



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

NRC EVALUATION REPORT

PACIFIC GAS AND ELECTRIC COMPANY

DIABLO CANYON NUCLEAR PLANT, UNIT NOS. 1 AND 2

DOCKET NOS. 50-275 AND 50-323

INDIVIDUAL PLANT EXAMINATION OF EXTERNAL EVENTS (IPEEE)

1.0 INTRODUCTION

On June 28, 1991, the NRC issued Generic Letter (GL) 88-20, Supplement 4 (with NUREG-1407, Procedural and Submittal Guidance) requesting all licensees to perform individual plant examinations of external events (IPEEE) to identify plant-specific vulnerabilities to severe accidents and to report the results to the Commission together with any licensee-determined improvements and corrective actions. In a letter dated June 27, 1994, and supplement dated November 13, 1995, Pacific Gas and Electric Company, submitted its response to the NRC for the Diablo Canyon Nuclear Plant, Unit Nos. 1 and 2.

The NRC contracted with Energy Research, Inc. (ERI) to conduct a Step 1 review of the licensee's IPEEE submittal and its associated documentation in March 1995 and sent a request for additional information (RAI) to the licensee in September 1995. The licensee responded to the RAI on November 13, 1995. Based on the results of the review, the NRC concluded that the aspects of seismic, fires, and high winds, floods, and transportation and others were adequately addressed. NRC and contractor review findings are summarized in the evaluation section below. Details of the contractor's findings are presented in the technical evaluation report attached to this evaluation report.

In accordance with Supplement 4 to GL 88-20, the licensee proposed to resolve Unresolved Safety Issue (USI) A-45, "Shutdown Decay Heat Removal Requirements," Generic Safety Issue (GSI) 103, "Design for Probable Maximum Precipitation (PMP)," and GSI-131, "Potential Seismic Interaction Involving Movable In-Core Flux Mapping System Used in Westinghouse Plants." The licensee did not propose to resolve any additional USIs or GSIs as part of the Diablo Canyon IPEEE.

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2.0 EVALUATION

The Diablo Canyon Plant (DCPP) is a two-unit, Westinghouse 4-loop pressurized-water reactor (PWR) located about 12 miles south/southwest of San Luis Obispo, California. The plant was designed to a seismic acceleration level of 0.75g PGA (peak ground acceleration) anchored to a Regulatory Guide 1.60 spectral shape. For seismic and fire events, the licensee has performed a Level 1 probabilistic risk assessment (PRA) and a qualitative containment performance assessment for DCPP. For the analyses of other external events, the licensee used the progressive screening procedure as described in NUREG-1407.

Core Damage Frequency Estimates

The licensee estimated a seismic core damage frequency (CDF) of $4.2E-5$ /reactor-year (RY) using a site-specific hazard curve. The licensee estimated a CDF of $2.7E-5$ /RY due to internal fires for DCPP. The licensee also estimated that the contribution from other external events (i.e., external floods and high winds) are insignificant at the Diablo Canyon site. The licensee estimated that the CDF due to internal events is about $8.8E-5$ /RY, including internal flooding.

The CDF estimates compare reasonably with those of other plants.

Dominant Contributors

Seismically induced station blackout sequences contribute the most, about 40 percent of the total seismic CDF. These sequences consist of seismically induced loss of offsite power in combination with one or more of the following top contributors: 4-kV vital AC power system, failure of the diesel generator system, 125V vital DC power system, and relay chatter. The most significant seismic failures of components are: 230-kV transformer station, turbine building shear wall, 4-kV switchgear (chatter) and diesel generator control panel. The licensee identified that the human recovery actions that may be required to deal with potential seismically-induced severe accidents are: (1) to reduce component cooling water (CCW) heat loads with one CCW pump, (2) to locally cross-tie units 1 and 2, and (3) to switch to containment sump recirculation.

The fire CDF is dominated by fires in the control rooms and cable spreading rooms, which contribute about 70 percent of the total fire-induced CDF. The important system/equipment contributors to the estimated fire CDF that appear in the top sequences are mostly associated with the loss of component cooling water (CCW), auxiliary feedwater (AFW), auxiliary saltwater (ASW) systems or vital buses. The licensee identified that the human recovery actions that may be required to deal with potential fire-induced severe accidents are: (1) to trip reactor coolant pumps prior to seal damage, (2) recovery of CCW and ASW prior to LOCA, and (3) to close pressure-operated relief valve (PORV) that was stuck-open due to a fire-induced hot short.

The licensee's IPEEE assessment appears to have examined the significant initiating events and dominant accident sequences.



Containment Performance

The licensee has assessed containment performance under seismic conditions at Diablo Canyon by reviewing the seismically induced core damage sequences and plant damage states. Because the plant damage states specify the entry conditions for a Level II (containment performance) analysis, a qualitative understanding of containment performance was obtained. The licensee has performed seismic containment walkdowns as part of the Long Term Seismic Program (LTSP). The licensee has also assessed the containment failure modes caused by fire and concluded that the Level II internal events containment performance analysis applies to the Diablo Canyon plant's fire PRA.

The licensee's containment performance analyses for seismic and internal fire events appeared to have considered important severe phenomena and are consistent with the intent of Supplement 4 to GL 88-20.

Generic Safety Issues

As a part of the IPEEE, a set of generic and unresolved safety issues (e.g., USI A-45, GSI-131, GSI-103, GSI-57, and the Sandia Fire Risk Scoping Study [FRSS] issues) were specifically identified during the initial planning of the IPEEE program and explicitly discussed in Supplement 4 to GL 88-20 and its associated guidance in NUREG-1407 as needed to be addressed in the IPEEE. The NRC's evaluations of these issues are provided below.

1. USI A-45, "Shutdown Decay Heat Removal Requirements"

The licensee's process of addressing USI A-45 external events was very similar to that used for internal events quantification. The seismic and fire PRA event trees and plant system fault trees were based on the internal event/fault trees and modified for seismic and fire events. The staff finds that the licensee's USI A-45 evaluation is consistent with the guidance provided in Section 6.3.3.1 of NUREG-1407.

2. GSI-131, "Potential Seismic Interaction Involving the Movable In-Core Flux-Mapping System used in Westinghouse Plants"

The licensee had previously addressed GSI-131 involving an evaluation of assessing the seismic capacity of the flux-mapping system. As a result of that evaluation, the licensee implemented modifications to improve the seismic capacity of the cart supporting assemblies of the flux-mapping system. The staff finds that the licensee's GI-131 evaluation and improvements are consistent with the guidance provided in Section 6.2.2.1 of NUREG-1407.

3. GSI-103, "Design for Probable Maximum Precipitation"

The licensee has assessed GSI-103 and concluded that the new probable maximum precipitation (PMP) criteria will not have any impact on DCP. The staff finds that the licensee's GSI-103 evaluation is consistent with the guidance provided in Section 6.2.2.3 of NUREG-1407.



4. GSI-57. "Effects of Fire Protection System Actuation of Safety-Related Equipment"

The licensee has assessed the impact of inadvertent actuation of fire protection systems on safety systems which is also one of the issues identified in the FRSS. The staff finds that the licensee's GSI-57 evaluation is consistent with the guidance provided in EPRI's Fire-Induced Vulnerability Evaluation (FIVE).

5. Fire Risk Scoping Study Issues

The licensee has addressed the Fire Risk Scoping Study issues. The licensee has followed the EPRI guidance on FRSS issues. The NRC finds that the licensee's evaluation is consistent with the guidance provided in NUREG-1407.

In addition to those safety issues discussed above that were explicitly requested in Supplement 4 to GL 88-20, four generic safety issues were not specifically identified as issues to be resolved under the IPEEE program; thus, they were not explicitly discussed in Supplement 4 to GL 88-20 and NUREG-1407. However, subsequent to the issuance of the generic letter, the NRC evaluated the scope and the specific information requested in the generic letter and the associated IPEEE guidance, and concluded that the plant-specific analyses being requested in the IPEEE program could also be used, through a satisfactory IPEEE submittal review, to resolve the external event aspects of these four safety issues. The following discussions summarize the NRC's evaluation of these safety issues at DCPD.

1. GSI 147. "Fire-Induced Alternate Shutdown/Control Room Panel Interactions"

The licensee's IPEEE submittal contains information addressing this issue (see Section 4.8.5 of the DCPD IPEEE submittal). The licensee performed a thorough review of the DCPD safe shutdown analysis in 1991 and 1992 and made some specific improvements to deal with this issue. Also, the licensee investigated specifically the concerns raised in NRC Information Notice 92-18, "Potential for Loss of Remote Shutdown Capability During a Control Room Fire." Based on the results of the IPEEE submittal review, the staff considers that the licensee's process is capable of identifying potential vulnerabilities associated with this issue. On the basis that no vulnerability associated with this issue was identified in the IPEEE submittal, the staff considers this issue resolved.

2. GSI 148. "Smoke Control and Manual Fire-Fighting Effectiveness"

The licensee's IPEEE submittal contains information addressing this issue (see Section 4.8.3 of DCPD IPEEE submittal). The licensee performed a thorough review of the DCPD's fire protection program against the evaluation guidance provided in EPRI's FIVE on this issue. The licensee concluded that DCPD's fire protection program meets or



exceeds all attributes listed in FIVE. Based on the results of the IPEEE submittal review, the staff considers that the licensee's process is reasonable and is capable of identifying potential vulnerabilities associated with this issue. On the basis that no vulnerability associated with this issue was identified in the IPEEE submittal, the staff considers this issue resolved.

3. GSI 156. "Systematic Evaluation Program (SEP)"

The plant is not an SEP plant.

4. GSI 172. "Multiple System Responses Program (MSRP)"

The licensee's IPEEE submittal contains information directly addressing the following external events-related MSRP issues: effects of fire protection system actuation on safety-related equipment (Section 4.8.4.2), smoke control and manual fire-fighting effectiveness (Section 4.8.3), effects of hydrogen line rupture (Section 4.2.1), seismically induced spatial interactions (Section 3.1.2), seismic-fire interactions (Section 4.8.1), seismically induced fire suppression system actuations (Section 4.8.1.2), seismically induced flooding (Section 3.1.3.10), seismically induced relay chatter (Section 3.1.3.6), evaluation of earthquake magnitude greater than safe shutdown earthquake (Section 3), the IPEEE-related aspects of common cause failures related to human errors (Section 3.1.3.4 and 4.4.3), non-safety-related control system/safety-related system dependencies (Section 4.8.1.3), and effects of flooding and/or moisture intrusion on non-safety related and safety-related equipment (Section 4.3.5). Based on the results of the IPEEE submittal review, the staff considers that the licensee's process is capable of identifying potential vulnerabilities associated with this issue. On the basis that no potential vulnerability associated with this issue was identified in the IPEEE submittal, the staff considered the IPEEE-related aspects of this issue resolved.

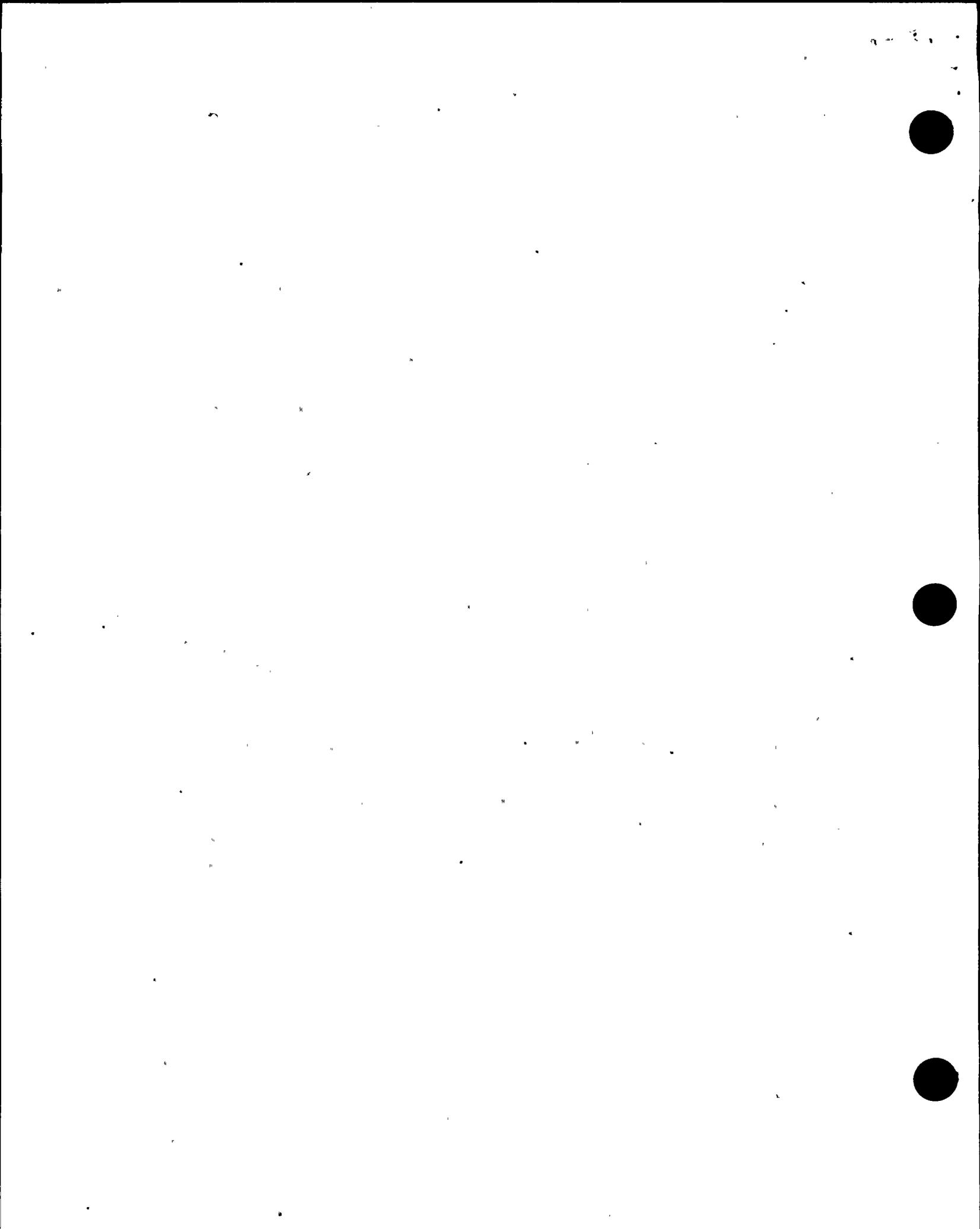
Unique Plant Features, Potential Vulnerabilities, and Improvements

The licensee reported no unique safety features at the plant.

The licensee defined a potential severe accident vulnerability as having any component, system, operator action, or accident sequence that contributes more than 50 percent to the CDF or has CDF greater than $1E-4$ /RY [criteria recommended by Nuclear Management and Resources Council (NUMARC)]. The licensee did not identify any potential severe-accident vulnerabilities related to seismic, fire, or other external events. However, a number of plant improvements were made as part of the LTSP that will reduce potential seismic vulnerabilities at DCPP.

3.0 CONCLUSIONS

On the basis of the above findings, the staff notes that (1) the licensee's IPEEE is complete with regard to the information requested by Supplement 4 to

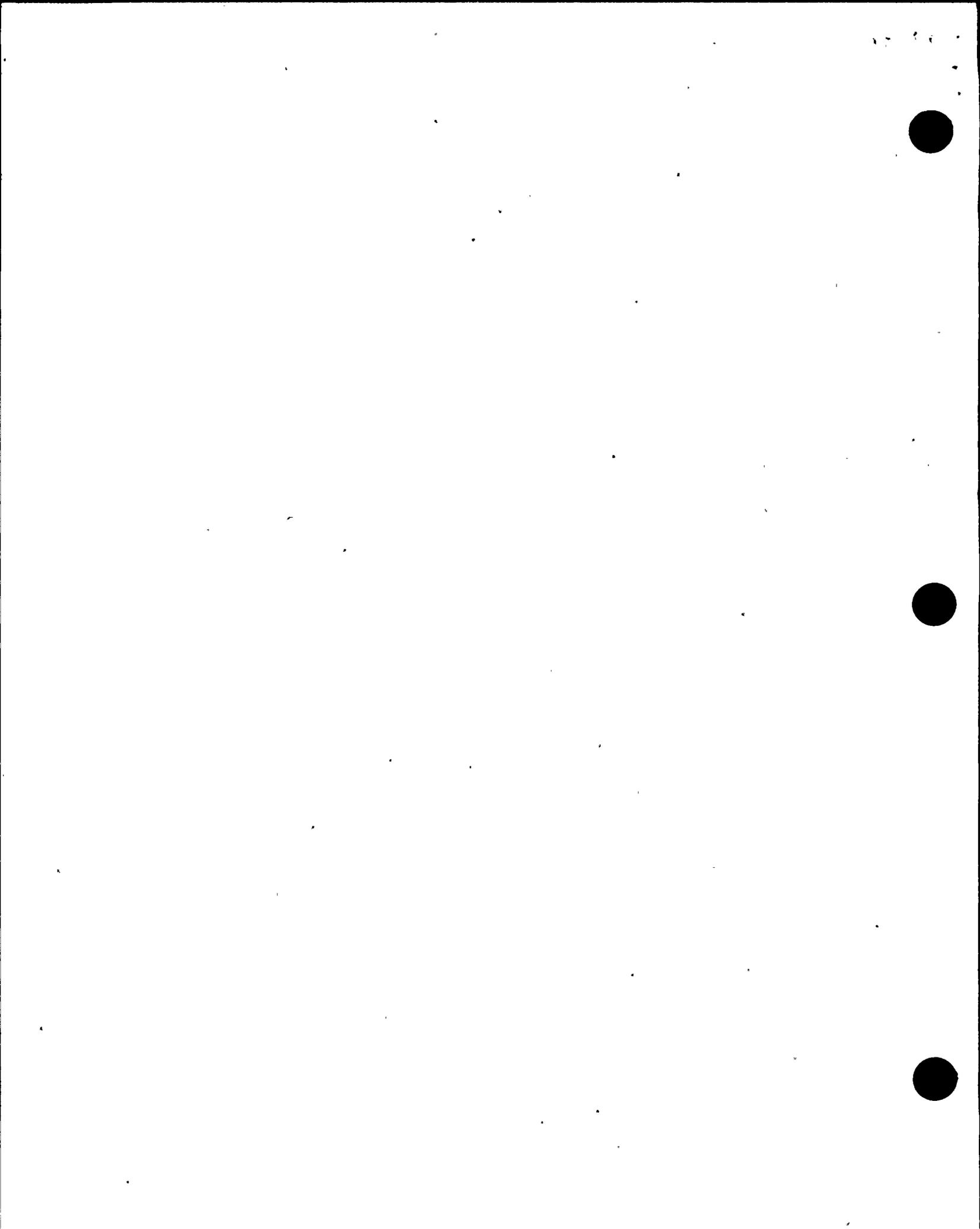


GL 88-20 (and associated guidance in NUREG-1407) and (2) the IPEEE results are reasonable given the Diablo Canyon design, operation, and history. Therefore, the staff concludes that the licensee's IPEEE process is capable of identifying the most likely severe accidents and severe accident vulnerabilities, and therefore, that the Diablo Canyon IPEEE has met the intent of Supplement 4 to GL 88-20 and the resolution of specific generic safety issues discussed in this ER.

It should be noted, that the staff focused its review primarily on the licensee's ability to examine Diablo Canyon for severe accident vulnerabilities. Although certain aspects of the IPEEE were explored in more detail than others, the review was not intended to validate the accuracy of the licensee's detailed findings (or quantification estimates) that underlie or stemmed from the examination. Therefore, this ER does not constitute NRC approval or endorsement of any IPEEE material for purposes other than those associated with meeting the intent of Supplement 4 to GL 88-20 and the resolution of specific generic safety issues discussed in this ER.

Date: December 4, 1997

Attachment: Technical Evaluation Report



Attachment

DIABLO CANYON NUCLEAR POWER PLANT
INDIVIDUAL PLANT EXAMINATION OF EXTERNAL EVENTS
(IPEEE)
TECHNICAL EVALUATION REPORT

