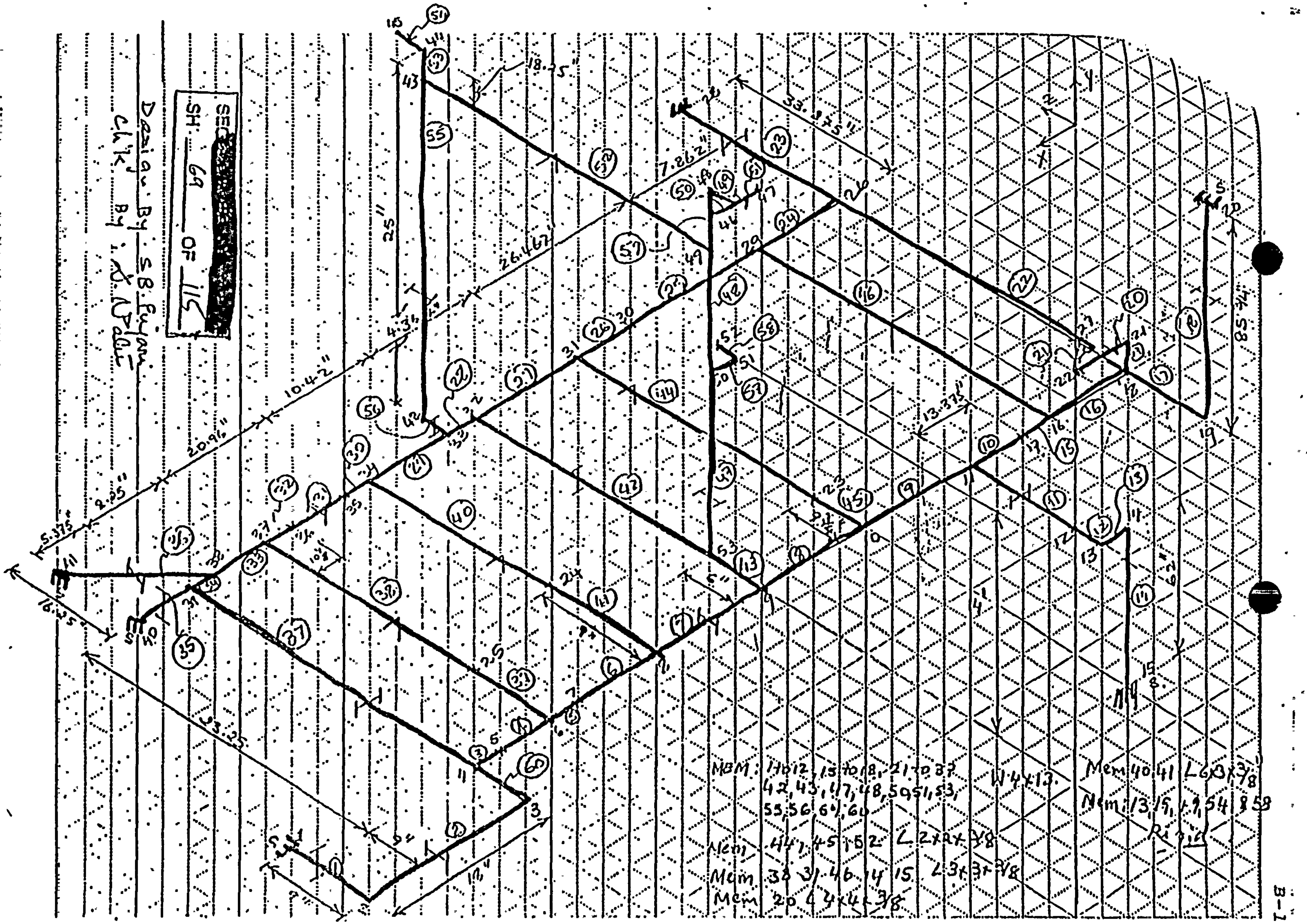
DRAWING B-

P.P.P. VERIFIED

AS PER QA ACCEPT 8-27-8

PACIFIC GAS & ELECTRIC CO.
APPROVED FOR CONSTRUCTION
ENGINEERING DEPARTMENT
DATE 11-10-83
BY




SEC [redacted]
SH. 69 OF 115
Design By S.B. Fujan
Ch'k'd By: J. Valt
MBM: 11to12, 13to18, 21to37, 42, 43, 47, 48, 50, 51, 53, 55, 56, 60, 60 W4x13.
Mem 40, 41 L6x3x3/8
Mem: 13, 19, 19, 54 & 58 Rigid
Mem 44, 45, 52 L2x2x1/8
Mem 38 39, 46, 14 15 L3x3x3/8
Mem 20 L4x4x3/8
33.375"
7.862"
26.462"
10.42"
20.96"
8.85"
5.375"
16.35"
33.25"
18.25"
25"
4.34"
13.375"
74.58
13"
9"
5"

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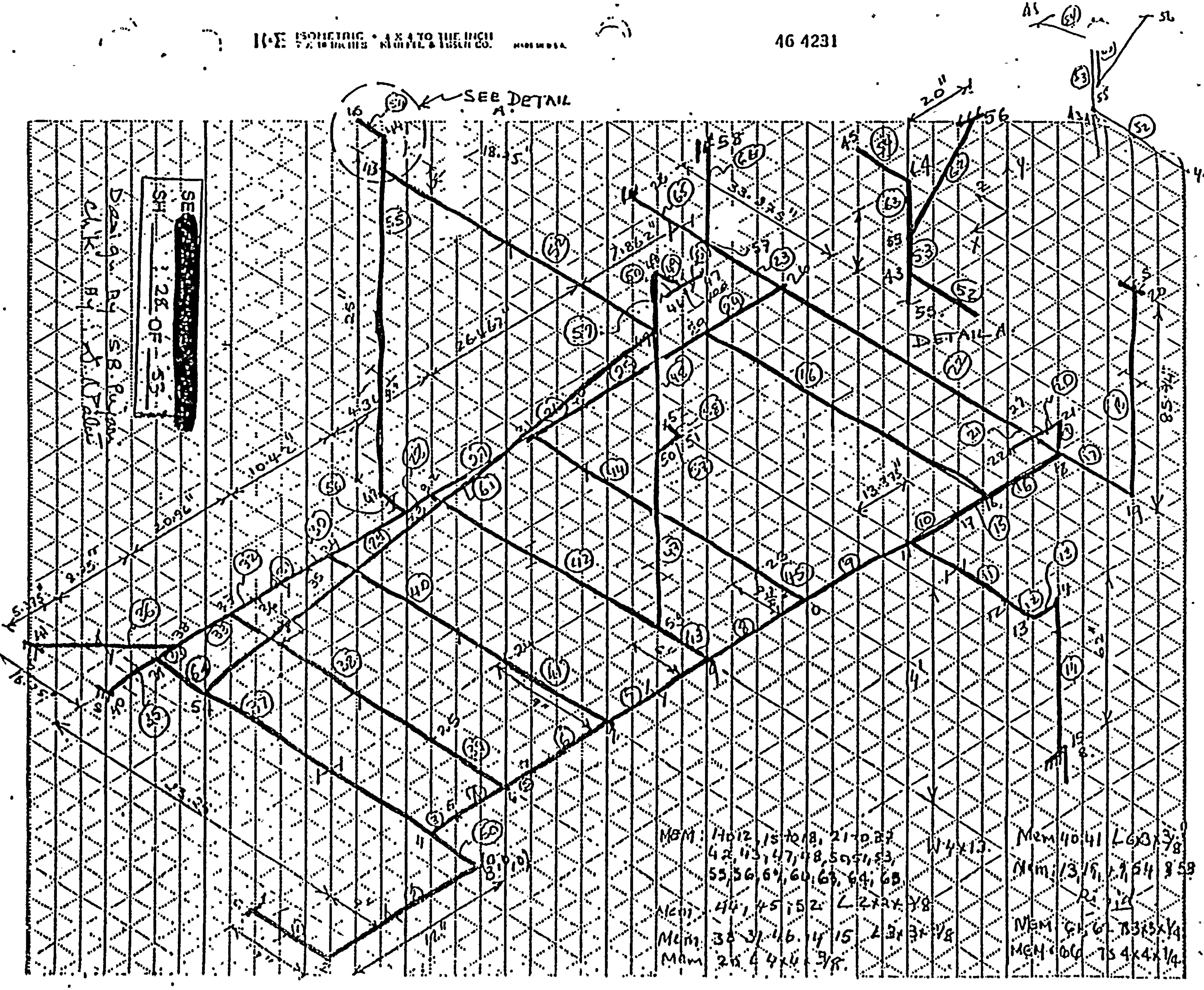

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TELEDYNE
ENGINEERING SERVICES

DCNPP-IDVP-PP-001
REVISION 0

DIABLO CANYON NUCLEAR POWER PLANT

INDEPENDENT DESIGN VERIFICATION PROGRAM

PROGRAM PROCEDURE

PHASE I ENGINEERING PROGRAM PLAN

This Program Procedure, DCNPP-IDVP-PP-001 is issued for the purpose of implementing the Program Management Plan.

W. E. Cooper 820331

Approved/Program Manager/Date

5.4.1.3 Acceptance Criteria

Additional verification will be required if the results vary by more than:

- 15% for the building dimensions and properties.
- For the building, 15% for the frequencies, provided the mode shapes agree.
- For the response spectra 15% in peak accelerations and 15% for the peak frequencies

5.4.2 Piping

5.4.2.1 Sample

Table II contains the piping problems chosen for independent verification. This sample of 10 piping analyses were chosen on the following basis:

- Obtain a sample from all buildings
- Obtain a sample from all elevations
- Obtain a sample from a diversity of systems
- Obtain samples from lines most important to safety (risk of radiation release).

This sampling strategy is based on the fact that each piping analysis is a lengthy and complex undertaking that requires examination and verification of a large body of data. In addition, consistent with the overall plan, if discrepancies are found, additional verification will be required.

5.4.2.2 Methodology

The methodology for the verification is based on the following points:

- A field verification of installation of the sample lines will be performed.

- Models will be developed from field verified drawings.

- The methods used for the analysis will in general parallel those used for the Hosgri analysis of the piping. The applicable Hosgri criteria are included in Attachment III.

- The analysis will consider deadweight, pressure and seismic loads.

- The verification analyses will be done using ADLPIPE, a different computer program than was used for the Hosgri analysis.

- ADLPIPE has been benchmarked against standard problems.

5.4.2.3 Acceptance Criteria

Upon completion of the independent analysis of the 10 piping runs, the results will be compared with the design analysis. The following procedure will be employed.

. Field tolerances are defined in PGandE's 79-14 program.

- For both the verification and design analysis, select all points in the line that are stressed to 70% of allowable stress or more. These are the reference locations

- If fewer than 5 such points are found, select the 5 most highly stressed points as reference locations.

- Compare design and verification stresses at the reference locations. If the stresses differ by more than 15% or exceed allowable stress, additional verification is required.

- Compare all support loads to the design analysis results.

- Compare all equipment nozzle loads to the design analysis results.

- Compare all valve accelerations to the design analysis results.

Additional verification is required if differences greater than 15% result in the last 3 steps or if allowable values are exceeded.

5.4.3 Pipe Supports

5.4.3.1 Sample

Twenty pipe supports have been chosen from those associated with the 10 piping verification analyses. These supports were chosen from different locations and represent a cross section of the different types of supports: snubbers, rigid restraints and spring hangers.

For the remainder of the supports included in the 10 piping analyses;

- Compare loads calculated from the independent analyses with the design loads. Loads differing by 15% or over allowable will require additional verification.

5.4.4 SMALL BORE PIPING

5.4.4.1 Sample

The small bore piping at Diablo Canyon Unit 1 has been supported using standard criteria for the spacing of supports or spacing tables. This is a standard approach in the industry. A sample of 3 runs of approximately 150 feet each of small bore piping has been chosen for review. This sample of piping will include 20 supports or more. In view of the fact that a relatively simple standard methodology was employed in the design, the sample chosen is expected to permit a satisfactory verification of the design.

However, the sample will be expanded as necessary to include analyses representative of each of the original design organizations performing work for PG&E (including PG&E itself) with respect to the design of small bore piping.

5.4.4.2 Methodology

The verification of the small bore piping will consist of two parts:

- Field verification of the sample to establish that the pipe installations conforms to the design criteria.

- Independent review of the design criteria to establish that the criteria satisfy the applicable stress limits and provide conservative support design loads using Hosgri seismic inputs. The Hosgri small bore piping criteria is included in Attachment II.

In reviewing these criteria, and the application of the criteria, particular attention will be given the effects of other influences, if any are applicable, such as concentrated masses represented by valves and their operators, system layout, and any other dynamic loadings which are required to be considered.

5.4.4.3 Acceptance Criteria

Acceptability of the field installation will be based upon the PGandE tolerances developed for the I&E 79-14 Bulletin review. Instances of violation of the criteria will require additional verification.

Review of the design criteria will consider the levels of seismic input throughout the plant together with the size and schedule of piping to ensure adequate margins are developed by use of the criteria. The criteria will be considered satisfactory if general stress levels satisfy the allowable stress criteria within ± 15% and support design loads are within ± 15% of conservatively calculated design loads.

If these criteria are not met, additional verification will be required.

Robert L. Cloud and Associates, Inc.

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Interim Technical Report

DIABLO CANYON UNIT 1
INDEPENDENT DESIGN VERIFICATION PROGRAM
SMALL BORE PIPING REPORT
ITR #30 REVISION 0

Docket No. 50-275
License No. DPR-76

[signature] 1/12/83
Project Engineer/Date
Technical Review

Edward Denison 1/12/83
Project Manager/Date
Approved P 105-4-839-030

D-

5.0 CONCLUSION

The IDVP review of the span rules and the field implementation showed that the rules generally satisfied the licensing criteria and that the small bore piping was installed in accordance with these span rules. The following generic concerns were noted:

- o The span rules do not address insulated piping.

- o The span rules do not limit the areas where small bore piping is installed. The span rules may not satisfy the licensing criteria for all areas of the plant (i.e., all high response spectra areas).

- o The Hosgri Report specifically allows the support of 6 inch piping using span rules, however, this pipe size was not addressed in the span rules. Also, the Hosgri Report does not prohibit the support of piping larger than 6 inches by the use of span rules.

- o The piping first mode frequencies resulting from use of the span rules are less than 15 hertz (licensing criteria) for certain piping sizes and configurations.

- o For 3 and 4 inch pipe, the span rules do not specifically limit the unsupported distance from a change of direction containing a run of pipe that requires axial restraint.

In addition, one specific concern was noted:

- o While the Hosgri Report implies that the 1969 J.A. Blume report (Reference 6) demonstrates the conservatism of the span rule approach, the IDVP found no evidence to confirm this in the Blume Report.

These six concerns, and the following three items from the original design, will be addressed by the DCP corrective action program and verified by the IDVP.

- o Certain piping configurations are supported in the field with the use of undocumented engineering judgements.

- The maximum vertical (all sizes) and horizontal (> 2 inches) runs of pipe are assumed to be 50 feet and 100 feet, respectively.

- Certain hangers in the field are not marked. Although the licensing criteria does not require that hangers be field marked, the IDVP considers this to be good engineering practice. Following the DCP corrective action program, the IDVP will verify that the small bore pipe support qualifications are not affected by unmarked hangers.

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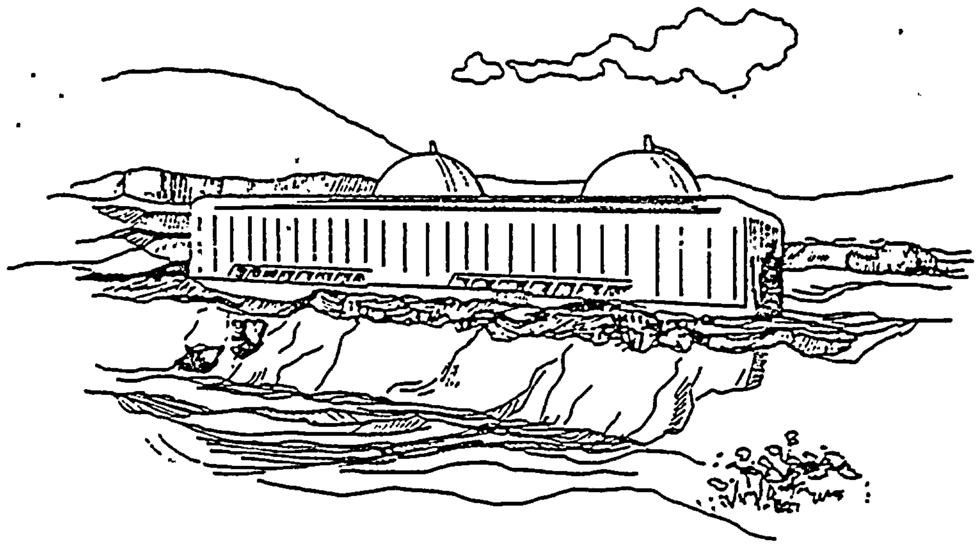
PACIFIC GAS AND ELECTRIC COMPAN

PHASE I FINAL REPORT
DESIGN VERIFICATION PROGRAM



Diablo Canyon Power Plant

1982

2.2.2 SMALL BORE PIPING

Small bore piping at the Diablo Canyon Plant was designed by either dynamic analysis or by use of spacing criteria. A review of this piping is performed to confirm satisfaction of the design basis requirements.

2.2.2.1 Scope.

All Design Class 1 small bore piping less than or equal to 2 in. in diameter are reviewed for compliance with the original design criteria. The piping is qualified either by a sampling or generic review. The generic program provides a review of all piping and analyses for those issues identified to have the potential to cause modification. These issues were identified by ITP and IDVP reviews. The sampling program shows qualification of all piping and analyses for all other design and analysis considerations and no modifications are anticipated to maintain qualification.

2.2.2.1.1 Generic Review

The generic review of small bore piping represents a comprehensive review of all small bore piping potentially affected by the issues included in the review. The piping is qualified by specific review or reanalysis of all components or areas of concern, or by analysis of worst case examples.

The following issues are included in this review:

(1) Computer seismically analyzed small bore piping and associated thermal analysis

(2) Valve qualification

(3) Seismic and thermal piping anchor movement (SAM, TAM)

(4) Design class change boundaries

(5) Hot piping designed by spacing criteria.

2.2.2.1.2 Sampling

Sampling methods are used to ensure qualification of the remainder of the small bore piping and to address design considerations not included in the generic review. Sampling will ensure that these areas will not have any significant impact on the small bore piping. Any items that are of significance will be further evaluated.

Included in the sample review are the following:

(1) As-built piping accuracy

(2) Revised seismic spectra

(3) Concentrated masses

(4) Effect of pipe insulation weight

(5) Spans exceeding spacing criteria

(6) Anchor and equipment loads

(7) Equipment and building seismic and thermal anchor movement

(8) Thermal analyses

(9) Integral valve bypass

(10) Vents and drains

2.2.2.2 Criteria

Piping code stress equations and allowable stress criteria are as stated in Section 2.2.1.2.

2.2.2.3 Methodology

2.2.2.3.1 General

Small bore piping is qualified by using span criteria methods or computer analysis.

2.2.4 SMALL BORE PIPE SUPPORTS

2.2.4.1 Scope

All Design Class 1 small bore pipe supports designs for piping less than or equal to 2 in. in diameter are qualified by sampling or generic reviews. The generic program provides a review of all pipe supports and analyses for those issues identified to have the potential to cause modification. These issues were identified by ITP and IDVP reviews. The sampling program shows qualification of all pipe supports and analyses for all other design and analysis considerations and no modifications are anticipated to maintain qualification.

2.2.4.1.1 Generic Review

The generic review of small bore piping supports represents a comprehensive review of supports potentially affected by issues included in the review. This is accomplished by review and/or analysis of all components, or analysis of worst case examples. Included in this review are the following:

(1) Standard support details

(2) Loads from seismic and thermal piping anchor movement

(3) Code boundaries

(4) Lug stress and lug local effect on pipe stress.

2.2.4.1.2 Sampling

Sampling methods are utilized to assure qualification of the remainder of the supports, and to address design considerations not included in the generic review. The sampling process is expected to confirm that these issues do not cause small bore support modifications. If this is not the case, further review is performed.

Included in this sample review are the following:

(1) As-built piping accuracy

(2) Revised spectra

(3) Concentrated masses

(4) Effect of pipe insulation weight

(5) Spans exceeding spacing criteria

(6) Equipment and building anchor movement

(7) Thermal loads.

Robert L. Cloud and Associates, Inc.

RLCA

Interim Technical Report

Diablo Canyon Unit I
Independent Design Verification Program
Verification Program for
PGandE Corrective Action

Revision 0

Docket No. 50-275
License No. DPR-76

Edward Denison 10/5/82

Project Manager/Date
Approved P105-4-839-008

Third, in cases where review or analysis of a sample is employed by PGandE to demonstrate conservative design, the IDVP will examine and evaluate the sample validity and perform design verifications on the PGandE sample (eg. Small Bore Piping).

In order to ensure the IDVP verification program integrity, samples for design verifications will be selected from lists of completed PGandE work. Design verifications will be performed in the offices of the IDVP participants. Sample selection may be staggered to allow the verification to proceed in parallel with the PGandE corrective action plan. In all cases, at least one sample from each category of work will be selected after PGandE completion of the entire scope.

The IDVP will also verify PGandE design office activities and "as-built" information at the site. The design office verification will include only technical interface control implementation and project indoctrination. Site verification will include both overall "as-built" modeling and specific details and dimensions. All physical modifications resulting from specific IDVP EOIs will be verified along with a sample of physical modifications resulting from the PGandE corrective action plan.

QUALITY ASSURANCE VERIFICATION

In addition to the technical verification, the IDVP will also verify the Quality Assurance procedures and implementation of design related corrective actions against the Diablo Canyon Project (DCP) QA Manual. This verification to be performed by R.F. Reedy, Inc., is discussed further in Section 16.0.

ACCEPTANCE CRITERIA

The acceptance criteria for the IDVP verification of the PGandE corrective action program is similar to that given in Phase II Engineering Program Plan, Revision 0 (pgs. 11 and 12).

Differences will be noted by the IDVP and evaluated as to source and to significance of that source with regard to both the specific item and as possible generic concern. If it is judged that the source of the difference is of significance to either, an Open Item Report will be issued. If the final design does not meet the licensing basis, it will be identified and reported in accordance with the Program Management Plan.

8.0 SMALL BORE PIPING

The PGandE plan for the small bore piping specifies a complete review of all Design Class I piping smaller that 2 1/2" qualified by computer analysis. In cases where the review reveals deficiencies in an existing analysis, these are to be corrected by additional qualification. In addition, for Design Class I piping smaller than 2 1/2" qualified by span evaluation procedures, the PGandE plan specifies a revision to the span evaluation procedures along with computer analysis of a sample of this piping to demonstrate conservative design. The IDVP will verify the corrective action by examination of the PGandE plan and implementation.

The IDVP will verify the corrective action for the computer analyzed small bore piping by following the large bore piping approach (Section 7.0) with design verification samples one half the size of large bore piping. Table 6 presents the logic and tasks involved.

The IDVP will verify the corrective action for small bore piping qualified by span evaluation procedures as shown in Table 7. The sections below provide further definition of the tasks.

8.1 IDVP VERIFICATION OF THE PGandE PLAN

The IDVP will verify the following three aspects of the PGandE small bore piping plan: revised span evaluation procedures, sampling and analysis.

Table 7

Small Bore Piping
Qualified by Span Evaluation Procedures

PGandE Plan Elements	PGandE Plan IDVP Tasks	PGandE Plan Implementation IDVP Tasks
Revised Span Evaluation Procedures	- verify consistency with previously noted field conditions, resolution of identified concerns and qualification of design to criteria	- verify specific items: o 4 remote operated valves o 4 welded attachments
Sampling	- verify that sample size and requirements will permit generic conclusions.	- verify sample selection through "as-built" and drawing verifications
Analysis	- verify that criteria and methodology are consistent with licensing documents	- perform design verifications on all analyses - verify design office technical interface control

<u>Revised Span Evaluation Procedures</u>: The revised span evaluation procedures will be verified against the previously examined span evaluation procedures (current as of November 30, 1981). All changes will be verified for consistency with the previously noted field conditions, resolution of identified concerns, and qualification of design to criteria.

<u>Sampling</u>: The PGandE sample size and requirements will be verified by the IDVP to determine if generic conclusions can be drawn through application of the sampling methodology. In particular the list of Design Class 1 piping qualified by span evaluation procedures will comprise the sample space.

<u>Analysis:</u> The criteria, methodology and procedures used by PGandE will be verified against the Hosgri Design Class 1 piping commitments contained in the FSAR, Hosgri Report, Safety Evaluation Report and Supplements and other licensing documents.

10.0 SMALL BORE PIPE SUPPORTS

The PGandE internal plan for small bore pipe supports specifies analysis of a sample of supports to demonstrate conservative design.

The IDVP will verify the corrective action by examination of the PGandE plan and implementation. Table 9 presents the logic and tasks involved. The sections below provide further definition of the tasks.

10.1 IDVP VERIFICATION OF THE PGandE PLAN

The IDVP will verify two aspects of the PGandE small bore pipe support plan: sampling and analysis.

Sampling: The PGandE sample size and requirements will be verified by the IDVP to determine if generic conclusions can be drawn through application of the sampling methodology. In particular, the list of all Design Class 1 supports for piping qualified by span evaluation procedures will comprise the sample space.

Analysis: The analysis criteria, methodology and procedures used by PGandE will be verified by the IDVP against the Hosgri Design Class 1 pipe support commitments contained in the FSAR, Hosgri Report, Safety Evaluation Report and Supplements, and other licensing documents.

Table 9

Small Bore Pipe Supports

andE Plan Elements	PGandE Plan IDVP Tasks	PGandE Plan Implementation IDVP Tasks
mpling	- verify that sample size and requirements will permit generic conclusions	- verify sample selection through "as-built" and drawing verifications
alysis	- verify that criteria and methodology are consistent with licensing documents	- perform design verifications on all analyses - verify design office technical interface control

10.2 IDVP VERIFICATION OF THE PGandE PLAN IMPLEMENTATION

The IDVP will verify the implementation of the PGandE plan by design verification, verifications of the sample selection, and design office verification.

10.2.1 IDVP Design Verification - PGandE Analysis

The IDVP will design verify all the PGandE sample analyses in accordance with written IDVP check lists to assure compliance with the PGandE Plan. These check lists will contain secific technical items noted in accordance with the PGandE plan. The design verifications will address the following technical items.

- o Establishment of design criteria
- o Establishment of scope and responsibilities
- o Establishment of design inputs
- o Reasonableness of assumptions
- o Applicability of analysis methods
- o Applicability of computer programs
- o Modeling methods and boundary conditions
- o Consistency of results based on judgement and/or simplified or alternate methods
- o Completeness of qualification
- o Satisfaction of design criteria

10.2.2 Sample Selection

The sample selection will be verified by the IDVP through field and drawing verifications.

10.2.3 IDVP Design Office Verification

The IDVP will verify PGandE design office activities.

Design office verifications will include only technical interface control implementation and project indoctrination in accordance with the PGandE Plan. Interface control includes project responsibilities and instructions, identification and execution of technical interfaces, document and information control distribution, and technical review and approval.

Robert L. Cloud and Associates, Inc.

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Interim Technical Report

IDVP VERIFICATION PLAN
FOR
DIABLO CANYON PROJECT ACTIVITIES
ITR #35
REVISION 0

Docket No. 50-275
License No. DPR-76

4/1/83
Project Engineer/Date
Technical Review

Edward Denison 4/1/83
Project Manager/Date
Approved P 105-4-839-035

2.3 REPORTING

The samples, procedures, criteria and results of the IDVP verification of the Diablo Canyon Project activites will be reported in a series of interim technical reports.

Acceptance criteria for this IDVP verification is similar to that given in the Phase II Engineering Program Plan, Revision 0 (pages 11 and 12). Differences will be noted by the IDVP and evaluated as to source and significance. If it is judged that the source indicates a possible generic concern, or if the final design does not meet the licensing criteria, an Open Item Report will be issued.

3.3 SMALL BORE PIPING AND SUPPORTS

For small bore piping and supports, the IDVP will verify DCP activities by examining the PGandE Phase I Final Report and its implementation. The report specifies a review by the DCP of all Design Class I small bore piping (smaller than 2-1/2 inches) qualified by computer analysis.

In addition, the report specifies that span evaluation procedures be revised and that a sample of piping and support be analyzed by the DCP to demonstrate conservatism of the revised procedures. If the review/sample reveals deficiencies, these are to be corrected by the DCP.

The IDVP will select 5 samples of small bore piping qualified by computer analysis. These samples will be selected and verified in the manner described for large bore piping in Section 3.2.

The IDVP will also verify the DCP sampling approach and several specific samples of small bore piping and supports qualified by span evaluation procedures.

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Interim Technical Report

DIABLO CANYON UNIT 1
IDVP REVIEW OF CORRECTIVE ACTION

Large and Small Bore Pipe Supports

ITR #60, Revision 1

Docket No. 50-275
License No. DPR-76

10/3/83
Project Reviewer/Date
Technical Review

Edward Denison 10/3/83
Project Manager/Date
Approved P105-4-839-060

2.0 DCP CORRECTIVE ACTION PROGRAM

The DCP prepared detailed procedures, instructions, and Design Criteria Memoranda (DCMs - References 6 to 18) to describe and control the steps and interfaces involved in the pipe support Corrective Action Program. These procedures include provisions for evaluation of compressive force in pipe support components (welded attachments, clamps, tee shoes, snubbers and spring hangers) by ANSI B31.1 and support members by the AISC code.

The following elements were included in the DCP Corrective Action Program:

Large Bore Pipe Supports

- Loads resulting from the piping dynamic, thermal, dead load, and hydrodynamic analyses (e.g., from the CAP for Design Class 1 piping) were used to review all Design Class 1 pipe supports. If required, new analyses were performed to incorporate as-built conditions and revised loads.

- Supports on non-seismic piping attached to seismic piping were considered as "code break" supports and designed as Design Class 1 supports. The code break supports were intended to isolate the response of the non-seismic piping from the seismic piping, and included two bilateral supports and one axial support located on the non-seismic piping.

- Supports were reviewed for consistency with piping analyses. Clearances were reviewed to assure that sufficient capability existed to accommodate pipe movements for the design conditions.

- Pipe supports were reviewed to ensure that the stresses were within allowables.

- In general, complex structures were analyzed using a structural analysis computer code (e.g., STRUDL).

o Supports other than springs were required to be designed with a natural frequency of at least 20 hertz (Hz). For those supports with a natural frequency of less than 20 Hz in the unrestrained direction, assurance was required that combined stresses from the restrained and unrestrained directions met allowables.

o All seismic supports were considered and verified (and modified, if required) as double-acting tension and compression elements.

o Support loads were combined and evaluated per the load combinations shown in Table 1.

o Loads on multiple pipe hangers were generally assumed to act simultaneously. An alternate method which may have been used was to combine the loadings from the different piping systems by the square root of the sum of the squares (SRSS) method.

o Standard component support adequacy (e.g., snubbers or spring hangers) was demonstrated by comparing the applied loads to the allowable loads from the load capacity data sheets or vendor allowables.

o New supports required to maintain piping stresses within allowables were also designed to meet licensing criteria and follow the CAP procedures. (Note, however, that new supports were required to meet a 33 Hz frequency criterion in the restrained direction rather than one of 20 Hz for existing supports.)

<u>Small Bore Pipe Supports</u>

The above elements for the large bore supports CAP were also used by the DCP for the small bore supports with the changes or additions described below.

The DCP methodology used in the CAP was to qualify all Design Class 1 small bore pipe supports as a result of generic or sample reviews.

The DCP review process included revisions to the small bore piping span rules. (The IDVP review of span rules is addressed as part of the small bore piping review in ITR #61, Reference 2a.)

The DCP Generic Review of small bore pipe supports consisted of review and application of issues to all analyses or span rule piping and supports. It applied to those analyses or designs for which previous DCP reviews had indicated generic issues with a potential need for physical modifications to maintain compliance with DCP licensing criteria. This was accomplished by DCP review and/or analysis of all components, or analysis of worst case examples. Included in this generic review were the following:

- o Standard support details (Reference 19)
- o Loads from seismic and thermal piping anchor movements
- o Code boundaries (seismic/non-seismic)
- o Welded attachment and associated local pipe stress.

The DCP Sampling Review was utilized by the DCP to assure qualification of the remainder of the supports, and to address design considerations not included in the generic review. The sampling process was directed toward those analyses or designs which were not anticipated to require modifications to maintain compliance. If this was not the case, further review was performed. Design considerations in the sampling review were the following:

- o As-built piping accuracy
- o Revised seismic spectra
- o Concentrated masses
- o Effect of pipe insulation weight
- o Spans exceeding spacing criteria
- o Equipment and building seismic and thermal anchor movements (SAM/TAM)
- o Thermal loads.

7.0 SUMMARY OF IDVP REVIEW RESULTS

7.1 REVIEW OF DCP METHODOLOGY FOR CORRECTIVE ACTION PROGRAM

Consistent with the program outlined in ITRs #8 and #35, the IDVP has reviewed the DCP methodology for the CAP which included specific reviews of procedures, instructions, and DCMs. The IDVP verified that the DCP methodology met all licensing criteria.

The methodology used by the CAP to address large and small bore pipe supports was found to adequately address the Design Class 1 pipe supports in the plant. The methodology was generally complete and thorough. DCP criteria and procedures provided appropriate guidance for the pipe support design effort. The IDVP found that the DCP General Pipe Support Status Report represented a complete listing of all Design Class 1 large bore supports in DCNPP-1 and was effectively used by DCP to track such items as the support revision status, plant location, and corresponding piping analysis.

For the small bore pipe supports, the IDVP found that the DCP sampling methodology (generic and sample reviews) and the size of the DCP sample were sufficient to substantiate the general DCP conclusions regarding the adequacy of the Design Class 1 small bore supports.

In addition to the DCP methodology, the IDVP considered reinforced pad stresses and the additional flexibility of pipe supports mounted on structural steel. In cases examined by the IDVP, the effect of including the building steel in the support frequency calculations was not significant. The reinforced pad stresses were found to be within the allowables.

The IDVP noted that the qualification criteria used by the DCP were more comprehensive than required by the documented licensing criteria, References 4 and 5. In particular, seismic anchor motion was considered and out-of-plane frequency for large bore supports was included explicitly. Also, the DCP reevaluated all DE, DDE, and thermal loadings.

7.2 ENGINEERING REVIEW

The engineering review results of the IDVP design verification of DCP corrective action for large and small bore pipe supports are based on the review of 22 large bore and 8 small bore pipe supports.

Many of the items noted in the individual result sections relate directly to the completeness or thoroughness of documentation provided in the DCP analysis packages. In these cases, either standard documentation sheets were omitted or the application of DCP engineering judgement was not documented.

Differences between the as-built condition, as field verified by the IDVP, and the DCP support drawings were judged to be minor and to have no impact on analysis results.

In addition, the IDVP field verified 12 small bore and 15 large bore support modifications.

To evaluate the impact on analysis results of all the above items that were not a matter of basic documentation or obvious engineering judgement (e.g., where there may have been a potential impact on the structural adequacy of the support), the IDVP performed alternate calculations.

In all cases, except as noted in Section 7.4, the IDVP determined that the above items did not affect the overall results of the DCP analyses or the structural adequacy of the supports.

7.3 COMPLETION REVIEW

The completion review results of the IDVP design verification of DCP corrective action for large and small bore pipe supports are based on the review of 4 large bore and 11 small bore pipe supports.

The purpose of the IDVP completion sample review is to confirm current (June 30, 1983 or later) design inputs, interface data, and criteria, not to review these analyses in detail.

Many of the results noted in Tables 6 and 7 relate directly to the completeness or thoroughness of documentation provided in the DCP analysis packages. In these cases, either standard documentation sheets were absent or the application of DCP engineering judgement was not documented.

In all cases, the IDVP determined that the above items did not affect the overall results of the DCP analyses or the structural adequacy of the supports.

7.4 EOI REPORTS

The IDVP review of sample pipe support analyses resulted in the issuance of four EOI reports (three for large bore and one for small bore) as presented below:

- EOI 1122 - The analysis for Support 10/70SL did not address the support frequency or stress in the unrestrained directions. The DCP revised the analysis to show that all stresses from loads in the unrestrained directions meet allowables. This analysis was accepted by the IDVP.

  EOI 1122 has been classified as a Deviation.

- EOI 1129 - The analysis for Support 56S/3A incorrectly analyzed a weld between the pipe lug and supporting steel. The DCP calculation used a conservative weld moment of inertia. (The stress met allowables if an accurate moment of inertia and weld section had been used.)

  This EOI has been classified as a Class C Error and does not represent a generic concern.

- EOI 1131 - The analyses for Supports 58S/16V and 63/26V did not evaluate the shear lugs or the attachment welds. The IDVP has determined that this item is a departure from DCP procedure, not an Error. The stresses in the shear lugs and attachment welds were determined by the IDVP to be low by engineering judgement.

  EOI 1131 has been classified as a Deviation.

- EOI 1139 - The analysis for Support 55S/73R to which small bore support 2159/2 is attached, incorrectly calculated a deflection and compared it to an erroneous allowable. The DCP deflection related to a frequency < 20 Hz.

  The DCP revised their analysis for support 55S/73R to which Support 2159/2 is attached. This revised analysis indicated a frequency > 20 Hz. The IDVP found this analysis acceptable.

  EOI 1139 has been classified as a Class C Error.

8.0 CONCLUSIONS

The IDVP has reviewed the DCP methodology of the Corrective Action Program and concludes the following:

- o The CAP adequately addressed Design Class 1 supports in the plant.
- o The CAP methodology was generally complete and thorough and met all licensing criteria.
- o DCP criteria and procedures provided appropriate guidance for the pipe support design effort.

To verify the implementation of the DCP methodology, the IDVP chose a representative sample of large and small bore Design Class 1 pipe supports. Based on the engineering and completion reviews and the resolution of four EOI reports, the IDVP concludes the following:

- o As-built conditions were generally reflected by the pipe support analyses.
- o The pipe support analyses were generally consistent with DCP criteria and procedures and with good engineering design practice.
- o The pipe supports were structurally adequate.
- o In some cases, the support analyses lacked documentation in support of DCP engineering judgement or related to DCP procedures.

Based on the above reviews, the IDVP concludes that Design Class 1 pipe supports at Diablo Canyon Nuclear Power Plant, Unit 1, were designed and built in conformity with applicable licensing requirements.

Robert L. Cloud and Associates, Inc.

RLCA

Interim Technical Report

DIABLO CANYON UNIT 1
IDVP VERIFICATION OF CORRECTIVE ACTION
-Small Bore Piping-
ITR #61, Revision 1

Docket No. 50-275
License No. DPR-76

Charles I. Browne 10/2/83
Project Reviewer/Date
Technical Review

Edward Denison 10/2/83
Project Manager/Date
Approved P 105-4-839-061

2.0 DCP CORRECTIVE ACTION PROGRAM

2.1 GENERAL METHODOLOGY

Small bore piping at the Diablo Canyon Plant was designed by either dynamic analysis or by use of span rules. A review of this piping was performed by the DCP to confirm satisfaction of all licensing criteria and design requirements.

The DCP methodology used in the Corrective Action Program was to qualify all Design Class 1 small bore piping based on generic or sample reviews.

The DCP Generic Review applied to those analyses or designs for which previous DCP reviews had indicated generic issues with a potential for physical modifications to maintain compliance with DCP licensing criteria. This Generic Review was accomplished by DCP review and/or analysis of all components, or analysis of worst case examples. Included in this Generic Review were the following issues:

- o Small bore piping that was previously analyzed by computer for seismic and thermal loadings
- o Valve qualification (allowable acceleration and valve support)
- o Seismic and thermal piping anchor movement (SAM/TAM)
- o Design class change boundaries (seismic/non-seismic)
- o Hot piping designed by span rules (normal operating temperatures exceeding 200 degrees Fahrenheit for carbon steel and 165 degrees Fahrenheit for stainless steel).

The DCP Sampling Review was utilized to qualify the remainder of the piping, and to address design considerations not included in the Generic Review. The sampling process was directed toward those analyses or designs which were not anticipated to require modifications to maintain compliance with licensing criteria. If this was not the case, further review was performed. Considerations included in the Sampling Review were the following:

- o As-built piping accuracy
- o Revised seismic spectra
- o Concentrated masses
- o Effect of pipe insulation weight
- o Spans exceeding spacing criteria
- o Anchor and equipment loads
- o Equipment and building seismic and thermal anchor movements
- o Thermal analyses
- o Integral valve bypass
- o Vents and drains
- o Lug welded attachments.

The DCP review process included revisions to the small bore piping span rules. These rules are based on conservative methods which provide guidelines to locate pipe supports (limit seismic pipe spans and control thermal pipe spans), to determine pipe support and equipment loads, and to ensure pipe stress qualification.

4.0 REVIEW OF COMPUTER ANALYZED PIPING

This section presents the IDVP reviews for 8 computer analyzed problems. The DCP computer analysis packages are listed in Section 12.0 as References 38 through 61 with the corresponding IDVP reviews listed as References 62 through 69.

4.1 DCP ANALYSIS 7-301, REVISION 0

4.1.1 Description

The piping in DCP analysis 7-301, Revision 0 consists of: 3/4 inch Design Class 1 drain lines attached to the pressurizer safety relief loop seals A, B and C; a 2 inch Design Class 1 line attached to the 12 inch pressure relief header; and a 1 inch Design Class I line that is attached to the Design Class 2 piping. The piping is located between elevations 140 and 176 feet within the containment pressurizer enclosure and is a portion of the reactor coolant system.

The DCP performed computer analysis of this problem for the generic issue of hot piping designed by span rules and the sample issues of insulation, concentrated weights, anchor movements (SAM/TAM), revised seismic spectra and as-built accuracy.

4.1.2 Scope of Review

In this review, all items from Checklists 1 and 2 were verified. In addition, the IDVP alternately enveloped and compared the Hosgri spectra to the DCP spectra analysis inputs (see Figures 4-1 and 4-2).

4.1.3 Results

The IDVP found the analysis to be in accordance with DCP criteria and acceptable for areas covered in the IDVP checklists. The following items were noted and resolved in the review:

1. Preliminary thermal operating modes were used by DCP in Revision 0. Revision of this analysis used values from the subsequent DCM.

2. An SIF of 1.3 (instead of 2.1) was applied at two socket weld locations without appropriate DCP field verification documentation. Also, at one location, an SIF = 1.0 (instead of 2.1) was applied for a half coupling.

3. One piping geometry modeling difference (location of data point 40A) between the computer model and the walkdown isometric was identified.

The IDVP examined the effects of the above items and found that all licensing criteria were met.

4.2 DCP ANALYSIS 8-305, REVISION 1

4.2.1 Description

The piping in DCP analysis 8-305, Revision 1 consists of 2 inch Design Class 1 lines attached to the boric acid tanks 1-1 and 1-2 and to the boric acid transfer pumps 1-1 and 1-2. Also, a portion of the 2 inch Class 1 line is attached to Design Class 2 piping. The piping is located between elevations 100 and 118 feet in the auxiliary building and is a portion of the chemical and volume control system.

The DCP performed computer analysis of this piping problem for the generic issue of piping that was previously analyzed by computer for seismic loadings.

4.2.2 Scope of Review

In this review, all items in Checklists 1 and 2 were verified. The IDVP also field verified the piping associated with this analysis.

4.2.3 Results

The IDVP found the analysis to be in accordance with DCP criteria and acceptable for areas covered in the IDVP checklists. The following item was noted and resolved in the review:

1. From the IDVP field verification, unintentional restraints (see Appendix C – Key Term Definitions) were not shown on the PGandE isometric.

The IDVP performed a simplified alternate calculation which showed that the unintentional restraints did not affect the stress qualification of the piping. The IDVP found that all licensing criteria were met.

4.3 DCP ANALYSIS 8-306, REVISION 3

4.3.1 Description

The piping in DCP Analysis 8-306, Revision 3 consists of 2 inch and 3/4 inch Design Class 1 lines for the reactor coolant pump 1-2 seal water injection. The lines are attached to the reactor coolant pump 1-2 and to containment penetration 42. Also, the piping is attached to Design Class 2 piping drain lines. The piping is located between elevations 90 and 110 feet in the containment building and is attached to the containment exterior and interior structures and to the annulus frames. The piping is a portion of the chemical and volume control system and the reactor coolant system.

The DCP performed computer analysis of this piping for the generic issue of piping that was previously analyzed by computer for seismic loadings.

4.3.2 Scope of Review

In this review, all items from Checklists 1 and 2 were verified. The IDVP also field verified the piping associated with this analysis.

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4.4 DCP ANALYSIS 8-310, REVISION 2

4.4.1 Description

The piping in DCP Analysis 8-310, Revision 2 consists of 2 inch and 3/4 inch Design Class 1 piping that is attached to Design Class 2 piping. Two anchors on the 2 inch pipe represent the decoupling of this piping from DCP large bore Analyses 3-104 and 9-104. The piping is located between elevations 93 and 116 feet inside the containment building and is a portion of the chemical and volume control system.

The DCP performed computer analysis of this piping for the generic issue of hot piping designed by span rules and the sample issues of insulation and concentrated weights.

4.4.2 Scope of Review

In this review, all items from Checklists 1 and 2 were verified. The IDVP also field verified the piping associated with this analysis.

4.4.3 Results

The IDVP found the analysis to be in accordance with DCP criteria and acceptable for areas covered in the IDVP checklists. The following items were noted and resolved in the review:

1. One pipe length, as shown on the DCP walkdown isometric was modeled exceeding the DCP tolerance.

2. Unintentional restraints, as shown on the DCP walkdown isometric and by IDVP field verification, were not explicitly addressed in the analysis.

3. Preliminary thermal operating modes were used by DCP in Revision 2. The DCP compared the preliminary data against values in the subsequent DCM and judged these acceptable.

The IDVP examined the effects of these items and found that all licensing criteria were met.

7.2 VENT AND DRAIN LINES

7.2.1 Description

The DCP initially based the seismic qualification of unsupported vents and drains (stub ends) on a generic approach (Reference 61). This generic calculation considered a sample consisting of 31 stub end vent and drain configurations which was based on an initial DCP plant walkdown. The sample configurations were divided into seven typical groups based on geometric similarities. This approach included the use of a 1.5 dynamic amplification factor to account for the interaction between the process pipe and the connection to the vent or drain line. Based on this approach, the DCP determined that one model (at 5 locations) required modifications to meet licensing criteria. The IDVP determined, however, that this approach, using the 1.5 factor, was not conservative for generic qualification and issued EOI 1144 (see Section 7.2.4).

Subsequent to the issuance of this EOI, the DCP expanded the qualification as described in Section 7.2.4.

7.2.2 Scope of Review

The IDVP reviewed all areas of the generic calculation and performed alternate calculations to evaluate each step of the qualification.

The IDVP also reviewed and verified on a sampling basis the additional steps performed by the DCP as part of their expanded qualification program which included the following:

- o Field walkdown
- o Maximum allowable accelerations
- o Large bore piping accelerations
- o Screening process for qualification
- o Vent/drain and piping coupled analysis.

7.2.3 Results

The IDVP found that the DCP generic calculation may not be conservative for the scope of Design Class 1 stub end vents and drains as indicated by the DCP.. See EOI 1144 below.

7.2.4 EOI Report Issued

EOI 1144 was issued because the DCP qualification analysis for vents and drains may not be conservative. The run pipe flexibility was accounted for by increasing the floor reponse spectra used as input to the vent or drain by a factor of 1.5. Dynamic amplification between the run of pipe and the vent or drain frequently exceeds a factor of 1.5.

In response to this EOI, the DCP expanded their program for the qualification of vents and drains to include the following:

- o One typical configuration was added to the previously identified 6 models (plus one model previously determined by the DCP to require modification).
- o Maximum allowable accelerations at the point of connection to the process pipe were determined for the 7 models.
- o Accelerations from all large bore Design Class 1 analyses were reviewed against maximum allowables for vent/drain models.
- o Based on a screening process, which included additional walkdowns and determination of actual vent/drain locations, the majority of vents/drains were found to be qualified (i.e., by comparison of acceleration values).
- o For those vents/drains not qualified at this point, the specific vents/drains were modeled with the large bore piping and qualified by the coupled analyses.

The IDVP verified various steps described above on a sampling basis. The IDVP concluded that these steps represent a comprehensive program that adequately demonstrates the qualification of vents/drains.

This EOI was resolved as an Error Class C.

9.0 RESOLUTION OF IDVP PREVIOUS CONCERNS

The IDVP reviewed the generic and specific concerns identified previously by the IDVP in ITR #30. These concerns, along with their respective resolutions, are presented in this section. The disposition of previously issued EOI reports is also presented.

Previous Generic Concerns

1. The span rules do not address insulated piping.

   o The revised DCP span rules (DCM M-40) includes guidelines for piping with insulation.

2. The span rules do not limit the areas where small bore piping is installed. The span rules may not satisfy the licensing criteria for all areas of the plant (i.e., all high response spectra areas).

   o The revised DCP span rules may be used for piping at any plant location since piping spans, support loads, etc. are determined based on corresponding acceleration factors.

3. The IDVP previously found inconsistencies relating to the limits on pipe size for span rule application. For instance, the Hosgri Report does not prohibit the support of piping larger than 6 inches by use of span rules. This pipe size was not addressed in the span rules yet was supported by span rule methodology.

   o The revised DCP span rules specifically limit the application to piping 2 inches in diameter and smaller. The DCP has qualified all Design Class 1 piping that is larger than 2 inches in diameter by performing computer analyses (Reference 4).

4. The piping first mode frequencies resulting from use of the span rules are less than 15 Hertz (licensing criteria) for certain piping sizes and configurations.

   o The DCP Corrective Action Program has provided assurance through extensive computer analyses that the Design Class 1 small bore piping meets all applicable stress criteria and that the corresponding pipe supports are properly designed (Reference 5).

5. For 3 and 4 inch pipe, the span rules do not specifically limit the unsupported distance from a change of direction containing a run of pipe that requires axial restraint.

   o (Same resolution as for Item 3 above.)

Previous Specific Concern

1. While the Hosgri Report implies that the 1969 J.A. Blume report (Reference 101) demonstrates the conservatism of the span rule approach, the IDVP found no evidence to confirm this in the Blume report.

   o The IDVP believes that the DCP Corrective Action Program has demonstrated the qualification of the small bore piping through an extensive program of piping computer analyses which addressed all significant issues. In addition, the DCP has revised the span rules and used them only for limited applications.

Previous EOI Reports

Two of the nine EOI reports that were issued as a result of the IDVP independent analyses were not resolved, as reported in ITR #30 Revision 0. These EOIs 1058 and 1059, were combined with EOI 1098 as an overall Error Class A or B for piping.

EOI 1058 was initially issued to note stresses for certain one and two lug configurations that exceed allowables assuming a maximum pipe span. Further analysis showed all stresses to be below the allowables for certain assumed worst case configurations. Lugs were included as part of the IDVP verification of DCP corrective actions. The worst case configurations originally assumed by the IDVP were re-examined together with the DCP analysis approach. The results of this verification will be reported in Revision 1 of this ITR.

EOI 1059 was issued to note three discrepancies:

- o The PGandE report (Reference 103) shows certain pipe stresses above the allowable. (Frequencies below 15 Hertz are also shown in this report.)
- o The 1969 preliminary Blume report (Reference 101), does not address span conservatism, as implied in the Hosgri Report (Reference 8).
- o The span tables do not address insulation weight or 6 inch piping.

These discrepancies have been resolved as noted above.

10.0 SUMMARY OF IDVP REVIEW RESULTS

10.1 REVIEW OF DCP METHODOLOGY

Consistent with the program outlined in ITRs #8 and #35, the IDVP has reviewed the DCP methodology for the CAP which included specific reviews of procedures, instructions, and DCMs. The IDVP verified that the DCP methodology met licensing criteria.

The methodology used by the CAP to address small bore piping was found to adequately address the Design Class 1 piping in DCNPP-1. The methodology was generally complete and thorough. DCP criteria and procedures provided appropriate guidance for the small bore piping effort.

The IDVP found that the DCP sampling methodology (generic and sample reviews) and the size of the DCP sample were sufficient to substantiate the general DCP conclusions regarding the adequacy of the Design Class 1 small bore piping. Also, the emphasis of the small bore piping qualification was through the use of computer analysis. The DCP methodology also included the revision and limited application of simplified span rules.

The DCP methodology for addressing specific areas involving pipe lug attachments and vent and drain line qualification was found to be adequate, considering the expanded program and additional analyses performed by the DCP in these areas.

10.3 EOI REPORTS

EOI 1098 is a generic Error Class A or B for large and small bore piping and supports. The resolution of the original concerns for small bore piping is discussed in Sections 3.4 and 8.0. This EOI also includes three concerns (SIFs, valve modeling and postulated HELB locations) which have been resolved through the IDVP verification of the completion sample.

EOI 1142 was issued because the anchor S1-8R on line 3900 was not considered by the design analysis for the effects of various loading conditions on other Design Class 1 supports. Since licensing criteria were met, this EOI was resolved as an Error Class C.

EOI 1144 was issued because the DCP qualification analysis for vents and drains may not be conservative. The run pipe flexibility was accounted for by increasing the floor response spectra used as input to the vent or drain by a factor of 1.5. Dynamic amplification between the run of pipe and the vent or drain frequently exceeds a factor of 1.5. In response to the EOI, the DCP expanded the qualification program for vents and drains which was based on actual accelerations from the piping analyses. This EOI was resolved as an Error Class C.

11.0 CONCLUSIONS

The IDVP has reviewed the DCP methodology of the Corrective Action Program (CAP) for small bore piping and concludes the following:

- The CAP adequately addressed all issues affecting Design Class 1 small bore piping in the plant.
- The CAP methodology and procedures were generally complete and thorough and met all licensing criteria.
- The key element in the Corrective Action Program was the qualification of DCP selected piping by the use of computer analysis.
- The use of revised span rules provided qualification for a limited scope of small bore piping.

The IDVP found the computer analyzed piping to be consistent with DCP procedures and to meet all licensing criteria. The DCP analyses (computer analyzed and span rule applications) adequately reflected as-built conditions.

The IDVP found that the span rules, while not conservative for all theoretical configurations, were applied only to a limited scope of small bore pipe. For this limited application, the span rules were adequate and met licensing criteria.

Based on the expanded program and additional analyses for the specific areas of pipe lug attachments and vents and drains, the IDVP found that qualification was adequately demonstrated and licensing criteria was met.

Based on the above reviews and comments, the IDVP concludes that the Design Class 1 small bore piping at Diablo Canyon Nuclear Power Plant, Unit 1 was designed in conformity with applicable licensing criteria.

TELEDYNE ENGINEERING SERVICES

DCNPP-IDVP-PP-008
REVISION 2

DIABLO CANYON NUCLEAR POWER PLANT

INDEPENDENT DESIGN VERIFICATION PROGRAM

PROGRAM PROCEDURE

PIPING SUPPORT BASEPLATE AND ANCHOR BOLT EVALUATION

(I&E BULLETIN 79-02)

This Program Procedure, DCNPP-IDVP-PP-008, is issued for the purpose of implementing the Program Management Plan.

W. E. Cooper 82/12/06

Approved/Program Manager/Date

TELEDYNE ENGINEERING SERVICES
CONTROLLED DOCUMENT
TES PROJ. NO. 5511
DATE 12/6/82

PIPING SUPPORT BASEPLATE AND ANCHOR BOLT EVALUATION (I&E BULLETIN 79-02)

1.0 SCOPE

As described in both the Phase I (Section 7.1) and Phase II (Section 2.2) Program Management Plans, this procedure defines the areas which will not be reviewed or evaluated by the IDVP for DCNPP due to prior TES involvement with I&E Bulletin 79-02 and DCNPP.

2.0 BACKGROUND

During 1980 under PG&E Contract No. 5-4-80, TES performed an I&E Bulletin 79-02 evaluation for DCNPP Unit 1. This work was presented in TES Technical Report TR-4121-2 "Final Summary Report - Evaluation of Seismic Category 1 Pipe Support Expansion Anchors in Response to USNRC I&E Bulletin 79-02" dated August 11, 1980.

In brief, TES verified all the Seismic Class I pipe support baseplate as-builts at the Unit 1 Site, performed all the baseplate/anchor bolt analysis and provided modifications to those failing to meet the 79-02 criteria. This program also included tests on HILTI HDI anchor bolts to establish shear, tension and cyclic load capabilities.

3.0 APPLICABILITY

This Program Procedure applies to all seismic Category 1 pipe supports that are reviewed or evaluated as part of the DCNPP IDVP Phase I and Phase II workscope.

4.0 PROCEDURE

(a) Any review or evaluation intended specifically for the 79-02 effort will be conducted separately from this Independent Design Verification Program.

(b) No specific 79-02 review or evaluation of pipe support baseplate/anchor bolt design or analysis will be performed in Phase I and Phase II of the IDVP.

(c) For pipe support assemblies which have baseplate/anchor bolt attachments, only those components other than baseplate and anchor bolts; e.g., standard support hardware, snubbers, support members, welds, etc., are included in the IDVP scope.

(d) For Phase I and Phase II, all baseplate/anchor bolt attachments will be considered rigid for determination of pipe support stiffness and frequency characteristics. 2

(e) If any IDVP participant, either previously or hence forth, reviews or performs any 79-02 related work as described herein, they will report it to the IDVP Project Manager, Dr. W. E. Cooper, who in turn will notify PG&E. This notification would include a full description of the work performed and its impact on the IDVP.