

Robert L. Cloud and Associates, Inc.

RLCA

Interim Technical Report

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

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Technical Review

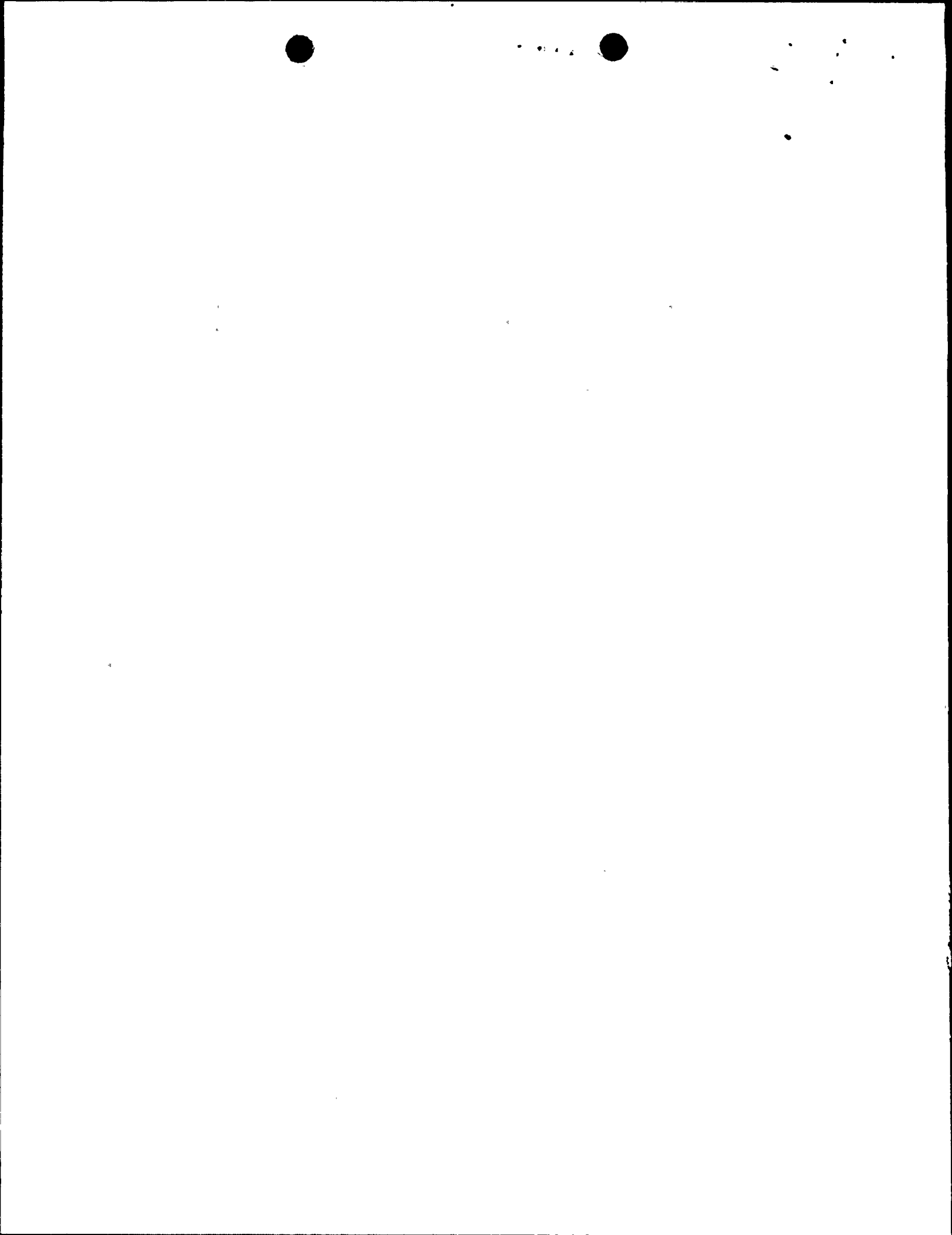
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IDVP Verification Plan
for
Diablo Canyon Project Activities

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PROGRAM MANAGER'S PREFACE

DIABLO CANYON NUCLEAR POWER PLANT - UNIT 1

INDEPENDENT DESIGN VERIFICATION PROGRAM

INTERIM TECHNICAL REPORT

IDVP VERIFICATION PLAN FOR DIABLO CANYON PROJECT

PHASE II ACTIVITIES

This is the thirty-fifth of a series of Interim Technical Reports (ITR) prepared by the DCNPP-IDVP for the purpose of providing a conclusion of the program.

This particular ITR defines the IDVP plan for verifying the safety-related structures, systems, and components for the response to loadings other than the Hosgri earthquake. In effect, this ITR substitutes verification of DCP activities for the initial sample defined by the IDVP Phase II Engineering Program Plan. As a result of the extensive Internal Technical Program being conducted by the Diablo Canyon Project in response to the Hosgri earthquake, many modifications have been made and reviews and reanalyses performed. This more recent work is now the justification for conformances with licensing criteria, both for Hosgri and for non-Hosgri considerations in the scope of RLCA responsibility.

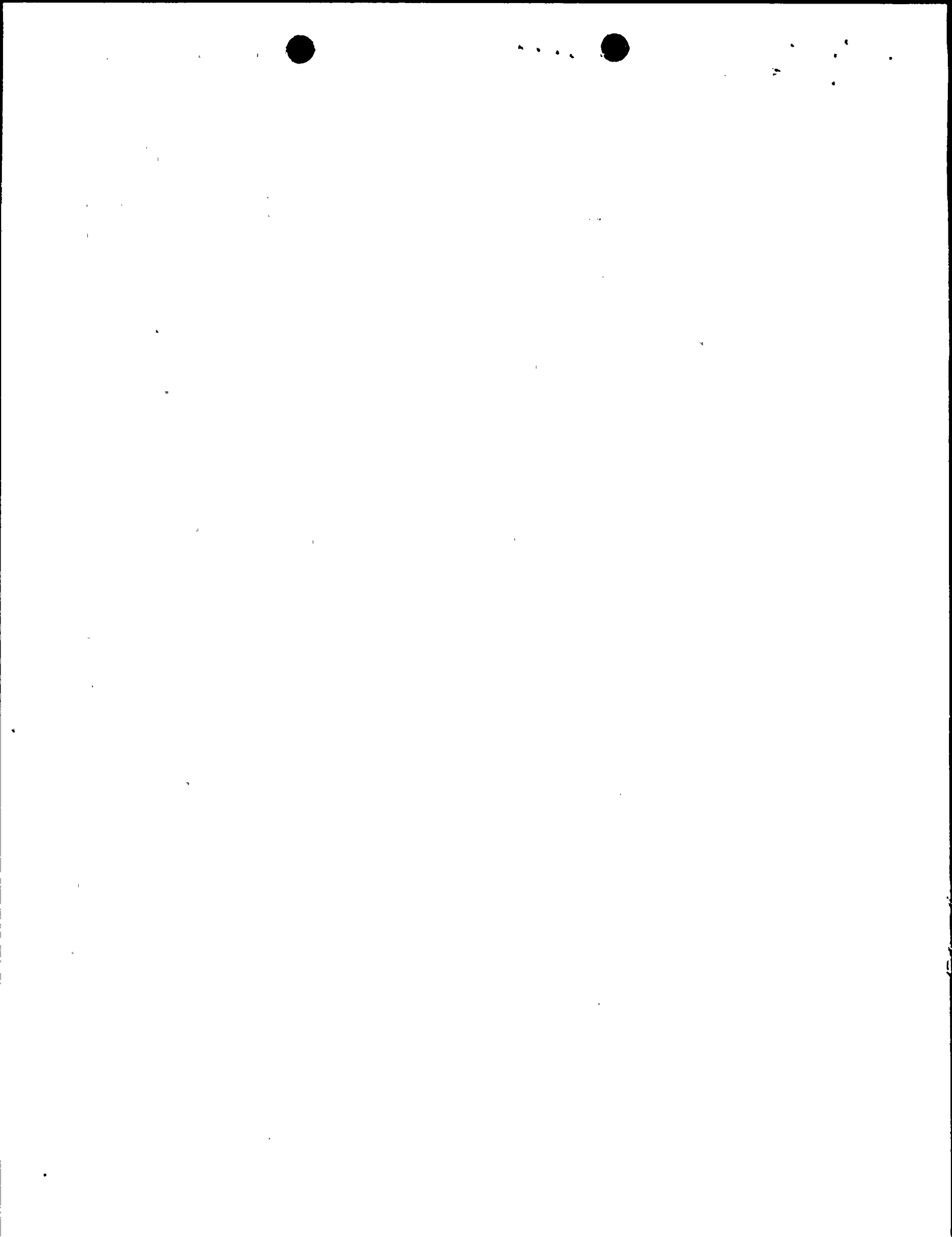
The scope of the verifications to be performed and the acceptance criteria are consistent with those defined by the approved IDVP Phase II plans.

As the IDVP Program Manager, Teledyne Engineering Services has participated in the development of this plan and approves it for use.

ITR Approved
IDVP Program Manager
Teledyne Engineering Services

R. Wray

R. Wray
Assistant Project Manager



1.0 INTRODUCTION

Purpose

This report outlines the Independent Design Verification Program (IDVP) plan to verify the Diablo Canyon Project activities that are applicable to the IDVP Phase II. Phase II includes evaluations of system design and structural/mechanical loading combinations unrelated to the Hosgri qualification (e.g., design earthquake, double design earthquake, thermal, pipe break, and accident conditions).

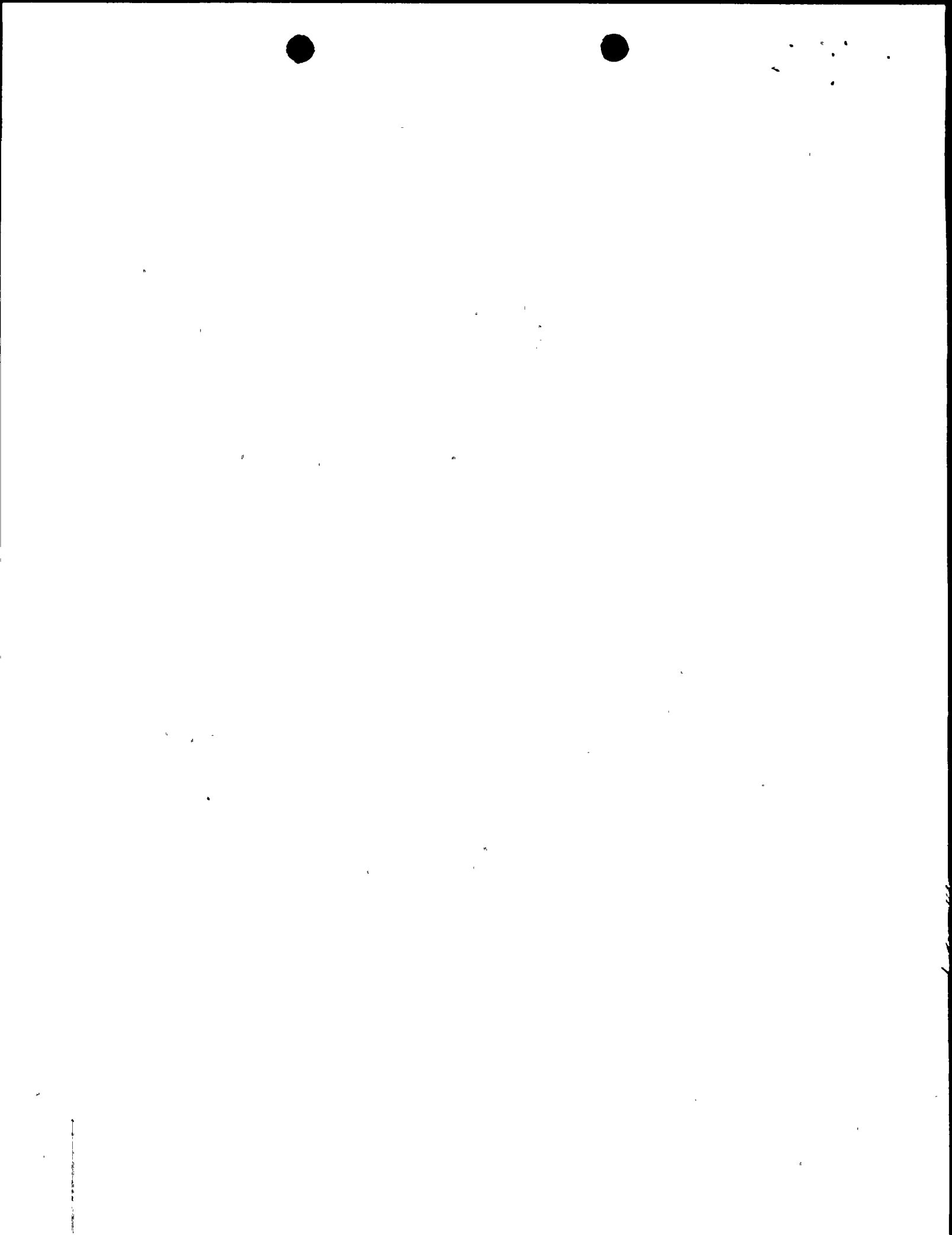
The Diablo Canyon Project activities to be verified in accord with this ITR are documented in the PGandE Phase I Final Report. To verify these activities, the IDVP will evaluate both the PGandE Phase I Final Report and its implementation.

Scope

This report describes the IDVP plan to verify the Diablo Canyon Project (DCP) activities that are not related to the Hosgri qualification. Throughout, reference is made to the PGandE Phase I Final Report (Reference 1).

The PGandE Phase I Final Report includes the DCP corrective action for the Hosgri qualification as well as DCP activities for all structural/mechanical loading combinations unrelated to the Hosgri qualification. The IDVP plan for verification of DCP corrective action for the Hosgri qualification is described in ITR #8 (Reference 2).

This report does not address the Phase II IDVP effort related to system design evaluation which is being performed by Stone and Webster Engineering Corporation in accordance with the IDVP Program Plans (References 3 and 4) and ITR #34 (Reference 5).



2.0 IDVP VERIFICATION

2.1 PGandE PHASE I FINAL REPORT

The IDVP will review the PGandE Phase I Final Report which contains a description of the DCP activities related to structures, piping, rupture restraints, equipment, electrical raceways, instrument tubing and HVAC duct and supports. The IDVP will verify that the DCP activities outlined in the PGandE Phase I Final Report which are applicable to Phase II of the IDVP have been completed.

This review is being conducted concurrently with the verification of the PGandE corrective action for Phase I.

2.2 DCP IMPLEMENTATION

2.2.1 IDVP Sampling Approach

In general, the IDVP verifies samples of the Diablo Canyon design either by performing independent calculations or design verifications. To date, three sets of samples have been selected for Phase I. First, a sample was obtained for independent calculations. Second, a sample was selected for additional verification/sampling. Third, a sample was used to verify PGandE corrective action. A further description of the three sample types is given below:

<u>Phase I</u>	<u>Sample No.</u>	<u>Sample Type</u>	<u>Documented in:</u>
I	1	Independent Calculations	DCNPP Independent Design Verification Program, Phase I Engineering Program Plan, Revision 0
I	2	Additional Verification/ Sampling	Additional Verification and Additional Sampling, ITR #1, Revision 1
I	3	Corrective Action	Verification Program for PGandE Corrective Action, ITR #8, Revision 0



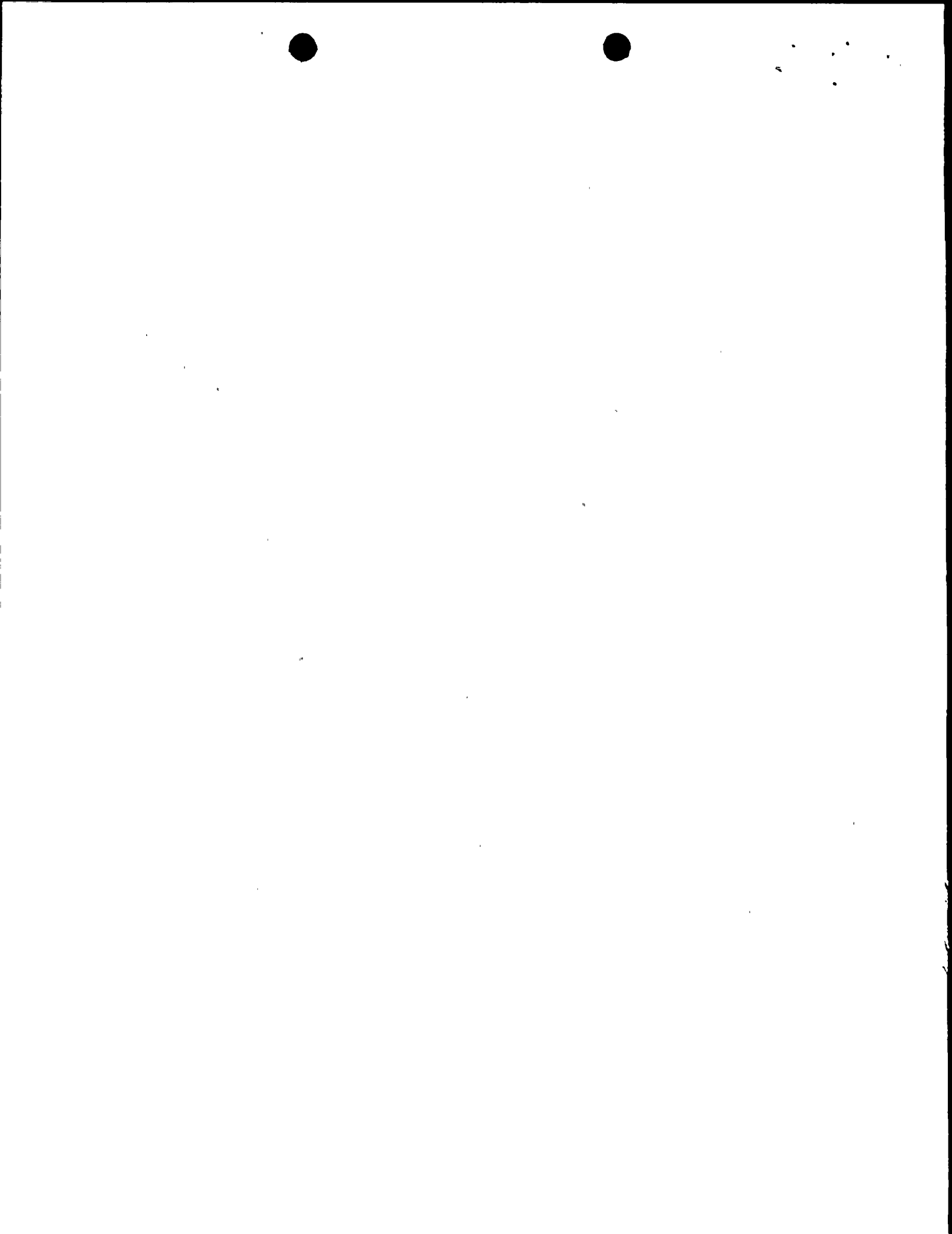
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The IDVP approached Phase II sampling in the same manner as Phase I by specifying three types of samples. However, Phase II independent calculations (sample type 1) and additional verification/sampling (sample type 2) were found to be inappropriate for the following reason: The objective of sample types 1 and 2 was to evaluate the design of the plant as of November 30, 1981. Large-scale DCP activities have in essence changed this 1981 design. Therefore, for Phase II, only sample type 3 (verification of DCP activities) will be selected by the IDVP.

Where possible, this Phase II sample will consist of building structural members, piping, equipment, supports, raceways, tubing, and HVAC duct included in the Phase I samples. This will take advantage of previous Phase I field verifications and analyses.

The following example demonstrates how this Phase II sample will take advantage of the Phase I IDVP sampling. For the auxiliary building, the Phase II dynamic model is the same as the Phase I dynamic model except for the elevation 85 feet mass and soil spring. Phase I independent calculations performed by RLCA generally showed agreement with design values to within the 15% acceptance criteria. A value that differed by more than 15% is the torsional rigidity for elevation 115 feet to 140 feet. This torsional rigidity calculation was selected as the Phase I corrective action sample. Therefore, the Phase II sample need only to include the elevation 85 feet mass and soil spring calculation.

An exception is the Phase II equipment and rupture restraint verification. This will require new samples because a larger number of equipment types exist within the Phase II scope, and rupture restraints were not previously sampled for Hosgri loadings. For all new samples, the following areas will be verified: "as-built" conditions, modeling, frequency determination, model boundary conditions, non-Hosgri inputs, loads and stresses, and postulated break locations in the case of piping.



2.2.2 Design Verification

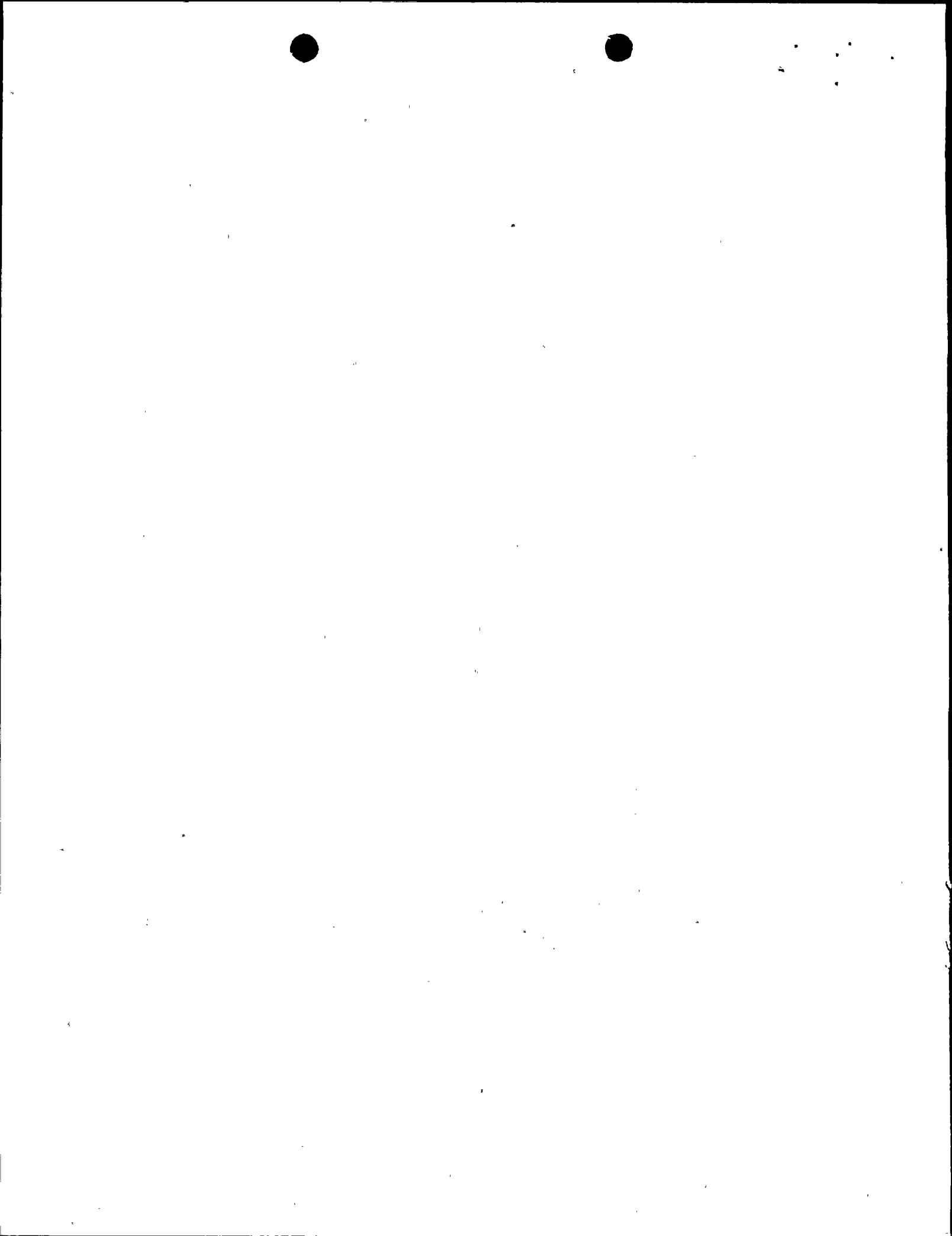
The IDVP will verify the implementation of the PGandE Phase I Final Report by examining representative DCP procedures, instructions and analyses.

The Phase II qualification analyses for structures, piping and components will be design verified against written IDVP checklists which emphasize differences from the Hosgri particularly when the non-Hosgri qualifications are controlling. These permit a step-by-step verification of the implementation of criteria and procedures specified in the PGandE Phase I Final Report. The checklists address the following general technical areas:

- o Establishment of correct design criteria
- o Establishment of scope and responsibilities
- o Establishment of correct design inputs (including defined loadings)
- o Reasonableness of assumptions
- o Applicability of analysis methods
- o Applicability of computer programs
- o Consistency of results based on reviewer judgement and/or simplified methods
- o Completeness of qualification
- o Satisfaction of design criteria.

2.2.3 Field Verification

Overall analytical modeling techniques and methodology will be evaluated on the basis of consistency with the as-built condition. Selected details and dimensions in the qualification analyses will be field verified. Field verification will also be performed on a sample basis to assure that required modifications are made.



2.3 REPORTING

The samples, procedures, criteria and results of the IDVP verification of the Diablo Canyon Project activities 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.



3.0 IDVP SAMPLES

3.1 STRUCTURES

For structures, 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 the dynamic analysis and member qualifications for the containment, intake, auxiliary, turbine and fuel handling buildings. If this review reveals deficiencies, these are to be corrected by the DCP.

The IDVP will select specific structural analyses and qualifications consisting of the following when they differ from those used in the Hosgri or those used in the non-Hosgri qualification are governing:

- o Model properties
- o Model boundary conditions and assumptions
- o Spectra generation and smoothing
- o Member qualifications.

For the auxiliary building, the following will be verified: the elevation 85 feet mass and soil spring; DE and DDE time history input, spectra generation (one direction) and smoothing; load distribution and member qualifications (3 elements).

For the intake structure, the following will be verified: the DE time history input, spectra generation (one direction) and smoothing; load distribution and member qualifications (3 elements).

For the containment building, turbine and fuel handling buildings, specific details are not available. The approach, however, will be similar to that of the auxiliary and intake structures.



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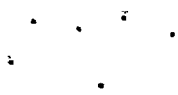
3.2 LARGE BORE PIPING AND SUPPORTS

For large 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 large bore piping and associated supports (i.e., piping larger than 2 inches in diameter). If this review reveals deficiencies, these are to be corrected by the DCP.

The IDVP will select specific piping and support samples consisting of the following:

- 10 Piping analyses
- 20 Pipe supports.

The ten analyses and twenty supports will generally be selected from the Phase I corrective action sample. For these samples, the input loadings and output loads/stresses will be verified. Modeling and field verification for these samples will have been conducted as part of the Phase I verification of DCP corrective action. Different analyses may be required to obtain representative samples of DE, DDE and thermal inputs; operating conditions; and other characteristics which differ from the Hosgri or control in the non-Hosgri qualification.



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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3.4 RUPTURE RESTRAINTS

For rupture restraints outside of containment, the IDVP will verify DCP activities by examining the PGandE Phase I Final Report and its implementation. The report specifies an analysis by the DCP of 30% of Design Class I rupture restraints. If the review reveals deficiencies, these are to be corrected by the DCP.

The IDVP will verify the DCP sampling approach and select a sample of 8 restraints to include restraints of various geometries, loadings, locations and design margins. For each sample, the IDVP will verify the following:

- o As-built conditions
- o Design loads
- o Structural adequacy
- o Gaps
- o Connections

Where possible, rupture restraints will be selected on piping included in previous IDVP samples to take advantage of field and pipe load verifications.



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3.5 EQUIPMENT

For equipment, 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 (E) HVAC, mechanical, electrical and instrumentation equipment. If this review reveals deficiencies, these are to be corrected by the DCP.

The IDVP will select an equipment sample consisting of the following:

- 1 tank
- 1 heat exchanger
- 1 valve
- 1 fan
- 1 compressor
- 1 electrical panel
- 2 assemblies qualified by
shake table testing
- 1 pump
- 1 mechanical filter.

The verification of these analyses will address all of the general technical areas noted in Section 2.2.2.



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3.6 ELECTRICAL RACEWAYS AND SUPPORTS

For electrical raceways 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 electrical raceways and supports. If the review reveals deficiencies, these are to be corrected by the DCP.

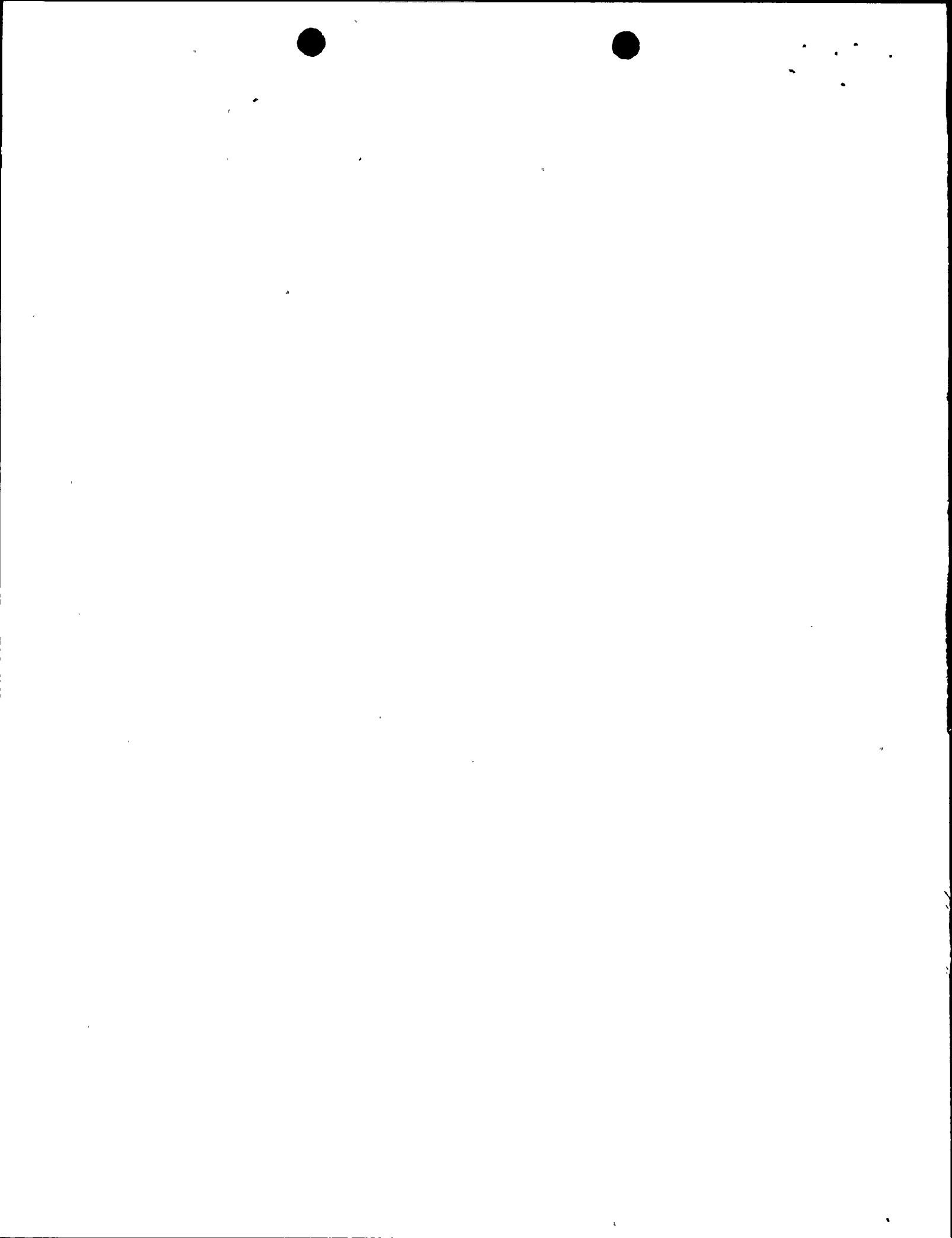
The IDVP will verify the DDE seismic inputs into the 20 raceway support analyses previously selected for the Phase I verification of DCP corrective action.



3.7 INSTRUMENT TUBING AND SUPPORTS

For instrumentation tubing and supports, the IDVP will verify DCP activities by examining the PGandE Phase I Final Report and its implementation. The report specifies an analysis by the DCP of a sample of Design Class I instrument tubing and supports. If the review reveals deficiencies, these are to be corrected by the DCP.

The IDVP will verify the DDE seismic inputs into the 15 instrument tubing and support analyses previously selected for the Phase I verification of DCP corrective action.



3.8 HVAC DUCT AND SUPPORTS

For HVAC duct 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 HVAC duct and supports. If the review reveals deficiencies, these are to be corrected by the DCP.

The IDVP will verify the DDE seismic inputs into the 15 HVAC duct and support analyses previously selected for the Phase I verification of DCP corrective action.



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4.0 SUMMARY

The Diablo Canyon Project activities to qualify the plant for loading combinations other than those required for the Hosgri 7.5M earthquake will be verified by examining the DCP plan, as presented in the PGandE Phase I Final Report, and its implementation.

Samples will be selected for: structures, large bore piping, small bore piping, supports, rupture restraints, equipment, electrical raceways, instrument tubing and HVAC duct. Samples will be field verified and design verified. Results will be documented for use in the plant licensing process.



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5.0 REFERENCES

<u>Reference No.</u>	<u>Title</u>	<u>RLCA File No.</u>
1	"Phase I Final Report - Independent Design Verification Program - Diablo Canyon Nuclear Power Plant," Pacific Gas and Electric Company, March 15, 1983.	
2	"Verification Program for PGandE Corrective Action - Diablo Canyon Unit 1 - Independent Design Verification Program," Robert L. Cloud and Associates, Inc., Interim Technical Report, Revision 0. (Revision 1 in progress).	P105-4-839-008
3	"Phase II Program Management Plan - Diablo Canyon Nuclear Power Plant Unit 1 - Independent Design Verification Program," Revision 0.	
4	"Phase II Engineering Program Plan - Diablo Canyon Nuclear Power Plant Unit 1 - Independent Design Verification Program," Revision 0.	
5	"Verification of Diablo Canyon Project Efforts by Stone and Webster Engineering Corporation," Interim Technical Report #34, Revision 1.	

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