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February 5, 2012

PG&E Letter DCL-12-016
U.S. Nuclear Regulatory Commission 10 CFR 50.90

ATTN: Document Control Desk
Washington, DC 20555-0001

Docket No. 50-275, OL-DPR-80
Docket No. 50-323, OL-DPR-82
Diablo Canyon Units 1 and 2
Response to NRC Request for Additional Information Regarding License Amendment Request 11-03, "Revision to Technical Specification 3.8.1, 'AC Sources - Operating' for Traveler TSTF-163, Revision 2, and Exception to Regulatory Guide 1.9, Revision 0"

References: 1. PG&E Letter DCL-11-038, "License Amendment Request 11-03, Revision to Technical Specification 3.8.1, 'AC Sources - Operating' for Traveler TSTF-163, Revision 2, and Exception to Regulatory Guide 1.9, Revision 0," dated March 28, 2011.

Dear Commissioners and Staff:

In Reference 1, Pacific Gas & Electric (PG&E) submitted License Amendment Request (LAR) 11-03 to revise the Operating Licenses to revise Technical Specification 3.8.1, "AC Sources - Operating," to incorporate Technical Specification Task Force Traveler 163, Revision 2, and to revise the Final Safety Analysis Report Update to identify an exception to Regulatory Guide 1.9, Revision 0, for the auxiliary feedwater pump motors.

On January 5, 2012, the NRC staff requested additional information required to complete the review of LAR 11-03. PG&E's responses to the staff's questions are provided in Enclosure 1.

This information does not affect the results of the technical evaluation or the significant hazards consideration determination previously transmitted in Reference 1.

PG&E makes no regulatory commitments (as defined by NEI 99-04) in this letter. This letter includes no revisions to existing regulatory commitments.

If you have any questions, or require additional information, please contact Tom Baldwin at (805) 545-4720.

I state under penalty of perjury that the foregoing is true and correct.

Executed on February 5, 2012.

Sincerely,

James R. Becker
Site Vice President

kjse/4328 SAPN 50366219/50341329
Enclosure
cc: Diablo Distribution
cc/enc: Gary W. Butner, Branch Chief, California Department of Public Health
Elmo E. Collins, NRC Region IV
Michael S. Peck, NRC, Senior Resident Inspector
Joseph M. Sebrosky, NRR Project Manager

PG&E Response to NRC Request for Additional Information Regarding License Amendment Request 11-03, "Revision to Technical Specification 3.8.1, 'AC Sources - Operating' for Traveler TSTF-163, Revision 2, and Exception to Regulatory Guide 1.9, Revision 0."

NRC Question 1a:

The licensee stated the following on page 15 of the enclosure to the license amendment request:

> *The test data from the 1R5, 2R5, 1R7, and 2R7 outages establish that there is adequate margin in the 4-second load timer interval to ensure there is no overlapping of loads and that the DG [diesel generator] is capable of starting and accelerating subsequent loads.*
>
> *For DGs 1-1 and 2-2 Bus H, the AFW [auxiliary feedwater] pump load is followed by the containment spray (CS) pump load. Since the AFW [auxiliary feedwater] pump motor is one of the largest loads sequenced on a bus (600 hp per FSAR [Final Safety Analysis Report] Update Table 8.3-5) and it has one of the longest start (acceleration) times, it is expected that the frequency recovery would require a longer interval than other ESF [engineered safety feature] loads. The frequency response for the AFW pump motors was compared to one another for available data from the 1R5, 2R5, 1R7, and 2R7 outages. The AFW pump response was consistent, indicating that the extended frequency recovery was not related to an unusual or degraded DG or AFW pump condition or DG overload. The test data demonstrates that the DG frequency consistently stabilizes within a nominal 2.2 to 2.3 seconds and that the DGs are capable of starting and accelerating the subsequent ESF loads.*

Provide a summary of the test data from the 1R5, 2R5, 1R7, and 2R7 outages to demonstrate that there is adequate margin in the 4-second load timer interval to ensure that there is no overlapping of loads, that the DG frequency consistently stabilizes within a nominal 2.2 to 2.3 seconds, and that the DG is capable of starting and accelerating subsequent ESF loads.

PG&E Response:

In License Amendment Request (LAR) 11-03 contained in Pacific Gas and Electric (PG&E) Letter DCL-11-038, dated March 28, 2011, PG&E only requested an exception to Regulatory Guide (RG) 1.9, Revision 0, Regulatory Position C.4, for the frequency recovery for Auxiliary Feedwater (AFW) pump loading for Diesel Generators (DGs) 1-1, 1-3, 2-2, and 2-3. The exception to RG 1.9, Revision 0, Regulatory Position C.4, for the frequency recovery is not being requested for any

other engineered safety feature (ESF) components loaded on a bus powered by the DGs. The frequency recovery for other ESF components loaded on a bus powered by the DGs meets the Regulatory Guide 1.9, Revision 0, Regulatory Position C.4, for the frequency recovery (2 percent of nominal in less than 40 percent of each load sequence time interval).

Frequency response data was collected during DG loading of ESF loads during Diablo Canyon Power Plant (DCPP) Unit 1 Fifth Refueling Outage (1R5), Unit 2 Fifth Refueling Outage (2R5), Unit 1 Seventh Refueling Outage (1R7), and Unit 2 Seventh Refueling Outage (2R7). The AFW pump frequency response for the collected data during these refueling outages is summarized below. The plots of the recorded frequency response during DG testing during 1R5, 1R7, and 2R7 are contained in Attachment 1 of the Enclosure of this letter.

1R5:
AFW pump 1-3 (DG 1-3) - frequency recovery time to within 2 percent of nominal was 2.2 seconds.

2R5:
AFW pump 2-2 (DG 2-2) - frequency recovery: frequency did not dip below 98 percent (see Note 1)
AFW pump 2-3 (DG 2-3) - frequency recovery: frequency did not dip below 98 percent (see Note 1)

Note 1: This information was obtained from a supplemental test that was performed with a single AFW pump motor started with the DG preloaded and the kilowatt sensing (KWS) relay actuation blocked (turbo assist defeated). During the scheduled DG loading surveillance test, frequency plots were not obtained due to recorder problems.

1R7:
AFW pump 1-2 (DG 1-1) - frequency recovery time to within 2 percent of nominal was 2.2 seconds.
AFW pump 1-3 (DG 1-3) - frequency recovery time to within 2 percent of nominal was 2.3 seconds.

2R7:
AFW pump 2-2 (DG 2-2) - frequency recovery time to within 2 percent of nominal was 2.2 seconds.
AFW pump 2-3 (DG 2-3) - frequency recovery time to within 2 percent of nominal was 2.2 seconds.

The results of the recorded data from 1R5, 1R7, and 2R7 show that there was no overlapping of loads and that frequency recovery above 98 percent of 60 Hertz (Hz) was under 2.4 seconds. When the AFW frequency recovery above 98 percent of 60 Hz was greater than 1.6 seconds (40 percent of the 4-second load timer interval),

following breaker closure of the AFW pumps, there was no impact on the ability of DG 1-1 and 1-2 to start and accelerate the containment spray pump. For DG 1-3 and 2-3, the AFW pump is the last ESF sequenced load.

NRC Question 1b:

Provide a discussion that demonstrates that all large loads are strictly dependant on sequencer permissive signals and that the loading sequence is not affected by process signals (e.g., system pressure, temperature, level, etc.) which could lead to overlapping or simultaneous actuation of loads.

PG&E Response:

For Diablo Canyon Power Plant (DCPP), all vital 4 kilovolt (kV) and 480 volt (V) large loads, that are sequenced on the bus powered by a DG, have a set of two timing relays, auto-transfer relays, and ESF relays that sequence the loads on the bus. The timers are energized when the DG output breaker closes on the vital 4 kV bus. Each timing relay has a setpoint to ensure the load sequence interval of 4 seconds is met. Failure of one timer does not preclude the rest of the loads to sequence on the bus.

The loading sequence for the vital 4 kV and 480 V loads, except the containment spray (CS) pump, are not affected by process signals. The AFW, auxiliary saltwater, and component cooling water pump circuits have other process based automatic start signals; however, they are blocked when the sole source of electrical power is the respective DG.

The CS pumps are powered by Bus G and Bus H. The CS pump start logic includes a process permissive (Hi-Hi Containment Pressure) and requires both the sequencing timer to time out and the Hi-Hi Containment Pressure permissive to be present for the CS pump to start. Therefore, the process signal for the Hi-Hi Containment Pressure cannot cause the CS pump to start prior to the sequencing timer timing out. The CS pump is the last ESF load to be sequenced on Bus G and Bus H. Therefore, in the event the Hi-Hi Containment Pressure permissive becomes present after the sequencing timer times out, there is no potential for overlapping or simultaneous actuation of another ESF load on Bus G and Bus H.

NRC Question 1c:

Clarify whether pumps were in recirculation mode or fully loaded during the testing period. If tested in recirculation mode, explain how the 4-second load time interval is adequate for worst case design basis accident loading conditions.

PG&E Response:

The AFW pumps were in recirculation mode during the testing period. It is acknowledged that the recirculation mode does not represent worst case loading conditions. The worst case loading condition generally corresponds with maximum flow. However, maximum AFW pump flow does not occur when the pumps are first started. At DCPP, one AFW pump supplies two steam generators (SG). Although the discharge valve to each SG is initially open, only one SG is assumed to be faulted (i.e. main steam line break or feedwater line break) and depressurized. Worst case loading occurs after the second SG begins to depressurize gradually due to subsequent reactor coolant system (RCS) cooldown. This occurs after the AFW motor acceleration period. Thus, the DG loading differences between these conditions is negligible during the motor acceleration period. Therefore, the 4-second load time interval is adequate for worst case design basis accident loading conditions.

NRC Question 1d:

The minimum steady-state frequency proposed in the LAR is 58.8 Hz. Provide details on the magnitude and duration of frequency variation that would be expected during sequencing of large loads when the DG is operating at this frequency.

PG&E Response:

LAR 11-03 requested changes to Technical Specification (TS) surveillance requirements (SRs) 3.8.1.2, 3.8.1.7, 3.8.1.12, 3.8.1.15, and 3.8.1.20. For SRs 3.8.1.2, 3.8.1.7, 3.8.1.12, 3.8.1.15, and 3.8.1.20, the DGs are started but they are not loaded. Therefore, there is no impact on DG loading or the performance of motors (pumps) or valves when the DG is operating at the proposed minimum steady-state frequency of 58.8 Hz during the performance of SRs 3.8.1.2, 3.8.1.7, 3.8.1.12, 3.8.1.15, and 3.8.1.20. LAR 11-03 did not request a change to the current minimum frequency value of 58.8 Hz contained in the TS 3.8.1 SRs.

When starting the AFW pump motors with an initial frequency of 60 Hz, the frequency is not expected to drop below 57 Hz (i.e., 95 percent of nominal) and is expected to recover to at least 58.8 Hz within 2.4 seconds. When starting other large loads with an initial frequency of 60 Hz, the frequency is not expected to drop below 57 Hz (i.e., 95 percent of nominal) and is expected to recover to at least 58.8 Hz within 1.6 seconds. If the initial frequency was 58.8 Hz rather than 60 Hz, all of the induction motors would exhibit increased torque capability and consequently accelerate faster. Therefore, the duration of the resultant frequency transient would be less than that for the load starting at 60 Hz.

Based on the frequency response data recorded during DG loading of ESF loads during 1R5, 1R7, and 2R7, after sequencing of a large load, the DG frequency may dip below 58.8 Hz, but it then recovers to at least approximately 60 Hz prior to the

next sequenced ESF load. Therefore, the 2.4 second recovery time is acceptable as it provides an additional 1.6 seconds time to recover to the approximately 60 Hz prior to the next sequenced ESF load.

NRC Question 1e:

Provide a summary of the impact on EDG loading when operating at extreme values of the TS frequency range (i.e., ≥58.8 Hz and ≤61.2 Hz). Identify if operating time and performance capabilities of critical motors (pumps) or motor operated valves are affected.

PG&E Response:

LAR 11-03 requested changes to TS SRs 3.8.1.2, 3.8.1.7, 3.8.1.12, 3.8.1.15, and 3.8.1.20. For SRs 3.8.1.2, 3.8.1.7, 3.8.1.12, 3.8.1.15, and 3.8.1.20, the DGs are started but they are not loaded. Therefore, there is no impact on DG loading or the performance of motors (pumps) or valves when operating at the extreme values of the TS frequency range (≥58.8 Hz and ≤61.2 Hz) for SRs 3.8.1.2, 3.8.1.7, 3.8.1.12, 3.8.1.15, and 3.8.1.20.

Current SRs 3.8.1.11 and 3.8.1.19 start and load the DG and require the DG to achieve a steady state voltage ≥3785 V and ≤4440 V and to achieve a steady state frequency ≥58.8 Hz and ≤61.2 Hz. LAR 11-03 did not request changes to SRs 3.8.1.11 and 3.8.1.19. For the requested exemption to the RG 1.9, Revision 0, in LAR 11-03, to allow 2.4 seconds or the frequency recovery for AFW pump loading for DGs 1-1, 1-3, 2-2, and 2-3, the step load change frequency transient recovery time for the AFW pumps does not impact the capability of the already running ESF motors. Induction motors are designed to operate with a 5 percent frequency variation according to the National Electrical Manufacturers Association (NEMA) Standard MG 1, which corresponds with the RG 1.9, Revision 0, recommended minimum frequency (i.e., 95 percent). This includes continuous duty motors (e.g., pumps) and motor operated valves (MOVs). Induction motor operation at less than nominal frequency impacts the performance capability in several ways. The available output torque increases and the synchronous speed (i.e., rpm) decreases.

Experience for DG loading at DCPP, has shown that properly operating DGs operate at a steady state frequency of 60 ± 0.25 Hz after loading of ESF pumps. This can be seen on the plots of the recorded frequency response during DG load testing in Attachment 1 of the Enclosure of this letter. The current TS Bases for the surveillance for the fast start test (SR 3.8.1.7) and hot restart test (SR 3.8.1.15) state that the "Actual steady state operation is expected to achieve a level of stability closer to the nominal 60 Hz value." This TS Bases statement was submitted to the NRC in PG&E Letter DCL-99-034, "Follow-up Items Related to Proposed Conversion to the Improved Technical Specifications Sections 3.3, 3.4, 3.6, 3.8, and 3.9," dated March 10, 1999, and was approved by the Staff as part of the TS Bases issued in License Amendments No. 135 to Facility Operating Licenses No. DPR-80

and No. DPR-82 for the DCPP, Unit Nos. 1 and 2, respectively, dated May 28, 1999. In the surveillance test procedures (STPs) for SRs 3.8.1.11 and 3.8.1.19, the DG steady state operating frequency is presently administratively limited to a range of 59.75 Hz and 60.25 Hz as indicated by the frequency recorder on the control board. If the frequency exceeds the administrative limits, the diesel frequency control is adjusted to within the administrative limits. Therefore, although current SRs 3.8.1.11 and 3.8.1.19 allow a steady state frequency ≥58.8 Hz and ≤61.2 Hz, properly operating DGs actually operate at a steady state frequency of 60 ± 0.25 Hz after loading of ESF pumps and thus the impact on DG load and the performance capabilities of pumps and valves is minimal.

NRC Question 2a:

According to the Diablo Canyon Final Safety Analysis Report (FSAR) Update, the second level of undervoltage protection for each vital 4.16 kilo-Volt bus is set at approximately 3800 Volts (V). The second level undervoltage setpoint is typically the minimum acceptable voltage for operation of safety-related equipment. In the license amendment request, the licensee is proposing a minimum voltage of 3785 V for sequencing and steady-state operation of the DG.

Provide a detailed discussion that demonstrates that equipment required for plant shutdown will perform within the design basis assumptions in the Diablo Canyon accident analyses when the DG is operating at the lowest allowable voltage and frequency.

PG&E Response:

LAR 11-03 requested changes to TS SRs 3.8.1.2, 3.8.1.7, 3.8.1.12, 3.8.1.15, and 3.8.1.20. For SRs 3.8.1.2, 3.8.1.7, 3.8.1.12, 3.8.1.15, and 3.8.1.20, the DGs are started but they are not loaded. Therefore, there is no impact on DG loading or the performance of equipment required for plant shutdown when the DG is operating at the lowest allowable voltage and frequency for SRs 3.8.1.2, 3.8.1.7, 3.8.1.12, 3.8.1.15, and 3.8.1.20. LAR 11-03 did not request a change to the current minimum voltage value of 3785 V contained in the TS 3.8.1 SRs.

Current SRs 3.8.1.11 and 3.8.1.19 start and load the DG and require the DG to achieve a steady state voltage ≥3785 V and ≤4440 V and to achieve a steady state frequency ≥58.8 Hz and ≤61.2 Hz. LAR 11-03 did not request changes to SRs 3.8.1.11 and 3.8.1.19. The steady state DG lower voltage limit of 3785 V coincides with the Second Level Undervoltage Relay allowable value. It has been demonstrated by an electrical power flow calculation that the voltage available at the terminals of ESF equipment is adequate for motor starting (i.e., 80 percent of motor continuous rating) and continuous operation (typically 90 percent equipment continuous rating) when the 4.16 kV vital buses are operating at 3785 V.

The motors for pumps and MOVs are designed to the NEMA MG 1 Standard. NEMA Standard MG 1 specifies alternating current motors shall operate successfully under running conditions with a variation in frequency up to 5 percent in rated frequency, with rated voltage. The lowest allowable steady state DG frequency is 2 percent below the normal frequency of 60 Hz and is well within the 5 percent variation specified for equipment capability.

The DCPP accident analyses assume equipment performance based on onsite and offsite power being provided at a continuous nominal 60 Hz. Properly operating DGs operate at a steady state frequency of 60 ± 0.25 Hz, except during the brief periods during loading of ESF pumps. In the STPs for SRs 3.8.1.11 and 3.8.1.19, the DG steady state operating frequency is presently administratively limited to a range of 60 ± 0.25 Hz (i.e., ± 0.4 percent) as indicated by the frequency recorder on the control board. If the frequency exceeds the administrative limits, the diesel frequency control is adjusted to within the administrative limits.

The accident analysis assume conservative ESF equipment performance delay times that bound the DG loading sequence and motor acceleration times. Therefore, the ESF equipment performance assumed in the accident analyses is not impacted since it is not credited until after the period when the DG is operating at the lowest allowable voltage and frequency due to the brief period of loading ESF equipment.

NRC Question 2b:

Confirm that the second level undervoltage relay does not have to be reset after actuation to allow the DG breaker to close.

PG&E Response:

The second level undervoltage relay does not need to be reset for the DG breaker to close. This capability is verified by STPs M-13F, M-13G, and M-13H, performed to meet the TS SR 3.8.1.11 loss-of-offsite power test, that verify upon actuation of the second level undervoltage relays that the DG starts and its breaker closes on the 4 kV bus.

NRC Question 3a:

TABLE 8.3-8 of the Diablo Canyon FSAR Update contains the following note:

> *Note 1: Original testing was done using a nominal 5-second load sequence time interval with the KWS relay installed. Since a nominal 4-second load sequence time interval is used in the design basis loading scenario and the EDG loading capability is demonstrated through computer simulation without KWS relays, the test results of Table 8.3-8 are of historical value.*

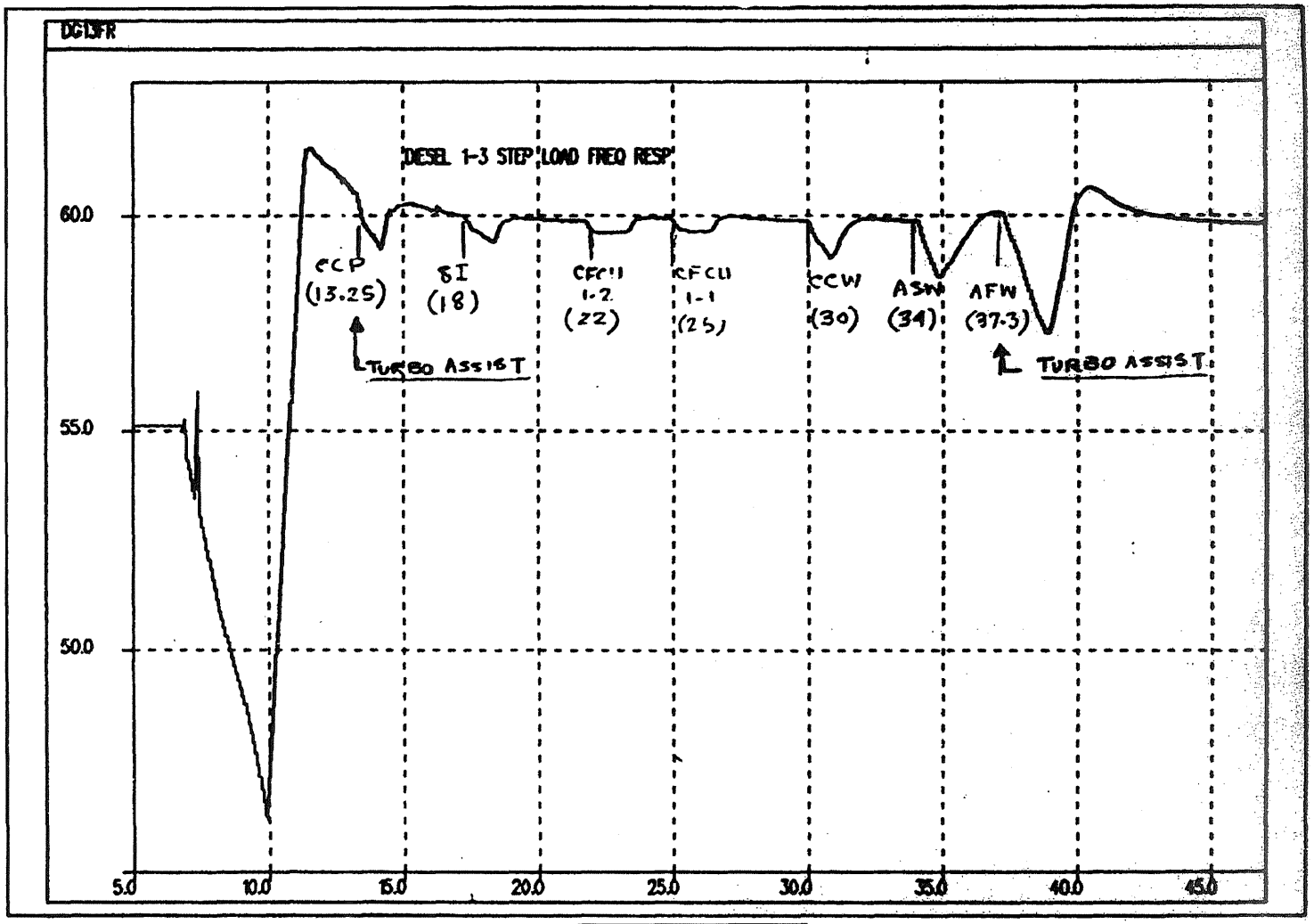
Provide details on how the computer simulation results are validated with actual operation of large loads, specifically as related to voltage and frequency variations during sequencing.

PG&E Response:

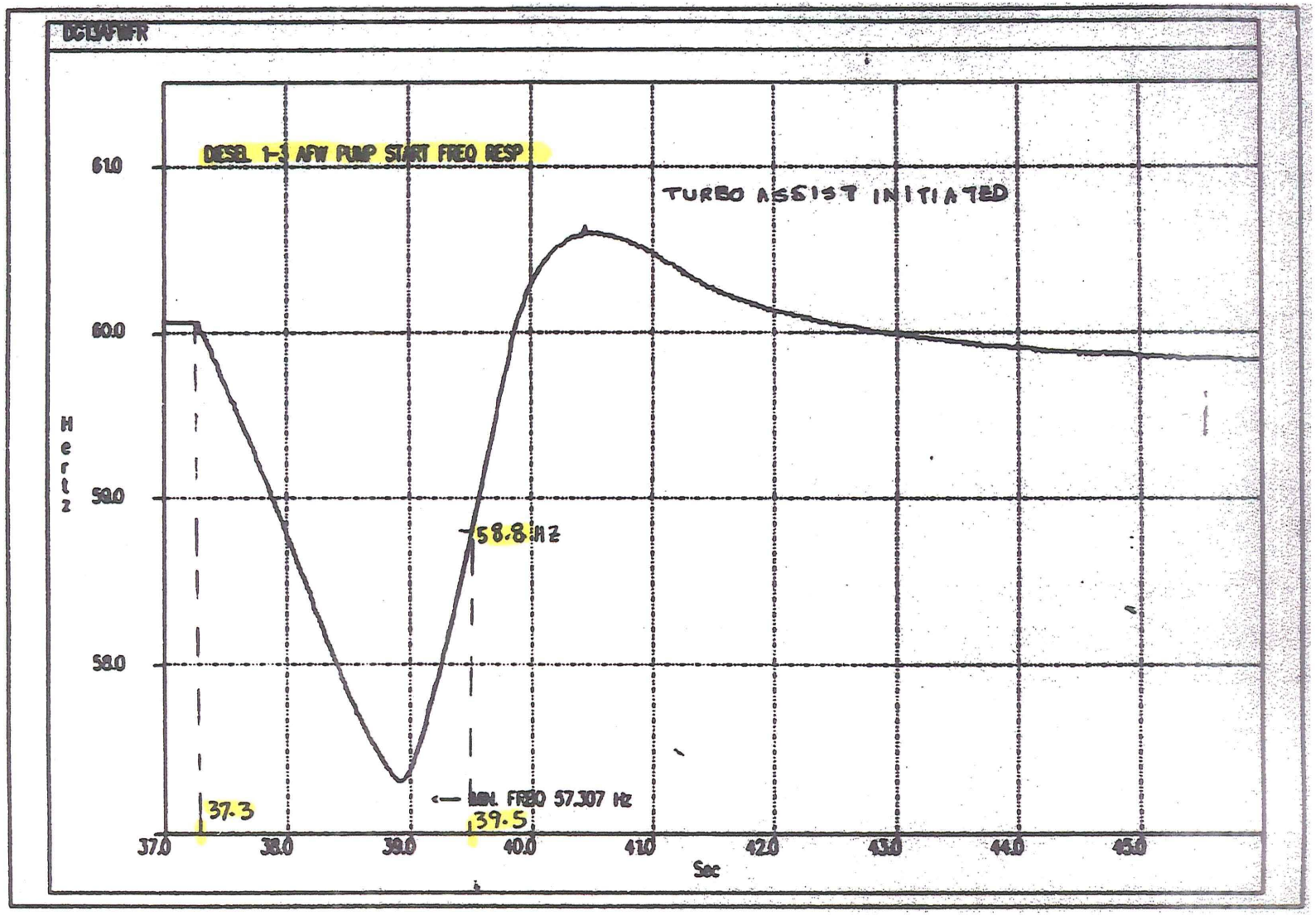
The Note 1 in Final Safety Analysis Report Update Table 8.3-8 refers to a one time computer simulation that was performed to support removal of the KWS relay. After removal of the KWS relay, DG loading surveillance testing was performed in the 1R7 and 2R7 outages with additional instrumentation to assess the actual DG voltage and frequency response to the RG 1.9 criteria. The computer simulation is no longer required or used to assess the DG voltage and frequency response. The reference to the computer simulation in FSAR Update Table 8.3-8 is historical information.

Diesel Generator Test Data from the 1R5, 1R7, and 2R7 Outages

1R5 Diesel Generator 1-3



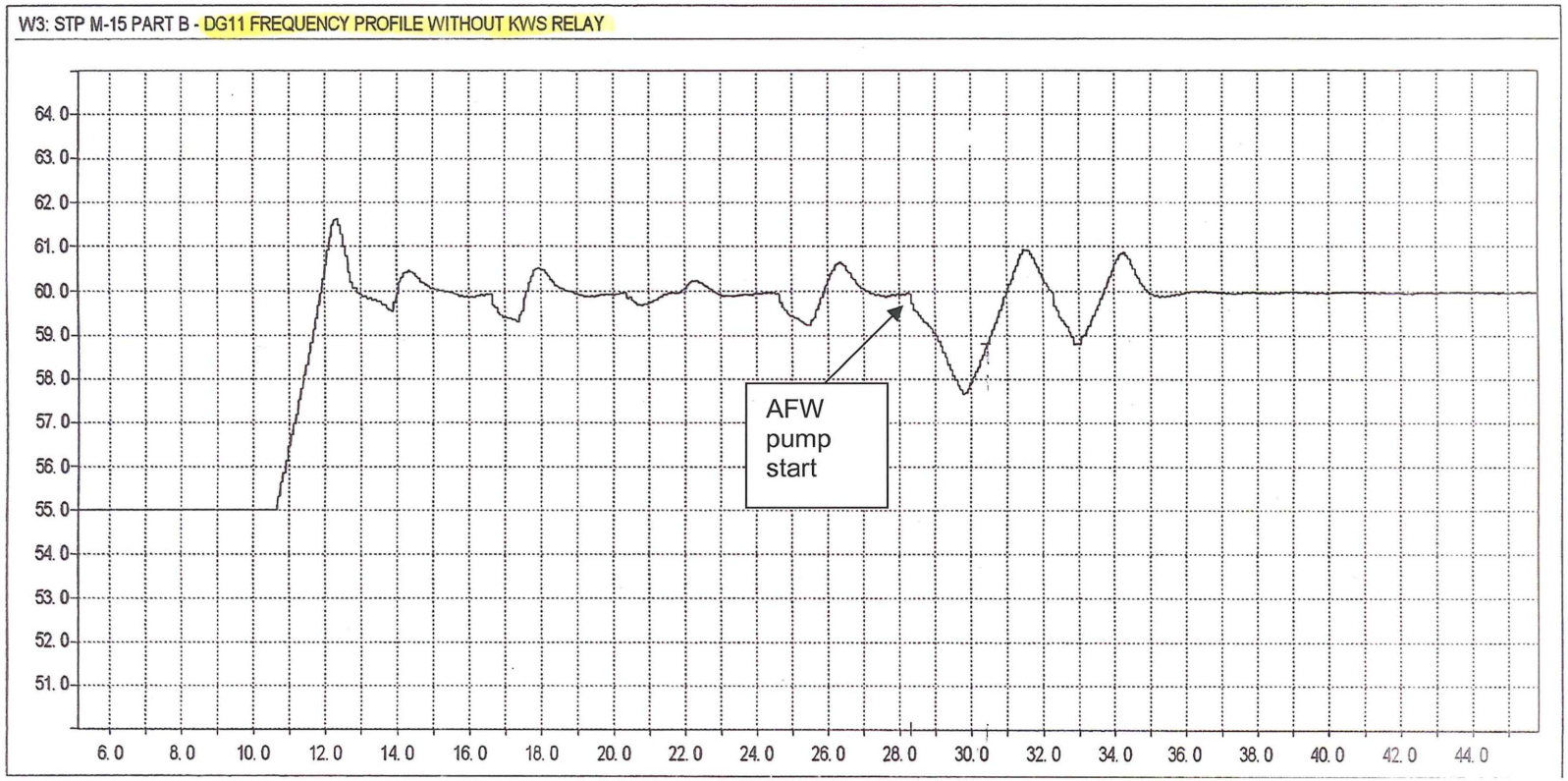
1R5 Diesel Generator 1-3



1R7 Diesel Generator 1-1

Dataset Name:	Unspecified
Version Number:	0
Series Name:	Unspecified
Date Acquired:	1-16-1996
Time Acquired:	15:02:00.56
Vert Units:	Hertz
Horiz Units:	Sec
Num Samples:	164736

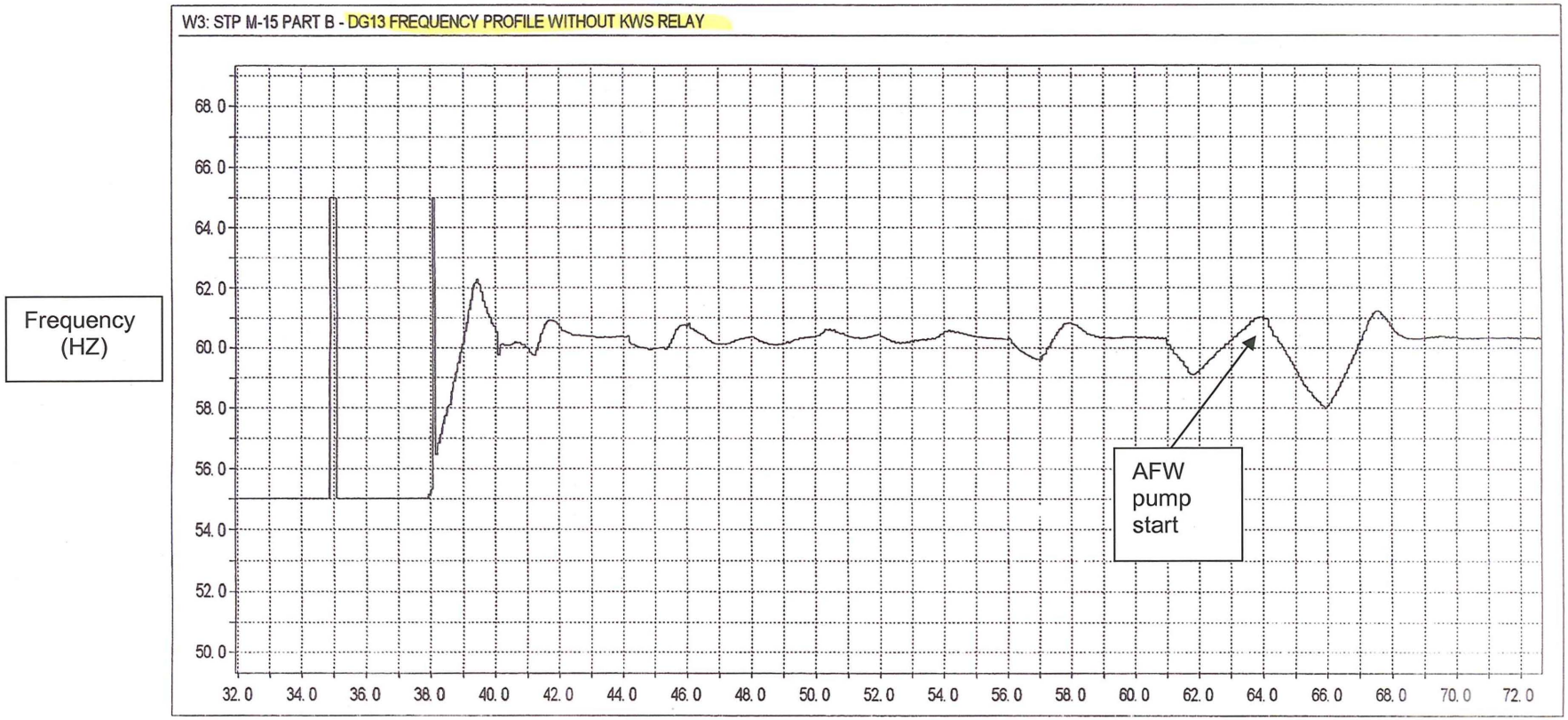
Sample Rate:	800
Maximum:	61.6309
Minimum:	54.9951
Comments:	



1R7 Diesel Generator 1-3

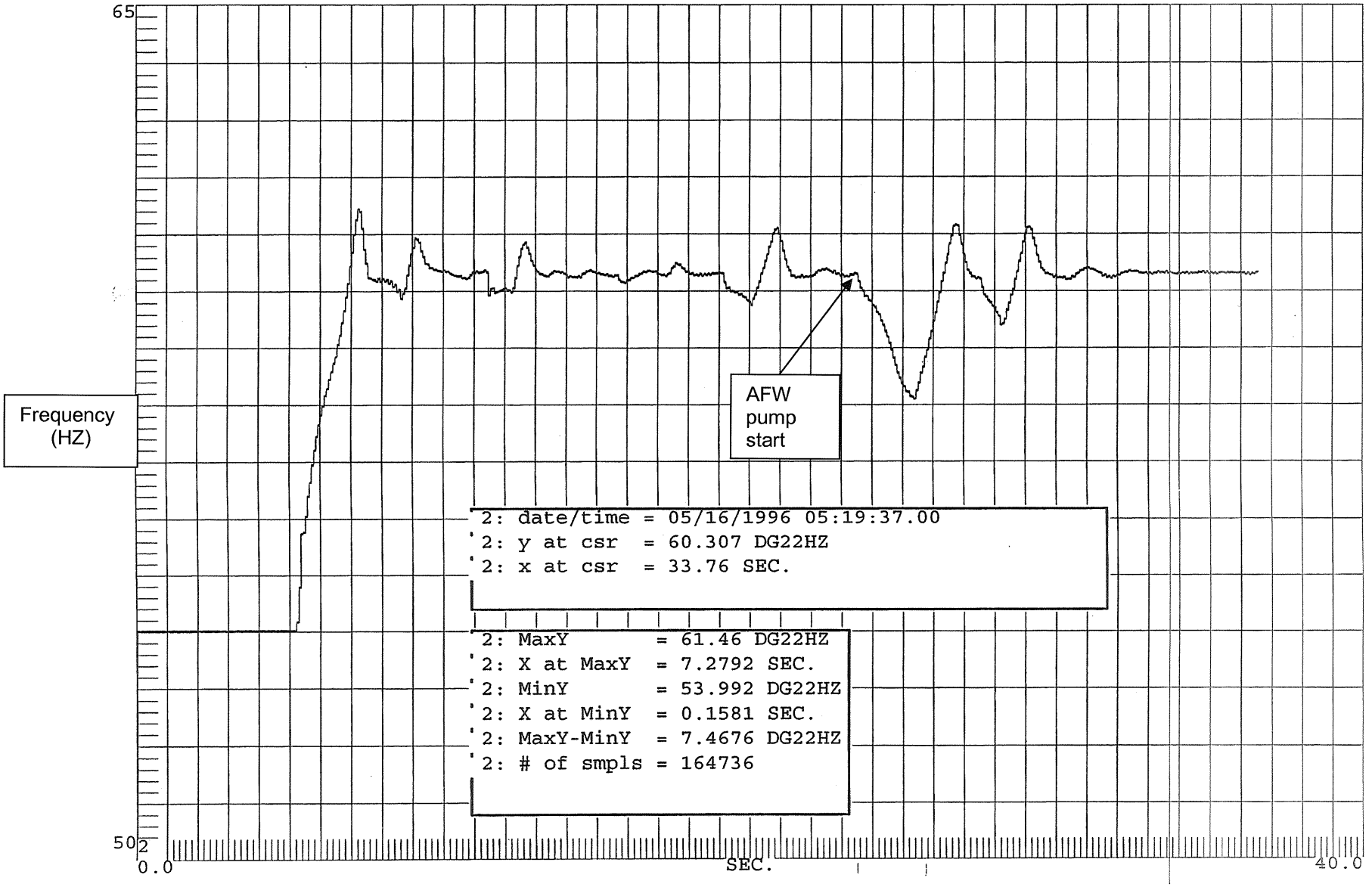
Dataset Name:	Unspecified
Version Number:	0
Series Name:	Unspecified
Date Acquired:	12-05-1995
Time Acquired:	17:28:18.14
Vert Units:	Hertz
Horiz Units:	Sec
Num Samples:	164736

Sample Rate:	800
Maximum:	64.9951
Minimum:	55.0146
Comments:	



Enclosure
Attachment 1
PG&E Letter DCL-12-016

2R7 Diesel Generator 2-2



2R7 Diesel Generator 2-3