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5511-416

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Re: Docket No. 50-275, OL-DPR-76
Diablo Canyon Unit 1

Subject: IDVP Final Report - Errata Package No. 2

Gentlemen:

Enclosed is the second submittal of Errata pages. After these pages have replaced those currently bound in the Final Report, the summary descriptions of errata should be filed following the tab Appendix G.

Although Revisions are not considered errata, Errata Package No. 2 contains three previously submitted Revision pages from which Revision change bars were omitted.

Very truly yours,

TELEDYNE ENGINEERING SERVICES

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WEC:cjr
Enclosures
cc: H.E. Schierling (NRC) (85)
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ERRATA

Page/Figure (F)/ Table (T)	Rev. No.	Location	Revision
4.1.6-2	0	Paragraph 1, Line 7	Changed "4.9.1" to "4.9.2"
4.5.2-2	0	Subsection "4.5.2 Large Bore Piping and Supports"	Put subsection 4.5.2 on a new page
4.5.2-3	0	Page Numbers	Changed page numbers from "4.5.1-3 thru 4.5.1-10" to "4.5.2-1 thru 4.5.2-8"
4.6.1-2	1	Paragraphs 1 and 2	Revision change bars added
4.6.2-5	0	Entire Page	Deleted page
4.6.2-6	0	Page Numbers	Changed page number from "4.6.2-6" to "4.6.2-5"
4.7.3-14	1	Entire Page	Revision change bars added
4.7.6-6	1	Entire Page	Revision change bars added
4.9.1-2	0	Paragraph 2, Line 2	Changed "all seven groups." to "the seven groups."
		Paragraph 5, Line 1	Changed "RLCA worst cases spectra" to " RLCA worst case spectra"
4.9.1-3	0	Paragraph 1, Line 1	Changed "EOI 1013 was classified as a Class B Error" to "EOI 1013 was resolved as a Class B Error"
		Paragraph 2, Line 3	Changed Line 3 from "related contractors should be addressed as a concern of the review" to related contractors be subjected to additional verification"
		Paragraph 3, Line 2	Deleted "which are"

ERRATA (Continued)

Page/Figure (F)/ Table (T)	Rev. No.	Location	Revision
4.9.2-5	0	Subsection "4.9.2.4 Buried Tanks"	Put subsection 4.9.2.4 on a new page (4.9.2-6), consequently moving subsection "4.9.2.5 Buried Piping" from page 4.9.2-6 to page 4.9.2-7
5.4.2-1	0	Paragraph 1, Lines 2, 6, and 7	Changed "Table 5-2" to "Table 5-4". Changed "File number used is that assigned by the IDVP to track the modification(s) described on that page." to "File number used is that assigned by the IDVP for the Specific Finding which led to the generic concern."
D.2-3	0	Lines 1 and 2	Deleted
F.1-3	0	PRAP	"Probabilistic" misspelled
		RFR	Changed "Robert F. Reedy Inc." to "Roger F. Reedy, Inc."

for one or both of the design process verification phases. The two organizations whose work was not included in the initial sample were Harding-Lawson Associates and Garretson-Elmendorf-Zinov (GEZ). Because of negative results from the subsequent evaluation of the QA Audit and Review, additional verification was performed of the soils work originally conducted by Harding-Lawson and Associates, as reported in 4.9.2 of this report. Because GEZ was known not to be included in the initial sample for Phase II, particular attention was given to their efforts by RFR, and EOI 7001 was opened to assure that additional investigation was conducted of one aspect of potential concern. Additional verification resolved the potential concern satisfactorily, and the EOI file was closed.

Therefore, the design process of PGandE and of all service-related contractors was included in either the initial sample or was part of the additional verification efforts.

4.5.2 Large Bore Piping and Supports

4.5.2.1 Initial Sample

ITR-12 reported the RLCA review of the IDVP initial sample for large bore piping. The initial sample consisted of ten piping models which were chosen based on the following considerations:

1. Location
2. System
3. Class
4. Model Decoupling - System Connection
   a. Rigid equipment analyzed by PGandE
   b. Rigid equipment analyzed by others
   c. Flexible equipment analyzed by PGandE
   d. Flexible equipment analyzed by others
   e. Large bore piping analyzed by PGandE
   f. Large bore piping analyzed by others
5. Concentrated Weights
   a. Remote operated valves
   b. In-line components
6. Group Performing Analysis
   a. PGandE
   b. URS/Blume
   c. CYGNA (EES)
   d. EDS Nuclear

The ten RLCA piping samples are described in Table 4.5-1 according to their system, location size, and operating conditions.

The RLCA effort for the initial sample consisted of the following major tasks:

- Field verification and comparison to design isometrics

- Development of a computer model of each model and an independent Hosgri seismic analysis

- Comparison of results to the stress or load criteria and to the results of the design analysis

- Follow-up analysis to reconcile differences, where possible, between the independent verification analyses and the design analyses

RLCA field verified each sample problem, starting with the Design Review Isometrics (design isometrics) prepared in response to the NRC I&E Bulletin 79-14. The information which was field verified included: pipe size, location, concentrated weights (valves, flanges, etc.), insulation, vent/drain lines, valves (e.g., operator orientation), supports (location, type, orientation) and connected equipment.

Based on the design isometrics and the field verification results, RLCA developed an ADLPIPE computer program model for each sample. Particular consideration was given to modeling boundary conditions and intermediate supports (e.g., whether terminal equipment was rigid or flexible, supports were active or inactive (large gaps or one-way supports)), and modeling concentrated masses, including centers of gravity of such components as remote operated valves. Once the model geometry and piping properties were formulated, seismic and deadweight loads were defined for each piping sample.

For seismic analysis:

- Hosgri response acceleration spectra were assembled based on pipe size and attachment locations.

- The damping ratios used were 3% for piping with a nominal diameter greater than 12 inches and 2% for piping with a nominal diameter less than or equal to 12 inches.

- The response spectrum method was used.

- Two separate analyses were performed in which the dynamic response for each analysis was calculated based on one horizontal plus one vertical input spectra. The response on a modal level from each direction was added by absolute sum. All modal responses were then combined by SRSS to obtain the final 2-D response. The total response was enveloped from the two separate analyses, one with North-South Horizontal and Vertical Spectra, the other with East-West Horizontal and Vertical Spectra.

- The dynamic response considered the greater of either 10 modes or all modes less than 33 Hz, the rigid cutoff frequency.

In addition to seismic loads, sustained loads consisting of deadweight and pressure loadings were also evaluated and combined with seismic.

RLCA compared the results of their independent analyses to both the Hosgri licensing criteria allowables and to the design analyses results. The Hosgri criteria for piping are based on Equation 12 of ANSI B31.1b-1973. For the comparison of Hosgri stresses between the verification analyses and the design analysis (based on the cited equation), RLCA selected the five locations of highest combined stresses or locations where the combined stress exceeded 70% of the allowable. A comparison of pipe support loads, nozzle loads, and valve accelerations for the verification and design analyses was also performed.

In cases where comparisons of seismic stress or seismic support load results between the verification and design analyses exceeded the 15% acceptance criteria, RLCA examined the differences through follow-up analyses. The follow-up analyses consisted of making the verification model more and more identical to the design model until seismic stresses, loads, and accelerations met or approached the 15% criteria, or until the differences were explainable.

The initial sample effort on large bore piping led to 73 EOI Files. These were resolved as follows:

Findings (ER/A, ER/AB, ER/B):	932, 938, 963, 1014, 1069, 1098, 1106
Combined with Findings:	961, 1009, 1021, 1025, 1060, 1105, 1115
Observations (ER/C, ER/D, PPR/DEV):	931, 933, 934, 936, 937, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 951, 952, 953, 954, 956, 957, 958, 959, 960, 964, 965, 966, 1050, 1062, 1063, 1071, 1074, 1075, 1076, 1080, 1081, 1084, 1085, 1086, 1089, 1090
Closed Items:	935, 955, 962, 994, 995, 996, 997, 1000, 1001, 1019, 1023, 1024, 1031, 1032, 1048, 1051, 1057, 1103,

Several of the above EOI Files, i.e., 1009, 1014, 1025, and 1086 are related to Hosgri spectra and are also covered in 4.3.2.1. At the time of issuance of ITR-12, EOI Files 938, 1103, and 1106 had not been resolved. Subsequently EOI Files 938 and 1106 were classified as an Error A and Error A or B, respectively, and EOI File 1103 has been closed out. EOI Files 1024, 1048, 1089, and 1090 were not included in ITR-12, but are included in this listing.

Based on these resolutions, RLCA identified eight generic concerns:

1. The PGandE 79-14 design isometrics in several cases do not completely reflect the "as-built" conditions. As a result, the design analyses differed from the "as-built" piping configurations.

2. The documentation and modeling of remote operated valves in several cases did not reflect the "as-built" conditions.

3. The modeling of attached equipment, either as in-line components or as terminal points, in several cases did not adequately consider equipment flexibilities and support conditions.

4. The design analysis response spectra, in several cases, did not envelope the Hosgri response spectra. In addition, Hosgri response spectra were not identified for several plant locations/elevations from which Design Class 1 piping is supported.

5. The tributary pipe mass assigned to support locations in the design analyses in certain cases were not considered in calculating support loads.

6. Pipe and component (e.g., flanges) weights in the design analyses in several cases differed from the vendor supplied values.

7. In several cases, the design analyses did not consider branch lines and analysis overlap in an adequate manner.

8. In several cases, the valve accelerations and equipment nozzle loads exceeded their respective allowable values.

In addition to the eight generic concerns, one specific RLCA concern related to the modeling of standard fittings, such as swage fittings and tees. In several cases, equivalent pipe properties were not used.

The DCP initiated a plan for corrective action of computer analyzed piping which included a complete walkdown and a review of all design analyses. Deficiencies were to be corrected by additional qualification. The IDVP verification program for the PGandE corrective action which is described in 4.5.2.3 assures that the above concerns have been addressed.

Upon completion of the initial sample, RLCA initiated an additional sample of five more models as dicussed in ITR-1. These models were selected from piping categories not represented in the initial sample (see 4.5.2.2). The additional models were selected to determine if all concerns with computer analyzed piping were identified for inclusion in the DCP Corrective Action Plan.

4.5.2.2 Additional Sample

ITR-17 reported the RLCA review of the IDVP additional sample for large bore piping. The additional sample consisted of five piping analyses which were selected considering the following categories of piping not included in the initial sample.

1. Piping connected to primary loop piping analyzed by others.

2. Computer analyzed field run piping

3. Design Class 1 subclasses not included in initial sample

The five piping analyses and their general characteristics are described in Table 4.5-2.

RLCA used the same analytical procedures and evaluation criteria in the additional sample as were used in the initial sample (see 4.5.2.2) except follow-up analysis was not performed where differences in results could be attributed to significant differences in geometry or analytical modeling.

The additional sample of large bore piping led to four EOI Files:

Finding (ER/A, ER/AB, ER/B):	1107
Combined with Findings:	1104, 1109
Observation (ER/C, ER/D, PPR/DEV):	None
Closed Item:	1108

EOI File 1107 was issued because the RLCA verification analysis showed stresses exceeding the allowable for small attached vent and drain lines and the existence of two supports which were deadweight supports only (capable of resisting gravity but not two-way seismic motion).

EOI File 1108 was listed as unresolved in ITR-17, but has subsequently been resolved as a Closed Item.

The following generic concern was reported in ITR-17:

- In several cases, the design analysis did not apply the appropriate stress intensification factors in determining pipe stresses, particularly, at socket welded connections.

4.5.2.3 Verification of DCP Activities

This verification was performed in response to the IDVP concerns expressed in the verification of the initial sample and additional sample. The verification was performed in accordance with ITRs-8 and -35.

(TO BE CONTINUED)

ITRs are presented in 4.6.2 through 4.6.8. The initial sample work completed the IDVP verification for valves.

The IDVP initial sample calculations did result in identification of certain deficiencies which warranted additional verification. The initial sample findings and recommended additional verification for each category of structures, systems and equipment are described in ITR-1. For the equipment sample, additional verification was performed for the categories of pumps, electrical equipment and HVAC components. The extent and results of the additional verification effort for this equipment is also discussed in 4.6.4, 4.6.6, and 4.6.7. The additional verification effort completed the Phase I verification of pumps.

In addition to equipment specific concerns, the IDVP identified generic concerns related to the control and use of the correct seismic spectra. These are discussed in more detail in 4.3 of this report. The DCP has addressed these Hosgri spectra concerns in their corrective action program. In the equipment area, the DCP is reviewing the seismic spectra used in the qualification of the various types of equipment against the current controlled spectra, and will requalify as required. The IDVP will verify the DCP corrective action program activities in the equipment area as defined by ITR-8 and ITR-35.

Verification of non-Hosgri aspects of this equipment is defined by ITR-35 as discussed in 1.3.4 and 3.5.6 of this report. That verification is also reported in this subsection. The DCP has reviewed all Design Class I (or IE) HVAC, mechanical, and electrical equipment and instrumentation. The IDVP Phase II sample included a tank, heat exchanger, valve, fan, compressor, electrical panel, pump, and mechanical filter. The verification emphasized differences from the Hosgri qualifications, particularly when the non-Hosgri qualifications are controlling. The following general technical areas were considered:

consider IDVP Phase II aspects. The following aspects were emphasized:

- Verification of the PGandE review methodology to assure that the correct spectra were checked by PGandE against the qualification analyses

- Completeness of qualification

(TO BE CONTINUED)

No additional verification/sample was required and no generic concerns were identified.

4.7.3.7 EOI Files for CRVP System

A total of 19 EOI Files were opened, and were resolved as follows:

Findings (ER/A, ER/AB, ER/B):	3
Combined with Findings:	2
Observations (ER/C, ER/D, PRR/DEV):	8
Closed Items:	5

The three Findings are EOIs 8012, 8017, and 8057. These are described further in Table 5-1. Since all three Findings generated generic concerns, they were considered in preparing 5.3 of this report. All three resulted in physical modifications and are addressed in 5.4 of this report. Two files were combined with EOI 8012 (8016 and 8046).

Of the 8 Files resolved as Observations, 2 were Class C Errors (8035 and 8059) and 6 were Deviations (8011, 8020, 8041, 8050, 8053, and 8061). One File (8035) resulted in modifications; this is included in 5.4 of this Final Report.

The remaining 5 Files (8007, 8008, 8042, 8044, and 8056) were resolved as being neither a Finding nor an Observation. See 7.2 of this report regarding the effect of EOI 8016 on Unit 2.

A total of nine EOI Files were opened as a result of the environmental analysis verification. In summary, they were resolved as follows:

Finding (ER/A, ER/AB, ER/B):	1
Combined with Findings:	4
Observations (ER/C, ER/D, PPR/DEV):	1
Closed Items:	3

The file resolved as a Finding was EOI 8001. This file generated a generic concern, and it was considered in preparing 5.2 of this report. The concerns identified in EOI Files 8003, 8006, 8033, and 8034 were combined into EOI File 8001 and will be addressed in 4.8.4. The resolution resulted in no physical modifications. The EOI File resolved as an Observation was a Class C Error (8040), and did not involve physical modifications. The remaining three EOI Files (8002, 8004, and 8005) were resolved as being neither a Finding nor an Observation.

- Reviewed the test procedure Wyle used to test each of the seven groups of Class IE electrical equipment and instrumentation.

- Verified the location of the electrical equipment and instrumentation included in the seven groups.

- Developed "worst case" response spectra for each group. These spectra provided the highest seismic accelerations associated with the location of the group.

- Made two response spectra comparisons. The RLCA worst case response spectra (worst case spectra) was compared to the Wyle test response spectra (test spectra). The Wyle target test response spectra (target spectra) was compared to the test spectra.

The RLCA worst case spectra were generated for two time histories (Blume and Newmark) according to building, floor location, elevation, type, and damping. The types of spectra were both vertical and horizontal. The horizontal consisted of East-West translation, North-South translation, East-West torsion, and North-South torsion. The RLCA worst case horizontal response spectra were developed by adding torsional effects to the translational spectra.

The test response spectra must envelop the required response spectra by at least 10%. Both the RLCA worst case spectra and Wyle target spectra were developed to represent the required response spectra.

Four EOI files were established in the course of this review. In summary, they were classified as follows:

Findings (ER/A, ER/AB, ER/B):	None
Observation (ER/C, ER/D, PPR/DEV):	1013
Closed Item:	1005, 1007, 1049

The text of ITR-4 indicated that EOI 1013 was resolved as a Class B Error. This file was subsequently downgraded in accordance with the procedure described in 3.6.2 of this report.

RLCA recommended that the correctness of target response spectra specified for all items shake table tested by PGandE and seismic service-related contractors be subjected to additional verification. RLCA recommended four specific actions:

- Confirm field locations of all equipment
- Select the applicable Hosgri response spectra
- Develop the worst case response spectra
- Compare the worst case response spectra to the target response spectra specified in the testing procedures.

Since all four of these actions concern proper definition of test conditions, they became DCP activities, subject to verification in accordance with ITR-8 as described in 4.9.1.4.

4.9.1.3 Verification of Initial Sample of Shake Table Test Mountings

For shake table testing, test specimens were removed from their in-service installations and mounted onto the test machine shake table. The test mountings were intended to simulate the in-service condition. Often, the in-service mountings were identical to those used for the tests; for example, the equipment would be bolted to the machine with the same bolts and through the same bolt holes. However, for testing convenience, some equipment was mounted to the shake table through an interposing fixture which was intended to simulate the dynamic and structural characteristics of the in-service mounting. One application of this approach would be in testing a sub-panel in a large cabinet, when an interposing fixture would be used to simulate the dynamic and structural characteristics of the entire cabinet.

In the review of the HLA soil analysis for the OWST, RLCA and their soils consultant performed the following:

- Toured the DCNPP site to examine exposed rock and in-situ backfill
- Reviewed the HLA soil analyses
- Compared boring location information from HLA boring logs to a IDVP field verified drawing and to the HLA report
- Compared HLA bedrock depth information with the PGandE final excavation drawing
- Compared the HLA lithology definition with HLA boring and test pit lugs and the Blume studies
- Compared HLA strength values against accepted literature data for comparable rock
- Verified the bearing capacity allowables for the bedrock in the OWST area

The results of the IDVP review determined that the HLA soils work related to lithology definition and bearing capacity allowables was acceptable. Two Files (EOIs 1100 and 1101) were issued based on the OWST soils review. Both of these EOIs were resolved as Deviations (Observations).

4.9.2.4 Buried Tanks

(TO BE COMPLETED)

4.9.2.5 Buried Piping

(TO BE COMPLETED)

5.4.2 Modifications in Response to Generic Concerns

Modifications made in response to generic concerns identified by the IDVP are described in Table 5-4. Each is summarized by a single page identified as Table 5-4-EOI File number. For an RLCA originated generic concern, the EOI number used is that of the EOI File used to track the generic concern when such a file existed. In all other cases, the EOI File number used is that assigned by the IDVP for the specific Finding which led to the generic concern.

The subject structure(s), system(s), or component(s) is identified; the general type of physical modification(s) is described; one or, when applicable more example(s) of the modification(s) is(are) provided; the status of IDVP verification is stated and the governing programmatic ITR is identified; and reference is made to the description in Table 5-1 or 5-2 and to the appropriate PGandE Final Report.

(TO BE CONTINUED)

FIELD	DESCRIPTION
SUBJECT	Description of item
COMMENTS	Any comments applicable to the revision being entered

NQAM	Nuclear Quality Assurance Manual (Bechtel)
NRC	Nuclear Regulatory Commission
NRR	Nuclear Reactor Regulation
NSC	Nuclear Service Corp.
NSSS	Nuclear Steam Supply System
OD	Other Deficiency
OIP	Open Item Transferred to PGandE
OIR	Open Item Report
PEI	Project Engineering Instructions (DCP)
PER	Potential Error Report
PGandE	Pacific Gas and Electric Company
PMP	Program Management Plan
PPRR	Potential Program Resolution Report
PRAP	Probabilistic Risk Assessment Programs
PRR	Program Resolution Report.
PSRC	Plant Staff Review Committee (PGandE)
QA	Quality Assurance
QAP	Quality Assurance Program
QAR	Quality Assurance Audit & Review
RCS	Reactor Coolant System
RFR	Roger F. Reedy Inc.
RHR	Residual Heat Removal
RLCA	Robert L. Cloud Associates
RRA	Radiation Research Associates
SIFPR	Supplementary Information for Fire Protection Review
SMAW	Shield Metal Arc Weld
SWEC	Stone & Webster Engineering Corporation
SWSQAP	Stone & Webster Standard Nuclear Quality Assurance Program
TAFW	Turbine-Drive Auxiliary Feedwater Pump
TES	Teledyne Engineering Services
TMI	Three Mile Island
W&B	Wismer & Becker
Wyle	Wyle Laboratories