

May 24, 1989

DOCKET NOS.: 50-275  
and 50-323

LICENSEE: PACIFIC GAS AND ELECTRIC COMPANY (PG&E)  
FACILITY: DIABLO CANYON NUCLEAR POWER PLANT, UNITS 1 AND 2  
SUBJECT: SUMMARY OF MAY 23, 1989 PUBLIC MEETING TO DISCUSS PROPOSED  
CHANGE IN ALLOWED OUTAGE TIME FOR A DIESEL GENERATOR FROM  
72 HOURS TO 7 DAYS (LAR 89-05, TAC NOS. 73109 AND 73110)

On May 23, 1989 the NRC staff and its consultants met with PG&E in Rockville, Maryland to discuss proposed License Amendment Request (LAR) 89-05, which would increase the allowed outage time (AOT) for any diesel generator from 72 hours to 7 days. This LAR was submitted by letter dated May 12, 1989. A report documenting the licensee's studies evaluating the risk and reliability of the revised AOT were submitted by letter dated May 11, 1989. In these submittals, the licensee stated that it plans to upgrade the onsite AC power system by adding a sixth diesel generator. This change would be made at the fourth refueling outage for Unit 2, which is scheduled to begin in October of 1991. Attendees at the meeting are given in Enclosure 1. The viewgraphs presented by the licensee during the meeting are given in Enclosure 2. At the conclusion of the meeting, the NRC staff stated that its review of the LAR was underway, and that if it needed additional information as part of its review, a request for such information would be transmitted to the licensee as soon as the need is established.

original signed by

Harry Rood, Senior Project Manager  
Project Directorate V  
Division of Reactor Projects - III,  
IV, V and Special Projects

Enclosures:

- 1. Meeting Attendees
- 2. Viewgraphs Presented by Licensee

cc: w/enclosures - see next page

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

May 24, 1989

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A handwritten signature in cursive script that reads "Harry Rood".

Harry Rood, Senior Project Manager  
Project Directorate V  
Division of Reactor Projects - III,  
IV, V and Special Projects

Enclosures:

1. Meeting Attendees
2. Viewgraphs Presented by Licensee

cc: w/enclosures - see next page

FACTORY 2025-2026 (1)

1. (1) The following information is required to be submitted to the Board of Directors for the purpose of the annual general meeting of shareholders to be held on 15th March 2026:

(a) A statement of the company's financial performance for the financial year ended 31st December 2025, including a profit and loss account, a balance sheet, and a cash flow statement, together with the directors' report and the auditors' report thereon.

(b) A statement of the company's financial position as at 31st December 2025, including a balance sheet, and a cash flow statement, together with the directors' report and the auditors' report thereon.

2. (2) The following information is required to be submitted to the Board of Directors for the purpose of the annual general meeting of shareholders to be held on 15th March 2026:

(a) A statement of the company's financial performance for the financial year ended 31st December 2025, including a profit and loss account, a balance sheet, and a cash flow statement, together with the directors' report and the auditors' report thereon.

Mr. J. D. Shiffer  
Pacific Gas and Electric Company

Diablo Canyon

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Main body of the document containing several columns of extremely faint, illegible text. The text is scattered across the page, with some faint clusters appearing in the lower right quadrant.

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ENCLOSURE 1

ATTENDEES

Public Meeting on License Amendment Requests LAR 89-05  
Diesel Generator Allowed Outage Time  
Diablo Canyon Combined Technical Specifications  
Tuesday, May 23, 1989

NAME

ORGANIZATION

Nilesh Chokshi	NRC/RES/PRAB
Kent Daschke	Westinghouse-NATD
Adel El-Bassioni	NRC/DREP/PRAB
Robert G. Fitzpatrick	BNL (Consultant to NRC)
Cynthia L. Haag	Westinghouse-NATD
Roger Johnson	PG&E
Jim Knight	NRC/DEST/SELB
John Knox	NRC/DEST/SELB
Barkeley S. Lew	PG&E
John McInerney	Westinghouse-NATD
Dick Robinson	NRC/RES
Harry Rood	NRC/DRSP/PDV
Raymond Thierry	PG&E
Ken Vavrek	Westinghouse
George Wu	PG&E

MEMORANDUM

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FROM : [illegible]

SUBJECT: [illegible]

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**DIABLO CANYON POWER PLANT**

**DIESEL GENERATOR**

**ALLOWED OUTAGE TIME STUDY**

**May 1989**

**PACIFIC GAS AND ELECTRIC COMPANY**





**DIESEL GENERATOR LAR**

**MEETING**

**PROPOSED AGENDA**

**MAY 23, 1989**

- |                                      |                     |
|--------------------------------------|---------------------|
| <b>1. OPENING STATEMENT</b>          | <b>NRC</b>          |
| <b>2. OVERVIEW OF LAR AND REPORT</b> | <b>PG&amp;E</b>     |
| <b>3. SYSTEM DESCRIPTION</b>         | <b>PG&amp;E</b>     |
| <b>4. PRA</b>                        | <b>PG&amp;E</b>     |
| - CALCULATIONS                       |                     |
| - SEQUENCES                          |                     |
| - RESULTS                            |                     |
| <b>5. RELIABILITY ANALYSIS</b>       | <b>WESTINGHOUSE</b> |
| - OVERVIEW                           |                     |
| - CASE MODELS                        |                     |
| - RESULTS                            |                     |
| <b>6. SUMMARY</b>                    | <b>PG&amp;E</b>     |

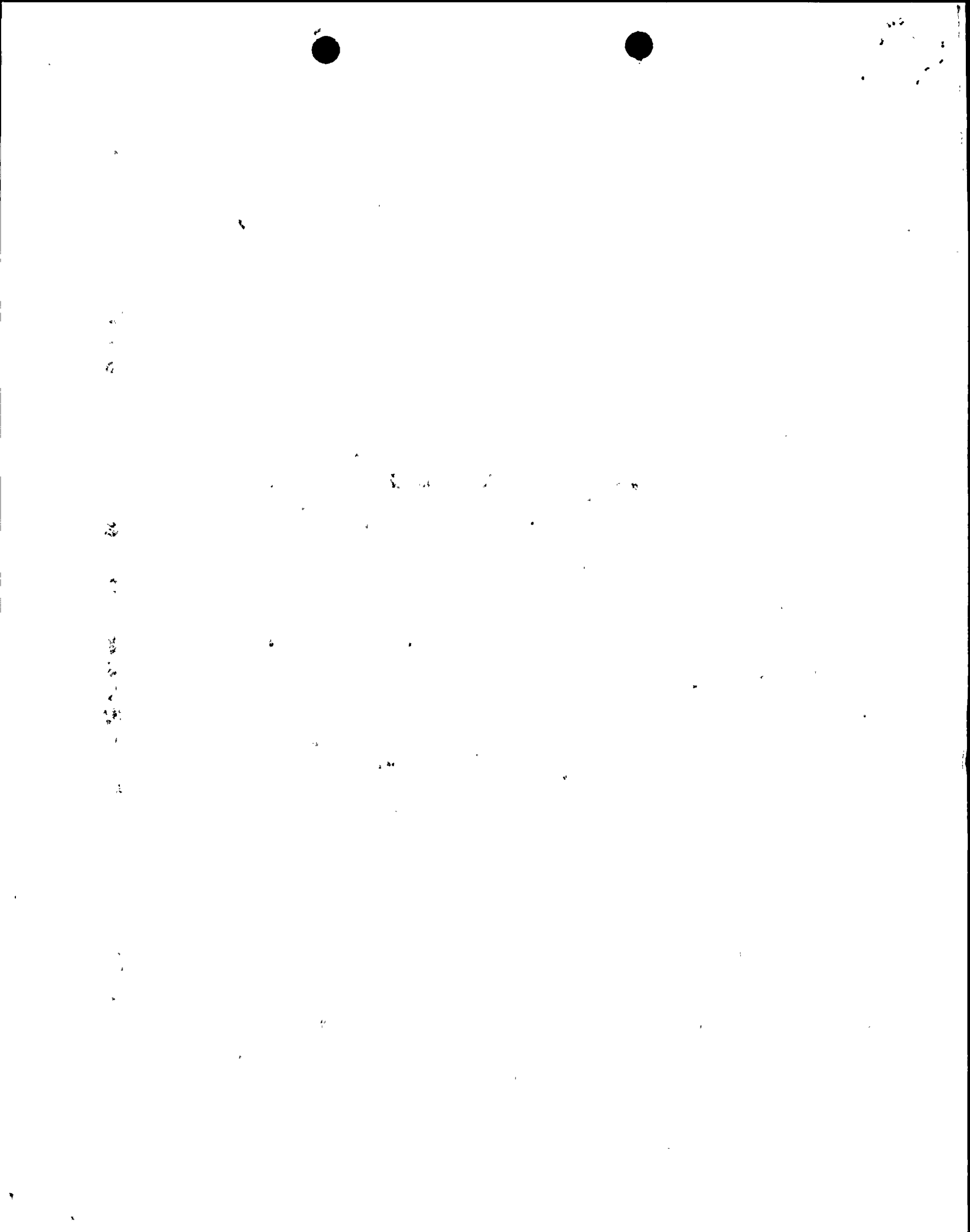


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## SCHEDULE OVERVIEW

NRC MEETING	MARCH 31, 1989
REPORT SUBMITTAL	MAY 11, 1989
LAR SUBMITTAL	MAY 12, 1989
NRC APPROVAL	MID-SEPTEMBER 1989
SIXTH DG INSTALLATION	FALL 1991





DIABLO CANYON POWER PLANT  
DIESEL GENERATOR ALLOWED OUTAGE TIME STUDY

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## SUMMARY OF ANALYSES

- USED TWO PROBABILISTIC EVALUATION METHODS
  - PRA BASED UPON LTSP DCPRA (PG&E/PLG)
  - RELIABILITY ANALYSIS BASED UPON BRUNSWICK/BNL METHODS (PG&E/WESTINGHOUSE)
- ANALYZED THREE CASES
  - FIVE DGS, 72-HOUR AOT, AND SINGLE 10 DAY PLANNED MAINTENANCE EACH CYCLE (BASE CASE)
  - FIVE DGS, 7-DAY AOT, AND SINGLE 7 DAY PLANNED MAINTENANCE EACH CYCLE (CASE 2)
  - SIX DGS, 7-DAY AOT, AND NO PLANNED MAINTENANCE (CASE 3)
- DETERMINED CHANGES IN ABSOLUTE AND RELATIVE RISK VALUES (CORE MELT FREQUENCY PER YEAR).
- FOUND THAT RELATIVE RISK CRITERION CONFIRMS THE ACCEPTABILITY OF A 7-DAY AOT. THERE WAS A NEGLIGIBLE CHANGE IN RISK WITH A 7-DAY AOT. ADDING A SIXTH DG WILL HAVE A POSITIVE BENEFIT, LARGER THAN THE EFFECT OF CHANGING TO A 7-DAY AOT.

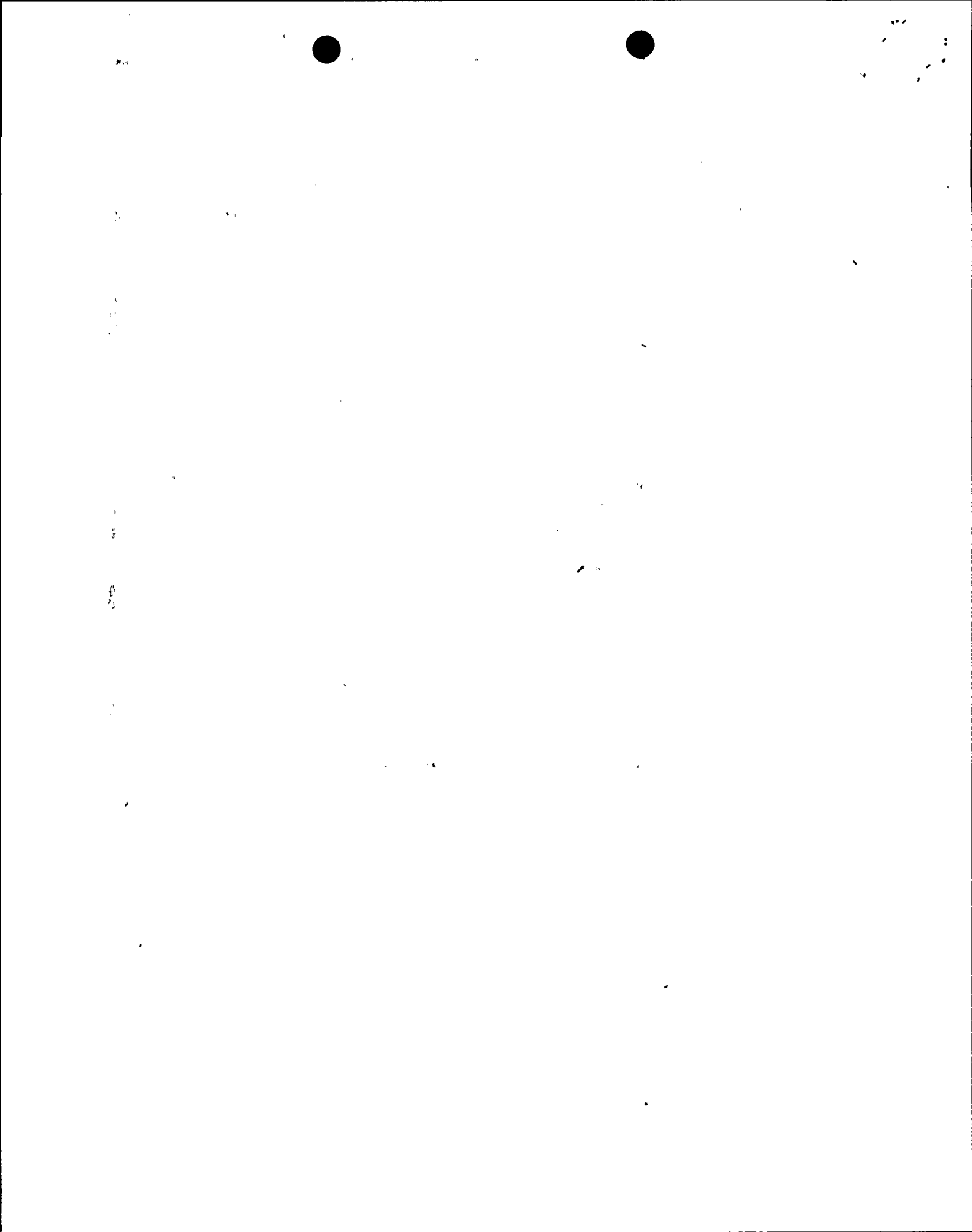


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## SYSTEM DESCRIPTION

- ELECTRIC POWER
- FIVE DIESEL CONFIGURATION
- SIX DIESEL CONFIGURATION
- TECHNICAL SPECIFICATIONS





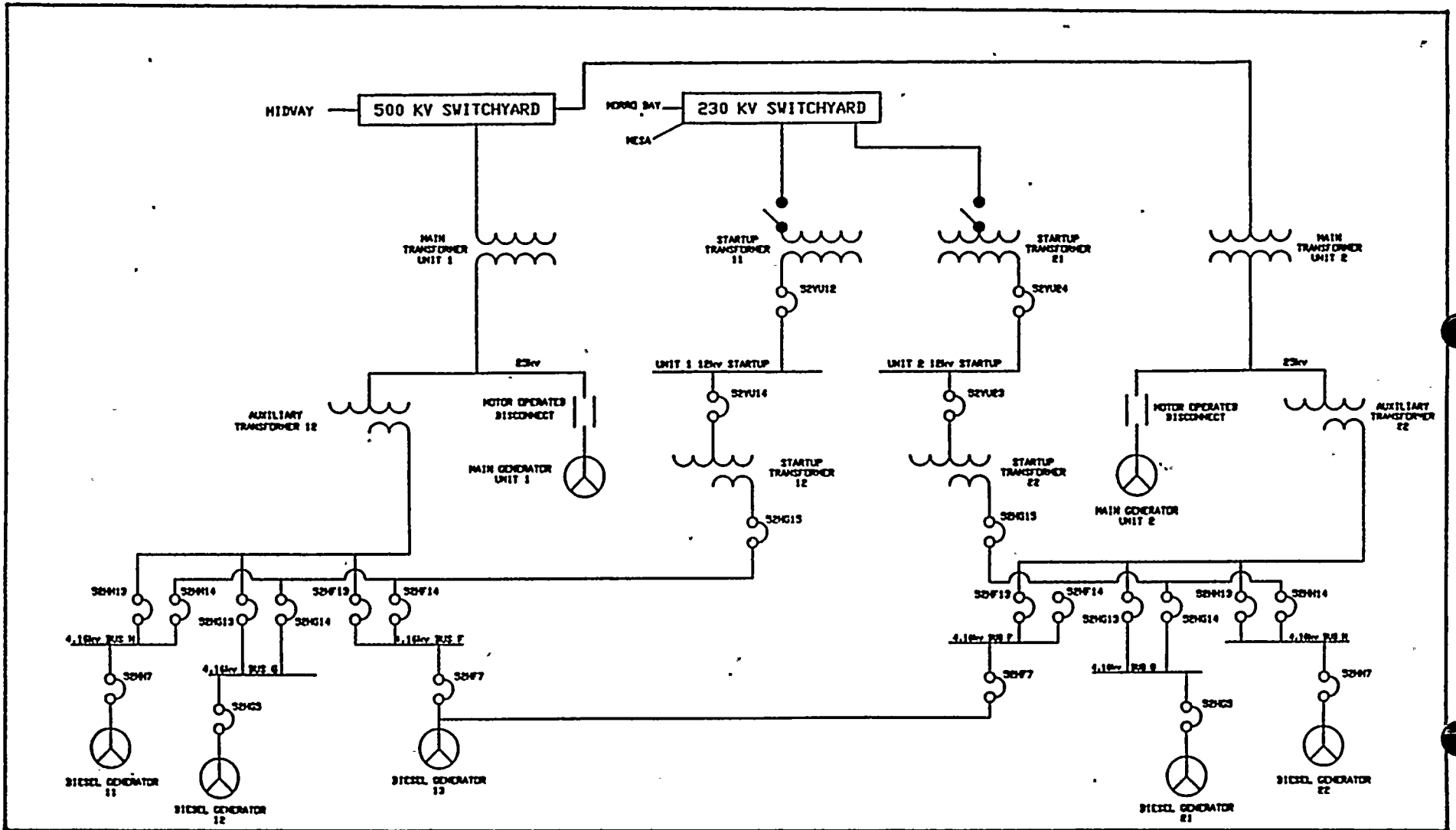
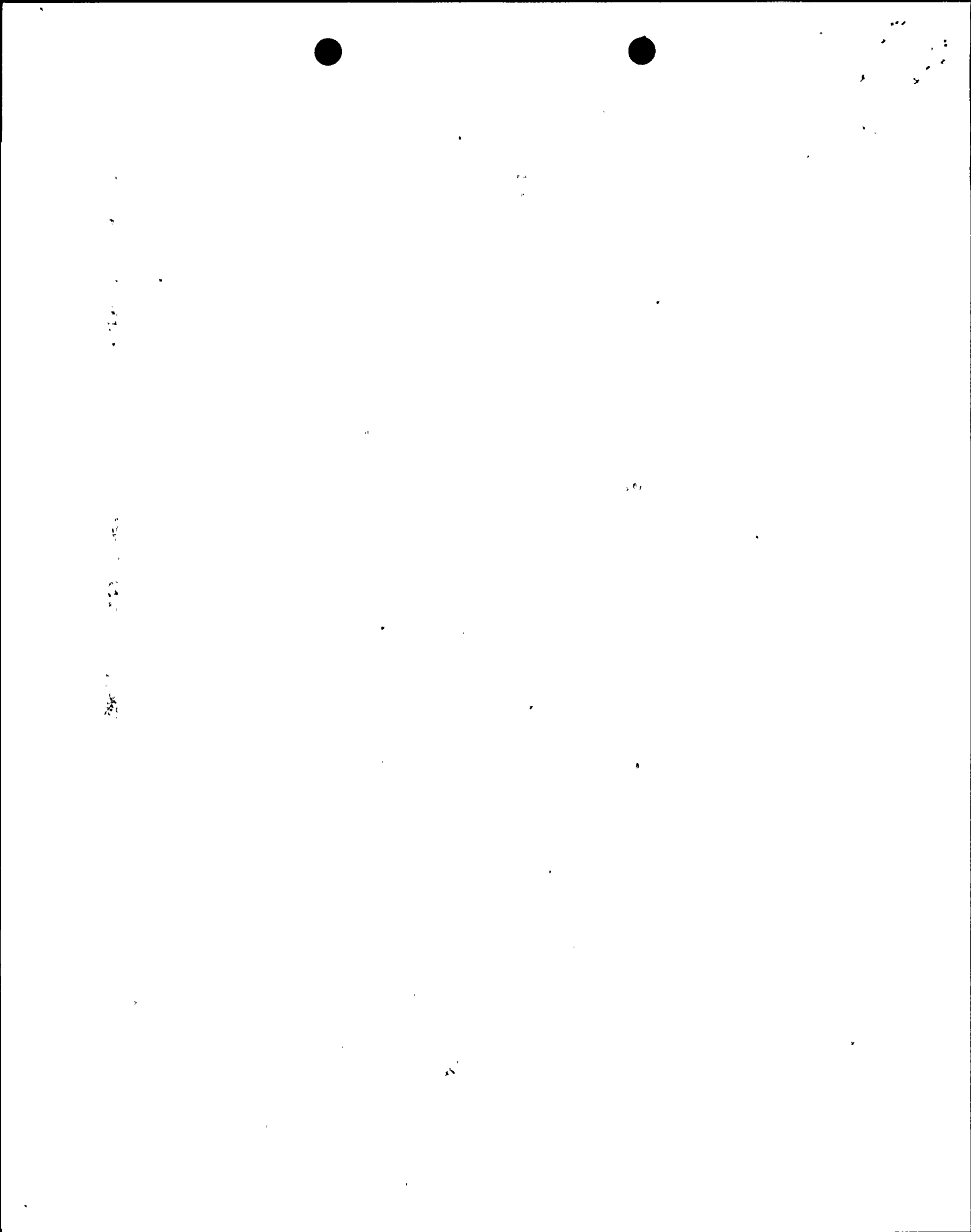
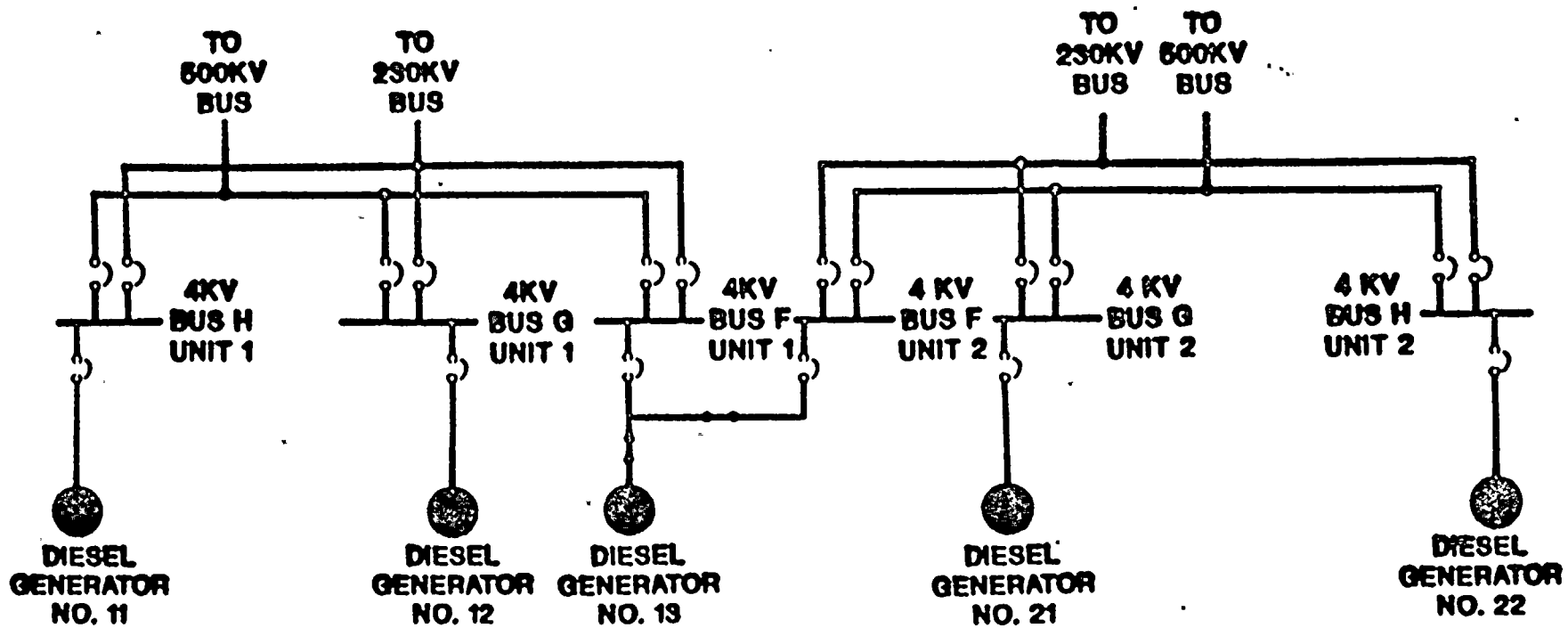


FIGURE 3-1  
DIABLO CANYON ELECTRIC POWER SYSTEM



# EXISTING DIESEL GENERATOR ARRANGEMENT



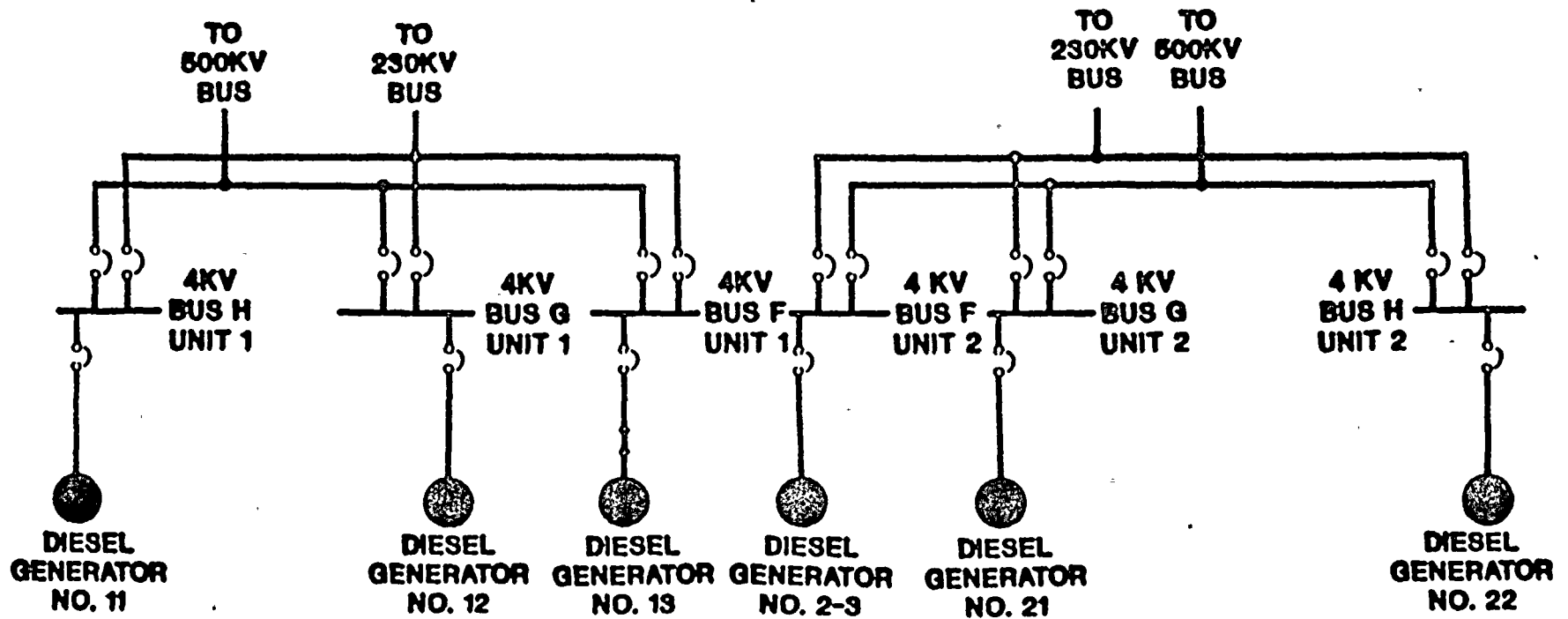


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# PROPOSED MODIFICATION ADDITION OF SIXTH DIESEL GENERATOR





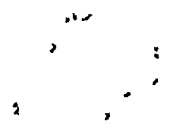
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## T.S. 3.8.1.1.B:

WITH A DIESEL GENERATOR OF THE ABOVE REQUIRED A.C. ELECTRICAL POWER SOURCES INOPERABLE, DEMONSTRATE THE OPERABILITY OF THE A.C. OFFSITE SOURCES BY PERFORMING SPECIFICATION 4.8.1.1.1A WITHIN 1 HOUR AND AT LEAST ONCE PER 8 HOURS THEREAFTER; AND IF THE DIESEL GENERATOR BECAME INOPERABLE DUE TO ANY CAUSE OTHER THAN PREVENTIVE MAINTENANCE OR TESTING, DEMONSTRATE THE OPERABILITY OF THE REMAINING OPERABLE DIESEL GENERATORS BY PERFORMING SPECIFICATION 4.8.1.1.2A.2 WITHIN 24 HOURS\*; RESTORE THE DIESEL GENERATOR TO OPERABLE STATUS WITHIN 72 HOURS OR BE IN AT LEAST HOT STANDBY WITHIN THE NEXT 6 HOURS AND IN COLD SHUTDOWN WITHIN THE FOLLOWING 30 HOURS.



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**BASES 3/4.8.1, 3/4.8.2, 3/4.8.3:**

... THE A.C. AND D.C. SOURCE ALLOWABLE OUT-OF-SERVICE TIMES ARE BASED ON REGULATORY GUIDE 1.93, "AVAILABILITY OF ELECTRICAL POWER SOURCES," DECEMBER 1974. {A} WHEN ONE DIESEL GENERATOR IS INOPERABLE, ...

**INSERT A**

EXCEPT FOR THE ALLOWED OUTAGE TIME ASSOCIATED WITH ACTION STATEMENT B. OF SPECIFICATION 3.8.1.1. THIS ALLOWED OUTAGE TIME WAS CHANGED TO BE CONSISTENT WITH THE RECOMMENDATION OF DIABLO CANYON POWER PLANT DIESEL GENERATOR ALLOWED OUTAGE TIME STUDY, MAY 1989



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## **PRA**

- **CALCULATIONS**
- **SYSTEM ANALYSIS**
- **CORE DAMAGE SEQUENCES**
- **RESULTS**



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**TABLE 4-1  
DEFINITION OF CALCULATIONS**

<u>Calculation</u>	<u>No. of DGs</u>	<u>Allowed Outage Time</u>	<u>Period of Scheduled Overhaul on Swing DG (with Unit 1 at power)</u>
1A	5	3 Days	0 Days
1B	5	7 Days	0 Days
2	5	3 Days	10 Days
3	5	7 Days	7 Days
4	6	7 Days	0 Days
5	5	No Maintenance	0 Days
6*	5	7 Days	1 year

\* This calculation evaluates the risk if the swing DG were unavailable for the entire year under a 7-day AOT.





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## SYSTEM ANALYSIS

- FOUR DISTINCT QUANTIFICATIONS
  - 3-DAY AOT (DCPRA)
  - 7-DAY AOT
  - SCHEDULED MAINTENANCE
  - ZERO MAINTENANCE
- NON-SEISMIC
- SEISMIC
- RESULTS IN TABLE 4-3
- EQUATIONS IN APPENDIX A



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**TABLE 4-3  
DIESEL GENERATOR SPLIT FRACTION VALUES**

Split Fraction	Calc. 1A & 2 (DCPRA) 3 Day AOT for all Diesels		Calcs. 1B & 3 & 4 7 Day AOT for all Diesels		Calcs. 2, 3 & 6 Scheduled Maintenance on Diesel 13		Calc. 5 Zero Diesel Maintenance	
	<u>Nonseismic</u>	<u>Seismic</u>	<u>Nonseismic</u>	<u>Seismic</u>	<u>S.F. Nonseismic</u>	<u>S.F. Seismic</u>	<u>Nonseismic</u>	<u>Seismic</u>
GF1	4.523E-02	8.510E-02	4.946E-02	8.721E-02	(1)		3.711E-02	7.561E-02
GG1	4.477E-02	8.417E-02	4.909E-02	8.654E-02			3.687E-02	7.507E-02
GG2	5.561E-02	9.502E-02	5.682E-02	9.428E-02	GG4 4.344E-02	GG5 8.114E-02	4.395E-02	8.226E-02
GG3	4.523E-02	8.510E-02	4.946E-02	8.721E-02			3.711E-02	7.561E-02
GH1	4.436E-02	8.334E-02	4.878E-02	8.595E-02			3.668E-02	7.462E-02
GH2	5.408E-02	9.329E-02	5.545E-02	9.275E-02	GH7 4.324E-02	GHA 8.064E-02	4.202E-02	8.060E-02
GH3	8.265E-02	1.115E-01	8.063E-02	1.090E-01	GH8 4.784E-02	GHB 8.685E-02	8.933E-02	1.008E-01
GH4	4.477E-02	8.417E-02	4.909E-02	8.654E-02			3.687E-02	7.507E-02
GH5	5.561E-02	9.502E-02	5.682E-02	9.428E-02	GH9 4.344E-02		4.395E-02	8.226E-02
GH6	4.523E-02	8.510E-02	4.946E-02	8.721E-02			3.711E-02	7.561E-02
2G1	4.396E-02	8.251E-02	4.847E-02	8.537E-02			3.651E-02	7.419E-02
2G2	5.364E-02	9.244E-02	5.507E-02	9.205E-02			4.145E-02	7.990E-02
2G3	6.250E-02	1.016E-01	6.254E-02	9.964E-02	2GC 4.631E-02	2GI 8.531E-02	5.629E-02	8.852E-02
2G4	2.898E-01	1.903E-01	2.726E-01	1.851E-01			3.834E-01	2.100E-01
2G5	4.436E-02	8.334E-02	4.878E-02	8.595E-02			3.668E-02	7.462E-02
2G6	5.408E-02	9.329E-02	5.545E-02	9.275E-02	2GE 4.324E-02		4.202E-02	8.060E-02
2G7	8.265E-02	1.115E-01	8.063E-02	1.090E-01			8.933E-02	1.008E-01
2G8	4.477E-02	8.417E-02	4.909E-02	8.654E-02			3.687E-02	7.507E-02
2G9	5.561E-02	9.502E-02	5.682E-02	9.428E-02			4.395E-02	8.226E-02
2GA	4.523E-02	8.510E-02	4.946E-02	8.721E-02			3.711E-02	7.561E-02
2H1	4.356E-02	8.169E-02	4.817E-02	8.481E-02			3.636E-02	7.379E-02
2H2	5.320E-02	9.162E-02	5.470E-02	9.138E-02			4.090E-02	7.925E-02
2H3	6.206E-02	1.005E-01	6.205E-02	9.863E-02	2HI 4.585E-02		5.589E-02	8.739E-02
2H4	6.922E-02	1.112E-01	6.996E-02	1.087E-01	2HJ 5.573E-02		6.415E-02	1.002E-01
2H5	7.729E-01	5.269E-01	7.521E-01	5.214E-01			8.494E-01	6.230E-01
2H6	4.396E-02	8.251E-02	4.847E-02	8.537E-02			3.651E-02	7.419E-02
2H7	5.364E-02	9.244E-02	5.507E-02	9.205E-02			4.145E-02	7.990E-02
2H8	6.250E-02	1.016E-01	6.254E-02	9.964E-02			5.629E-02	8.852E-02
2H9	2.898E-01	1.903E-01	2.726E-01	1.851E-01			3.834E-01	2.100E-01
2HA	4.436E-02	8.334E-02	4.878E-02	8.595E-02			3.668E-02	7.462E-02
2HB	5.408E-02	9.329E-02	5.545E-02	9.275E-02			4.202E-02	8.060E-02
2HC	8.265E-02	1.115E-01	8.063E-02	1.090E-01			8.933E-02	1.008E-01
2HD	4.477E-02	8.417E-02	4.909E-02	8.654E-02			3.687E-02	7.507E-02
2HE	5.561E-02	9.502E-02	5.682E-02	9.428E-02			4.395E-02	8.226E-02
2HG	4.523E-02	8.510E-02	4.946E-02	8.721E-02			3.711E-02	7.561E-02

Note: (1) This quantification was used to evaluate core damage sequences that involved failure of the swing DG. The DG split fractions not listed for this case were not needed to quantify these sequences.





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## CORE DAMAGE SEQUENCES

- NON-SEISMIC SEQUENCES
  - DOMINANT SEQUENCE MODEL
  - SCHEDULED MAINTENANCE SEQUENCES
  - APPENDIX B
  
- SEISMIC SEQUENCES
  - SEIS4 COMPUTER MODEL
  - COMBINATIONS OF SEISMIC/NON-SEISMIC FAILURES
  - SCHEDULED MAINTENANCE TERMS
  - APPENDIX C



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**TABLE 4-4  
ABSOLUTE FREQUENCY RESULTS**

<u>Calculation</u>	<u>No. of DGs</u>	<u>Allowed Outage Time</u>	<u>Period of Scheduled Overhaul on Swing DG (with Unit 1 at power)</u>	<u>Frequency (per year)</u>
1A	5	3 Day	0 Days*	2.078E-04
1B	5	7 Day	0 Days	2.120E-04
2	5	3 Day	10 Days	2.124E-04
3	5	7 Day	7 Days	2.152E-04
4	6	7 Day	0 Days	2.017E-04
5	5	No Maintenance	0 Days	2.042E-04
6	5	7 Day	1 Yr.	4.650E-04

\* DCPRA Assumption; see Ref. 4 and 14





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**TABLE 4-5**  
**RELATIVE RISK RESULTS**

<u>Description</u>	<u>Risk Ratio</u>	<u>Comments</u>
<b>Impact of Allowed Outage Time</b>		
<b>3 Day AOT:</b>		
-5 DG configuration	0.05*	Risk during AOT/risk during base period with no maintenance
<b>7-day AOT:</b>		
-5 DG configuration	0.08*	Risk during AOT/risk during base period with no maintenance
-6 DG configuration	0.08*	Risk during AOT/risk during base period with no maintenance

**Impact of Scheduled Outages**

-5 DG configuration (3 Day AOT) + 10 Days	0.04	Risk for scheduled outage/ risk for 18 months(72-hour AOT)
-5 DG configuration (7 Day AOT) + 7 Days	0.03	Risk for scheduled outage/ risk for 18 months(7-day AOT)
-6 DG configuration (7 Day AOT) + 7 Days	0.00	No scheduled outage/ risk for 18 months(7 Day AOT)

\* Based on mean maintenance duration.



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## RELIABILITY ANALYSIS OVERVIEW

- o MODELING TECHNIQUES AND DATA COMPATIBLE WITH DCPRA
- o ASSESS COMPLIANCE WITH DESIGN BASIS CRITERIA (LOOP, LOOP/LOCA)
- o MISSION TIME CONSISTENT WITH REGULATORY REQUIREMENTS (BLACKOUT)
- o MODEL DESIGNED TO BE STAND-ALONE, INCLUDES SUPPORT SYSTEMS IN FAULT TREES
- o RESULTS IN TABLES 5.8 AND 5.9
- o FAULT TREES IN APPENDIX D



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## RELIABILITY STUDY OVERVIEW COMPARISON

	<u>BRUNSWICK</u>	<u>DIABLO CANYON</u>
NUMBER OF DIESEL GENERATORS	4	5
EXTEND AOT FROM 3 DAYS TO 7 DAYS	YES	YES
LENGTHEN QUICK START INTERVAL FROM 12 TO 72 HOURS & STI FROM 2 TO 24 HOURS	YES	NA
CASES ANALYZED:		
- BASELINE	YES	YES
- LOOP EVENT	YES	YES
- LOOP WITH LOCA IN ONE UNIT	YES	YES
TOP-LEVEL (REDUCED) TREES	YES	YES
TIME DEPENDENT, PHASED MISSION APPROACH (FRANTIC)	YES	YES
DIESEL CROSS-TIE BETWEEN UNITS	YES	SWING DG ONLY
USE OF PLANT SPECIFIC DATA	YES	YES
COMMON CAUSE METHOD	BINOMIAL	BETA-FACTOR
TESTING PRACTICE IN AOT:	SIMULTANEOUS	SEQUENTIAL



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## CALCULATION MODELS

CURRENT FIVE DIESEL CONFIGURATION (3 AND 7-DAY AOT)

PLANNED SIX DIESEL CONFIGURATION (7-DAY AOT)

- o ALL DGS IN STANDBY
  - LOOP EVENT IN BOTH UNITS
  - LOCA IN UNIT 1 WITH LOOP EVENT
  
- o AOT CONDITION (ONE DG OUT OF SERVICE)
  - LOOP EVENT
  - LOCA IN UNIT 1 WITH LOOP EVENT



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**TABLE 5-8**  
**RELATIVE RISK ANALYSIS RESULTS**

	<u>Average/ Maximum Risk</u>	<u>Ratio</u>	<u>Standby Risk</u>
<b><u>72-Hour AOT - 5 DGs</u></b>			
LOOP	1.33E-05/ 1.48E-05	0.06	2.16E-04
LOOP/LOCA	7.74E-11/ 9.41E-11	0.08	1.03E-09
<b><u>7-Day AOT - 5 DGs</u></b>			
LOOP	1.68E-05/ 2.15E-05	0.08	2.19E-04
LOOP/LOCA	1.03E-10/ 1.42E-10	0.10	9.93E-10
<b><u>7-Day AOT - 6 DGs</u></b>			
LOOP	9.09E-06/ 1.14E-05	0.05	1.91E-04
LOOP/LOCA	8.78E-11/ 1.27E-10	0.13	6.55E-10





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TABLE 5-9  
AVERAGE ANNUAL RISK RESULTS

	<u>Annual Risk</u>
<u>72-Hour AOT - 5 DGs</u>	
LOOP	2.29E-04
LOOP/LOCA	1.10E-09
<u>7-Day AOT - 5 DGs</u>	
LOOP	2.35E-04
LOOP/LOCA	1.10E-09
<u>7-Day AOT - 6 DGs</u>	
LOOP	2.00E-04
LOOP/LOCA	7.43E-10





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## SUMMARY OF RESULTS

1. THE FREQUENCIES FOR ALL CASES ARE ACCEPTABLY LOW (IN THE E-4 RANGE).
2. THE RELATIVE RISK RATIO CRITERION IS SATISFIED FOR ALL CASES BY BOTH METHODS OF ANALYSES.
3. THE EFFECT OF CHANGING FROM A 72-HOUR TO A 7-DAY AOT IS INSIGNIFICANT, ON THE ORDER OF 1 PERCENT TO 3 PERCENT.
4. THE EFFECT OF ADDING THE SIXTH DG IS GREATER THAN THE EFFECT OF CHANGING TO A 7-DAY AOT, WITH A DECREASE ON THE ORDER OF 5 PERCENT TO 15 PERCENT.
5. THE TWO ANALYSES PROVIDE RESULTS WHICH ARE CONSISTENT. THE TRENDS OF THE RESULTS FOR THE THREE CASES ARE COMPARABLE BETWEEN THE PRA AND RELIABILITY ANALYSES. FURTHER, THE MAGNITUDE OF THE FREQUENCY RESULTS ARE COMPARABLE BETWEEN THE TWO DIFFERENT QUANTITATIVE APPROACHES.



**TABLE 6-1**  
**ANALYTICAL RESULTS<sup>(1)</sup>**  
**FOR UNPLANNED AND PLANNED MAINTENANCE ACTIVITIES**

	<u>PRA Analysis</u>			<u>Reliability Analysis (Unplanned)</u>	
	<u>Unplanned &amp; Planned<sup>(2)</sup></u>	<u>Unplanned</u>		<u>Frequency</u>	<u>Relative Ratio<sup>(3)</sup></u>
	<u>Frequency</u>	<u>Frequency</u>	<u>Relative Ratio<sup>(3)</sup></u>		
<b><u>BASE CASE</u></b>					
3-Day AOT/5 DGs (10 day Outage) <sup>(2)</sup>	2.12E-04	2.08E-04	0.05	LOOP 2.29E-04 LOCA/ LOOP 1.10E-09	0.06  0.08
<b><u>CASE 2</u></b>					
7-Day AOT/5 DGs (7 day Outage) <sup>(2)</sup>	2.15E-04	2.12E-04	0.08	LOOP 2.35E-04 LOCA/ LOOP 1.10E-09	0.08  0.10
<b><u>CASE 3</u></b>					
7-Day AOT/6 DGs (0 day) <sup>(2)</sup>	2.02E-04	2.02E-04	0.08	LOOP 2.00E-04 LOCA/ LOOP 7.43E-10	0.05  0.13

(1) PRA reflects frequency for Unit 1 only, whereas reliability considers frequency for both units

(2) Duration of outage for planned maintenance.

(3) AOT Risk Level/Non-AOT Risk Level

