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Site Vice President

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November 23, 2009

U. S. Nuclear Regulatory Commission
Washington, DC 20555 - 0001

ATTENTION: Document Control Desk

SUBJECT: **R.E. Ginna Nuclear Power Plant**
Docket No. 50-244

Reply to Request for Additional Information RE: Revisions to Loss-of-Power Diesel Generator Start Instrumentation Limiting Safety System Settings and Diesel Generator Load Test Value

REFERENCES:
(a) Letter from Mr. J. T. Carlin (Ginna LLC) to Document Control Desk (NRC) dated December 19, 2008, Application to Revise Technical Specification Limiting Conditions of Operation (LCOs) 3.3.2, 3.3.4, and 3.8.1

(b) Letter from Mr. J. T. Carlin (Ginna LLC) to Document Control Desk (NRC) dated January 22, 2009, Amendment to Application to Revise Technical Specification Limiting Conditions of Operation 3.3.2, 3.3.4, and 3.8.1

(c) Letter from Mr. E. A. Larson (Ginna LLC) to Document Control Desk (NRC) dated July 24, 2009, Reply to Request for Additional Information Associated with the Proposed License Amendment Request Regarding Revision of Technical Specification Limiting Conditions of Operation 3.3.2, 3.3.4, and 3.8.1

(d) Letter from Mr. D. V. Pickett (NRC) to Mr. J. T. Carlin (Ginna LLC) dated November 10, 2009, Request for Additional Information RE: Revisions to Loss-of-Power Diesel Generator Start Instrumentation Limiting Safety System Settings and Diesel Generator Load Test Value (TAC NO. ME0291)

On December 19, 2008, R.E. Ginna Nuclear Power Plant, LLC (Ginna LLC) submitted a License Amendment Request (LAR) seeking to revise Technical Specification (TS) Limiting Conditions of Operation (LCOs) 3.3.2, 3.3.4, and 3.8.1 (References (a) and (b)). As the result of an NRC Request for Additional Information, Ginna LLC subsequently submitted further information on July 24, 2009 (Reference (c)).

A001
NRR

WPLNRC-1002226

Subsequent to the most recent submittal, the NRC issued a second Request for Additional Information (Reference (d)). Attachment (1) contains our response to this request. Attachments (2) and (3) contain supporting information. No new commitments are being made in this submittal. Should you have questions regarding the information in this submittal, please contact Mr. Thomas Harding at (585) 771-5219 or via email at Thomas.HardingJr@cengllc.com.

Very truly yours,

STATE OF NEW YORK :
: **TO WIT:**
COUNTY OF WAYNE :

I, John Carlin, being duly sworn, state that I am Vice President, R.E. Ginna Nuclear Power Plant, LLC (Ginna LLC), and that I am duly authorized to execute and file this request on behalf of Ginna LLC. To the best of my knowledge and belief, the statements contained in this document are true and correct. To the extent that these statements are not based on my personal knowledge, they are based upon information provided by other Ginna LLC employees and/or consultants. Such information has been reviewed in accordance with company practice and I believe it to be reliable.

Subscribed and sworn before me, a Notary Public in and for the State of New York and County of Monroe, this 23 day of November, 2009.

WITNESS my Hand and Notarial Seal:

Notary Public

SHARON L. MILLER
Notary Public, State of New York
Registration No. 01MI6017755
Monroe County
Commission Expires December 21, 2010

My Commission Expires:

12-21-10
Date

Attachment 1: Response to Request for Additional Information Regarding Revisions to Loss-of-Power Diesel Generator Start Instrumentation Limiting Safety System Settings and Diesel Generator Load Test Value
Attachment 2: Pages from DA-EE-92-111-01, Diesel Generator A Dynamic Loading Analysis
Attachment 3: Pages from DA-EE-92-112-01, Diesel Generator B Dynamic Loading Analysis

cc: S. J. Collins, NRC
D. V. Pickett, NRC
Ginna Resident Inspector, NRC
P. D. Eddy, NYSDPS
A. L. Peterson, NYSERDA

ATTACHMENT 1

Response to Request for Additional Information Regarding Revisions to Loss-of-Power Diesel Generator Start Instrumentation Limiting Safety System Settings and Diesel Generator Load Test Value

Request for Additional Information Question #1a:

In response to Question #11c in the licensee's letter dated July 24,2009, it was stated that "Attachment 6 contains individual Diesel Loading Simulation results for A and B Diesel Generator in three different scenarios. For each diesel, a baseline (where the containment spray pump does not come on), a "most likely" and a "worst case scenario" are provided."

The NRC staff could not find the requisite response (voltage and frequency simulation) in Attachment 6 of the licensee's submittal. Please provide analysis for the worst case voltage and frequency transients of the diesel generator, if a containment spray pump is started coincident with another large load, and compare the voltage and frequency variation limits to those recommended in Regulatory Guide 1.9.

The attached pages from Diesel Generator A Dynamic Loading Analysis, DA-EE-92-111-01, revision 2, (Attachment 2) show the requested information for the A diesel generator.

- Section 7.4.6 provides the acceptance criteria, with section 7.4.6.2 containing Regulatory Guide 1.9 requirements.
- Case DGA FU1 – D/G loading without containment spray. Table 6 defines the design criteria reference lines in the diesel generator transient response plots. The analysis figures must be in color in order to differentiate the lines.
- Case DGA FU2 – containment spray loaded with MCC C with transient plots
- Case DGA FU3 – containment spray loaded with service water pump, WORST CASE, with transient plots

The attached pages from Diesel Generator B Dynamic Loading Analysis, DA-EE-92-112-01, revision 1, (Attachment 3) show the requested information for the B diesel generator. This analysis is currently being revised to include the level of detail shown in the A diesel generator analysis, it is not in color. The present revision does not have the criteria reference lines shown on the transient plots.

- Section 7.4.6.2 contains the Regulatory Guide 1.9 acceptance criteria.
- Cases FU1, FU2 and FU3 with voltage and frequency plots are provided.

Request for Additional Information Question #1b:

Also, explain how the UV (undervoltage) relays provide the same level of UV protection when the loads are fed from onsite emergency diesel generator source.

The 480 volt safeguards bus undervoltage (UV) protection contain degraded and loss of voltage relays that are active at all times. Each safeguards bus has its own set of UV protection relays.

When being fed from offsite power, actuation of the bus UV system strips all bus loads, except containment spray, MCC C and D and required downstream MCCs, and component cooling water breakers on buses 14 and 16. The normal bus supply breaker from the offsite power source is tripped. A start signal to the respective diesel generator

ATTACHMENT 2

Pages from DA-EE-92-111-01, Diesel Generator A Dynamic Loading Analysis

R.E. Ginna Nuclear Power Plant, LLC
November 23, 2009

CALCULATION COVER SHEET

A. INITIATION

Site ☐ CCNPP ☐ NMP ☒ REG

Calculation No.: DA-EE-92-111-01 Revision No.: 2

Vendor Calculation (Check one): ☐ Yes ☒ No

Responsible Group: NEE

Responsible Engineer: Bill Roettger

B. CALCULATION

ENGINEERING DISCIPLINE: ☐ Civil ☐ Instr & Controls ☐ Nuclear ☒ Electrical ☐ Mechanical ☐ Other ______

Title: DIESEL GENERATOR A DYNAMIC LOADING ANALYSIS

Unit ☒ 1 ☐ 2 ☐ COMMON

Proprietary or Safeguards Calculation ☐ YES ☒ NO

Comments: PERIODIC REVISION

Vendor Calc No.: ______ REVISION NO.: ______

Vendor Name: ______

Safety Class (Check one): ☒ SR ☐ AUGMENTED QUALITY ☐ NSR

There are assumptions that require Verification during walkdown: TRACKING ID: N/A

This calculation **SUPERSEDES**: DA-EE-92-111-01, REVISION 1

C. REVIEW AND APPROVAL:

Responsible Engineer: Bill Roettger [signature] 1/28/09
Printed Name and Signature Date

Is Design Verification Required? ☐ Yes ☐ No

If yes, Design Verification Form is ☐ Attached ☐ Filed with: ______

Independent Reviewer: Kiley Scott [signature] 1/29/09
Printed Name and Signature Date

Approval: Jarrell A. Jackson 10/5/09
Printed Name and Signature Date

7.4.6 **Simulation Acceptance Criteria**

7.4.6.1 The ETAP computer program was run for each of the cases outlined in section 2.1. The acceptance criteria were in accordance with IEEE-387 which specifies that the diesel generator should be capable of starting, accelerating, and being loaded with the design load within the time required by the equipment specification.

7.4.6.2 Regulatory Guide 1.9 specifies during motor starting the minimum frequency should not be less than 0.95 per unit (57 Hz) and should be restored to within 2% of nominal (58.8 Hz) within 60% of each load sequence interval. The minimum voltage should not be less than 0.75 per unit and should be restored to within 10% of nominal within 60% of each load sequence interval. Nominal voltage at Ginna is 480 volts RMS. The regulatory guide indicates that a greater percentage of the time interval may be used if it can be justified by analysis. However, the load sequence time interval should include sufficient margin to account for the accuracy and repeatability of the load sequence timer.

7.4.6.2.1 The above mentioned limits with regards to voltage and frequency will be interpreted as good "rule of thumb" design objectives however slight violations of those specific limits may be considered acceptable if justified by detailed dynamic analysis. Such analysis must demonstrate that the "intent" of the Regulatory Guide is met; namely all of the required loads do come up to rated voltage and speed within the time required to successfully mitigate an accident. Similarly, if the detailed dynamic analysis demonstrates that the intent of the Regulatory Guide is not met, even though the voltage and frequency criteria are not violated, the results would be considered unacceptable.

7.4.6.3 NRC Branch Technical Position PSB-1 (Reference 3.2.2) indicates that if the load shed feature is retained during sequencing of emergency loads to the bus, the setpoint value in the Technical Specifications for the loss of voltage relay must specify a value having maximum and minimum limits and the basis for those limits must be documented. Ginna does not bypass the automatic load shedding scheme during the sequencing of the emergency loads. It must therefore be demonstrated that the load shedding scheme will not inadvertently operate during a sequencing event (Reference 4.4.27).

7.4.6.3.1 Reference 4.3.7 (Section 11.1.2) indicates that the loss of voltage relays at Ginna have a maximum analytical limit of 381.2 volts (79.42% of 480V). This is the maximum voltage at which the loss of voltage relay is expected to begin timing during an undervoltage condition. Section 11.3.1 indicates that difference between dropout and pickup on the loss of voltage relays is 1%. The same section indicates that the minimum analytical time delay limit is 2.0 seconds. The voltage profiles on both Bus 14 and 18, during the sequencing event, should be such that the loss of voltage relays will not operate during this event.

7.4.6.4 Regulatory Guide 1.9 also indicates that the potential for temporary over-frequency conditions that may be associated with the successful acceleration of a motor load and/or a tripping of the single largest load must not exceed the nominal speed plus 75% of the differences between nominal speed and the overspeed trip setpoint or 115% of nominal whichever is lower. The Ginna diesel engine is equipped with an overspeed trip device that shuts off the fuel supply and requires a manual reset before the diesel can be restarted (Reference 4.4.27 and Data sheet in Attachment II). The EDG Data sheet indicates that the overspeed trip setpoint is adjustable between 990 and 1035 RPM. Reference 4.1.5 indicates that the acceptance criterion for the overspeed trip setpoint is 1000 to 1050 RPM. Assuming that the trip setpoint could drift down to 990 RPM (66 Hz) then the maximum allowable frequency after successful motor acceleration and/or trip of the single largest motor would be 64.5 Hz.

7.4.6.5 Regulatory Guide 1.9 also indicates that the transient following a complete loss of load should not cause the diesel generator speed to reach the overspeed trip setpoint. Again assuming that the trip setpoint could drift down to 990 RPM, the maximum allowable frequency associated with a complete loss of load would be 66 Hz.

7.5.1 Case DGA_FU1

7.5.1.1 Simulation Description

This case quantifies the "A" diesel generator loading sequence during the "Injection phase" for the case where the Containment Spray pump does not come on. The timing sequence will be set up to simulate a LOOP after a LOCA. The purpose of this simulation is to identify a baseline case that will be used as the basis for establishing worst case simulations.

Upon SI all of the safeguard loads would be sequenced onto the buses (offsite power available) and start the EDG. A LOOP after LOCA event would result in all loads being tripped with the exception of the MCC=s. Then after approximately a 1.3 second time delay the EDG breakers would close and the loads would be resequenced on. A key point associated with this simulation is that the EDG has achieved a steady state condition (ie. V= 1.0 pu) prior to the first load being applied. A simultaneous LOOP LOCA simulation would typically have a less severe initial voltage dip since the first loads are applied prior to the EDG settling out to 1.0 per unit. Field results for a simultaneous LOOP LOCA indicate the EDG initially overshoots and is above 1.1 per unit when the EDG breaker is closed (ie MCC load connected). The simultaneous LOOP LOCA simulation is covered later in this report (case DGA_FU6).

7.5.1.2 Simulation Timer Settings

At time = 0.1 second corresponds to the point in time when the Diesel Generator Breaker closes and is therefore connected to MCC C. The MCC breaker is not tripped by the undervoltage relays (LOOP condition). The breaker associated with SI1A closes at time = 0.35 seconds. This 0.25 second delay after the closing of the diesel generator breaker is due to the time delays associated with the resetting of the undervoltage relays and breaker closing and was measured during testing. All of the Agastat timers were assumed to be at their nominal setting. The complete load sequencing for this simulation is as follows:

Action Summary			
Time (Sec.)	Device Type	Device ID	Action
0.100	Tie Protective Device	MCC1C_32C	Close
0.350	Induction Machine	SI1A Motor	Accelerate
3.850	Induction Machine	SI1C Motor	Accelerate
8.850	Induction Machine	RHR1A Motor	Accelerate
13.850	Induction Machine	SWP1A Motor	Accelerate
18.850	Induction Machine	CF1A Motor	Accelerate
23.850	Induction Machine	CF1D Motor	Accelerate
28.850	Induction Machine	AFWP1A Motor	Accelerate
30.100	Tie Protective Device	MCCC_EquivMtr	Open
53.350	SPST Switch	Sw_DynFanN	Close

The computer simulation is not an exact representation of the stated scenario because the transients associated with MOV actuation have been included in the simulation even though many of these valves would have already operated to their required state before power was lost and the EDG is sequenced on. Including this effect is not considered overly conservative because the voltage dip associated with the MCC loads is not that significant in either magnitude or duration when compared to the motor loads. In addition, the SI1A may still be spinning at about 45% (See attachment III) of rated speed when it is resequenced. While this won't change the magnitude of the initial voltage dip, it should shorten the duration of the dip.

The SI1A motor may have a small amount of residual voltage left when it is reconnected. This residual voltage could cause the voltage dip to be slightly better or worse depending on the exact instant of closure. This effect is considered small since the SI1A motor has an open circuit time constant of about 1.4 second, ref. 4.4.15, and the "dead time" is expected to approach 1.7 seconds (1.3 second timer delay, .25 second delay indicated above and .15 second delay for D/G breaker closing and associated relay operation). Also the motors residual voltage may have been somewhat and/or nearly completely depleted by whatever event resulted in the loss of offsite power condition.

7.5.1.3 Simulation Results

The results of this simulation are summarized graphically below. These results were generated by running the ETAP results through the post processing program EZFG. The EZFG program read the DGA_FU1.TS1 ETAP output file. A complete listing of the ETAP input data and results are also attached. The horizontal blue and red lines are added as an aid in order to compare the results against various design criteria. The associated design criteria are summarized in the following table:

Table 6, EZFG Horizontal Line Markers

Design Criteria Referene Lines (EZFG)		
EZFG Horizontal Line	**Value**	**Description**
Frequency Blue Line	58.8 Hz	Reg Guide 1.9 recovery limit - must recover above this limit within 60% of each load sequence interval
Frequency Red Line	57 Hz	Reg Guide 1.9, Minimum Freq limit
Voltage Blue Line	90%	(% of 480), Reg Guide 1.9 recovery limit - must recover above this limit within 60% of each load sequence interval
Voltage Red Line	79.42%	(% of 480 V), Max Analytical Drop out limit for LOV relay (min operate time = 2.0 seconds), Reg Guide 1.9 limit for minimum voltage is 75% of 480
Power Blue Line	1.95 MW	Continuous rating of EDG
Power Red Line	2.275 MW	Maximum output of EDGA

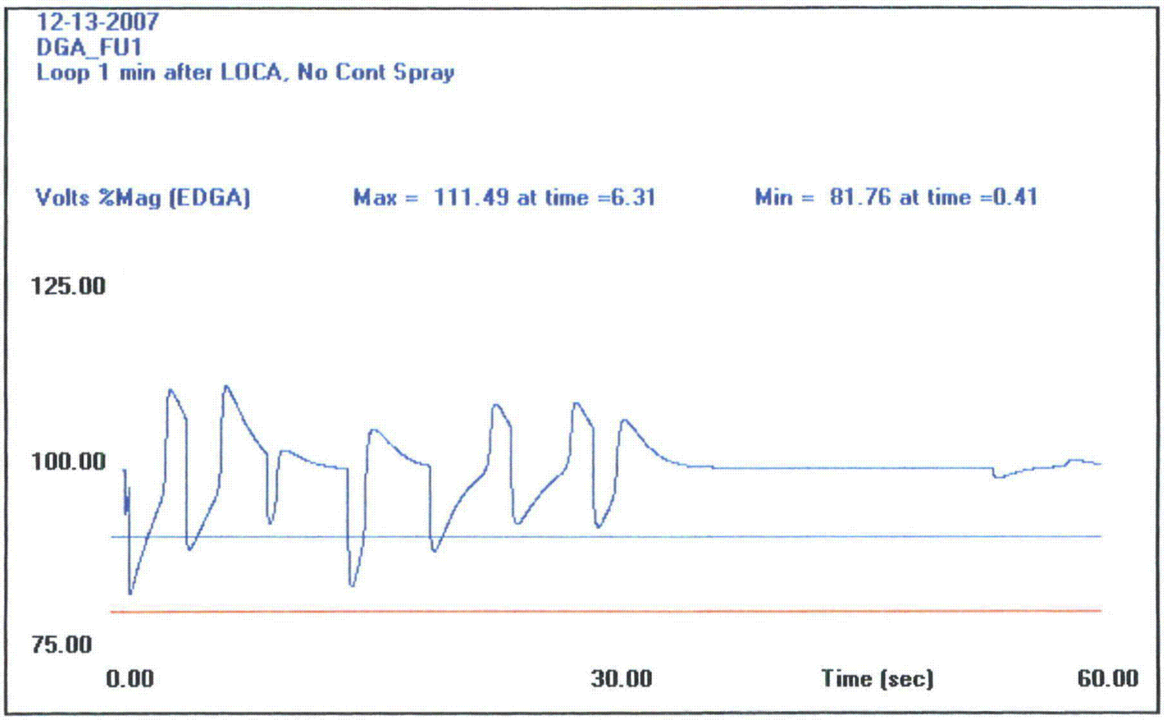


Figure 12, DGA_FU1, DG voltage (% 480V) profile

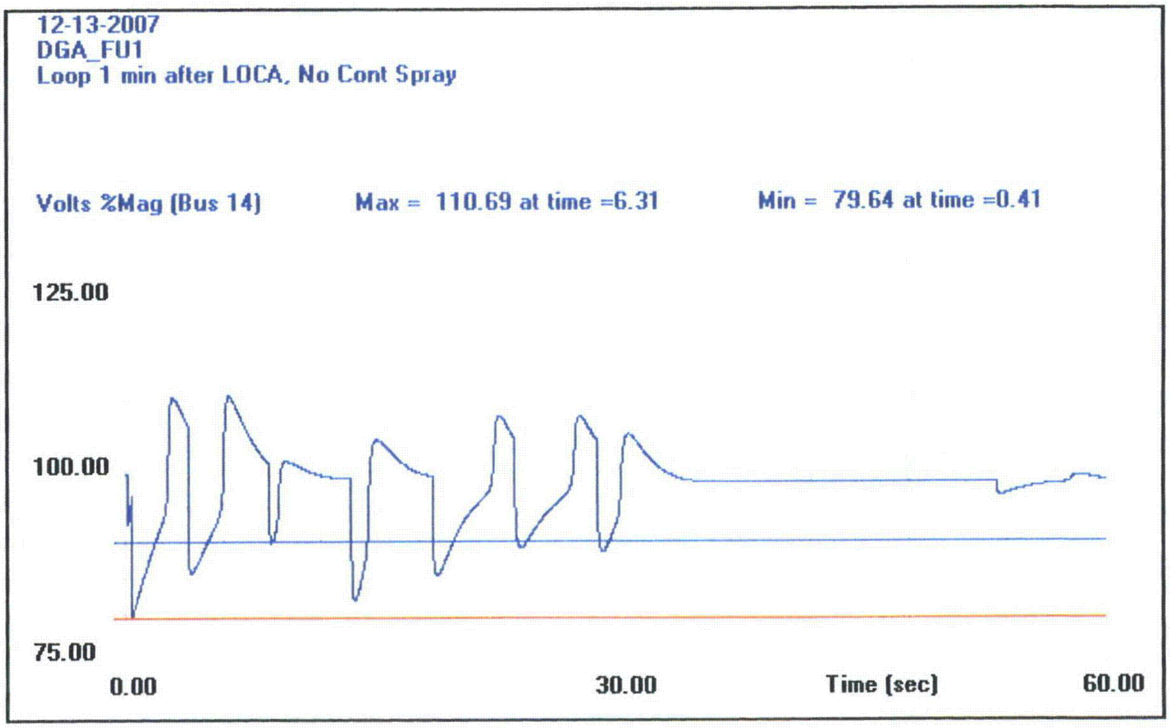


Figure 13, DGA_FU1 Bus 14 voltage (% 480V) profile

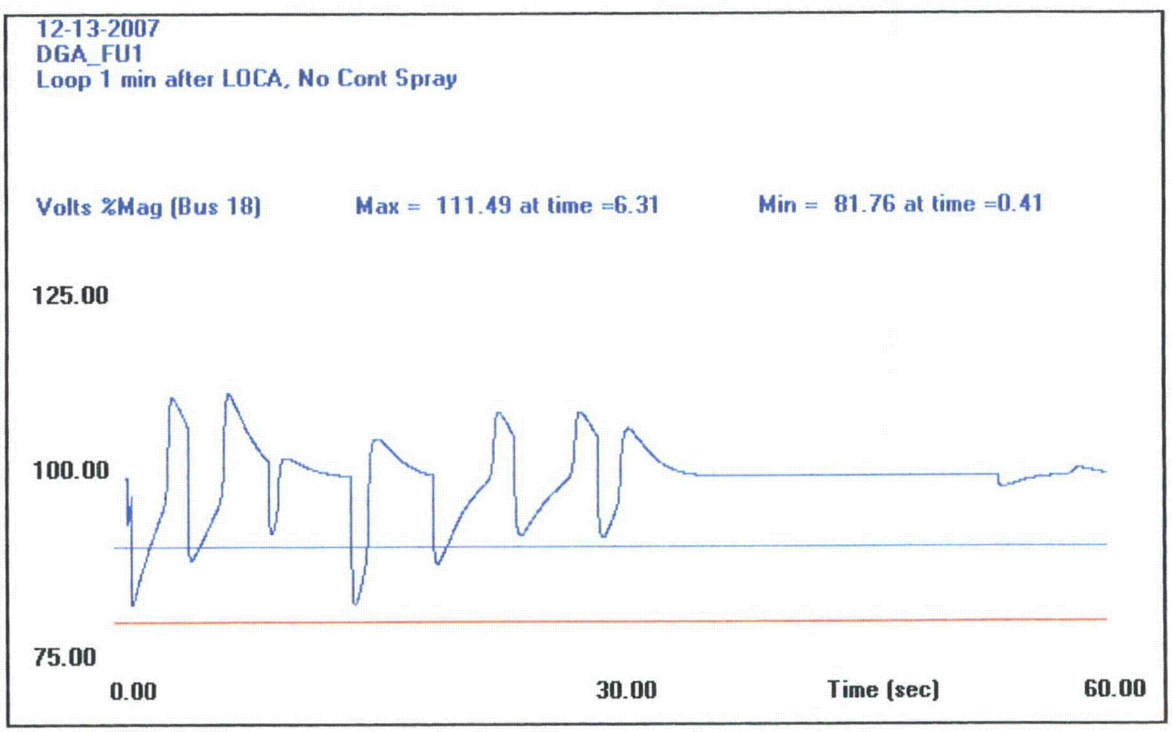


Figure 14, DGA_FU1, Bus 18 voltage (% 480V) profile

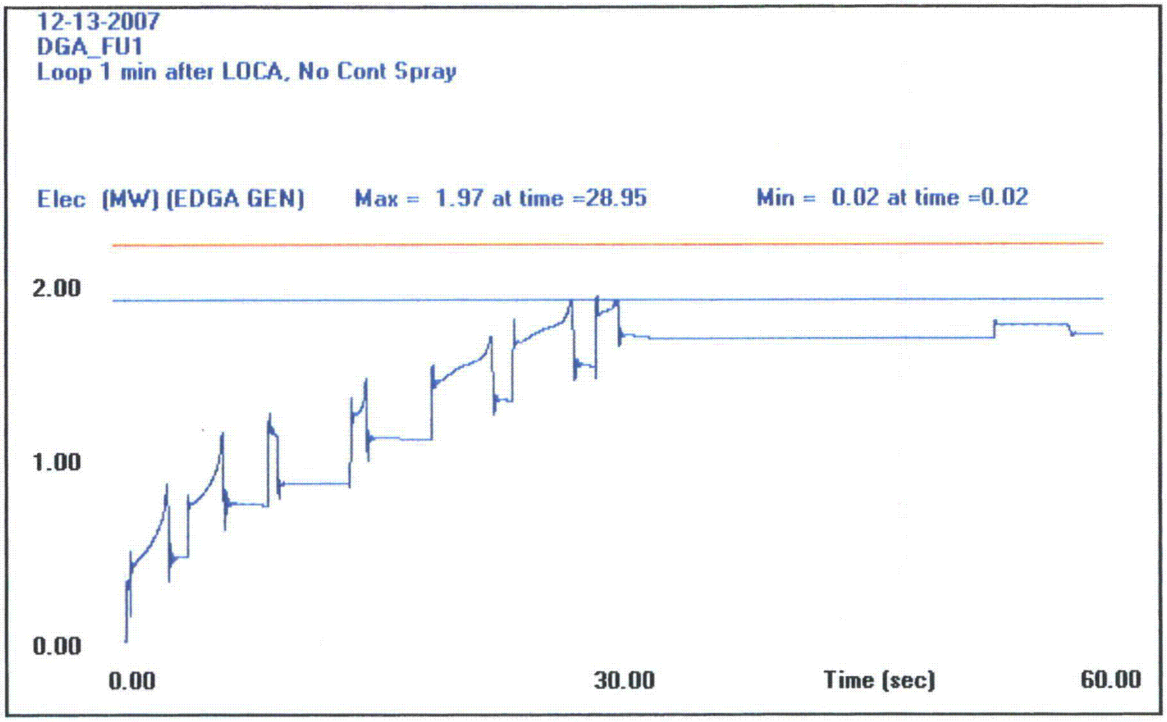


Figure 15, DGA_FU1, DG Power Profile

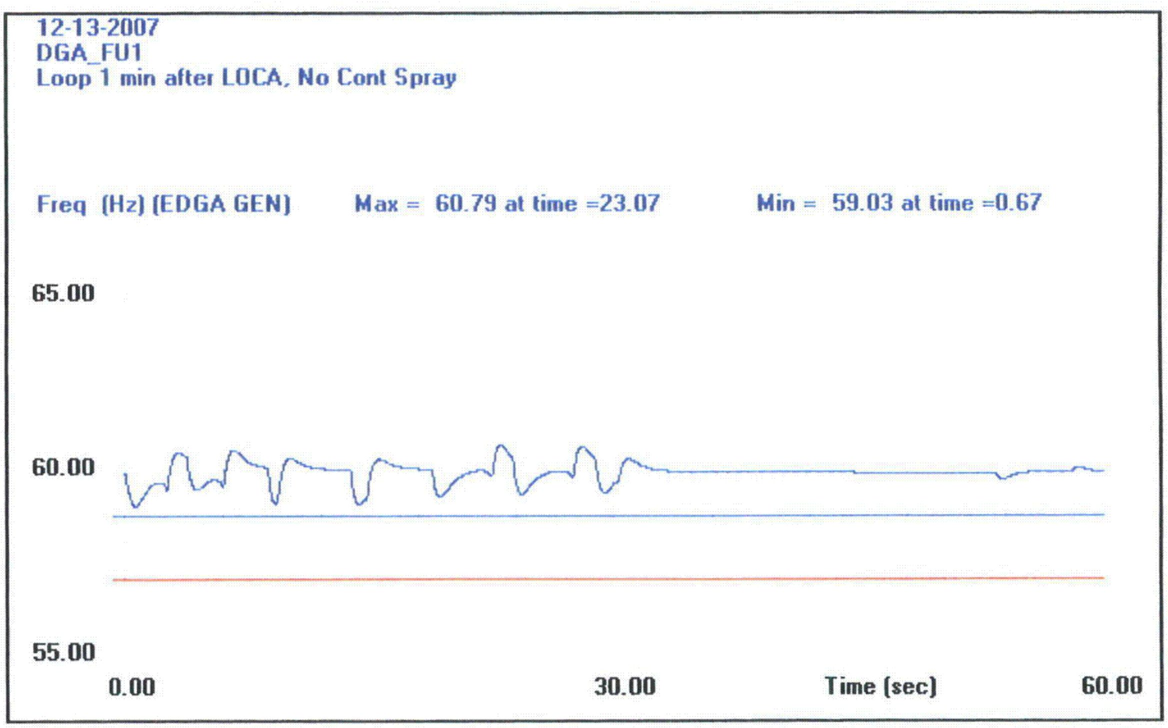


Figure 16, DGA_FU1, DG Frequency Profile

The above figures demonstrate that there are no Regulatory Guide violations associated with this simulation. They also demonstrate that the loss of voltage relays will not inadvertently operate and that all of the motors successfully accelerate.

The results of this simulation can be used to help determine the worst point in time for the Containment Spray to come on. This "worst case time" scenario will then be incorporated into the DGA_FU3 simulation.

The effect of the most recent revisions to this calculation are illustrated in the following three figures which compare the DGA_FU1 results for the 2007 and 1997 ETAP simulations. The EZFG program reads the 1997 ETAP output file (DGAFU1.OUT, Red Line) and compares it to the 2007 ETAP output file (DGA_FU1.TS1, Blue Line). All of the EZFG target multipliers are set to 1.0 for this comparison.

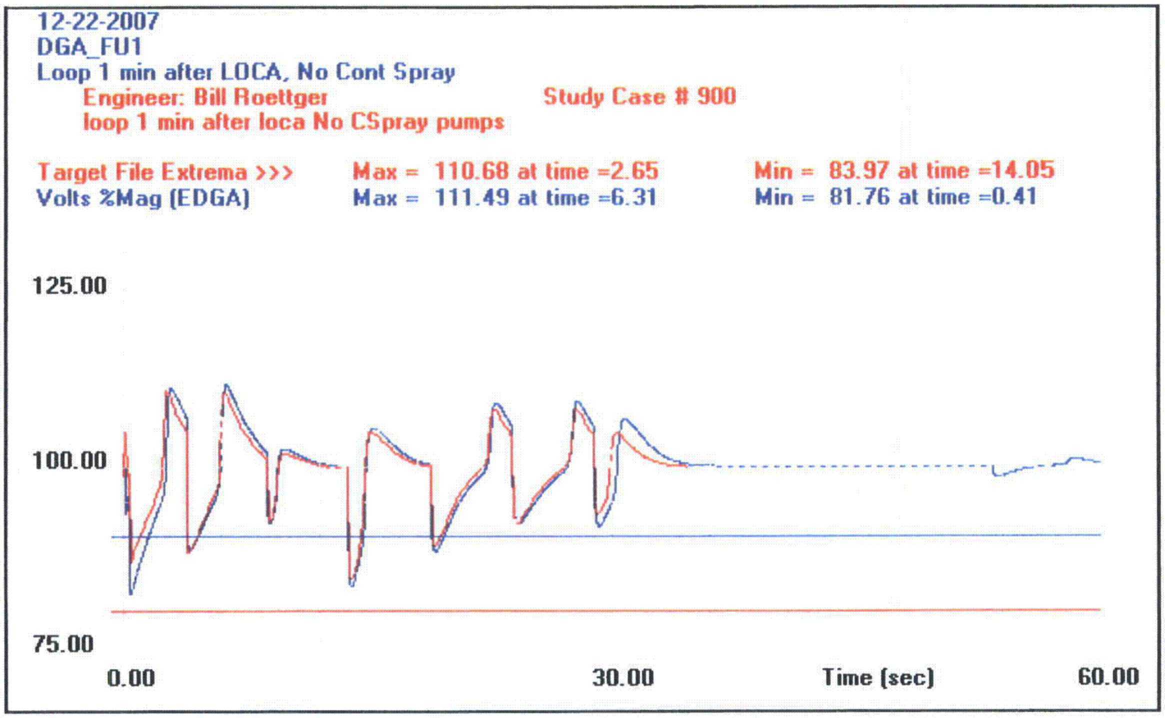


Figure 17, DGA_FU1, DG voltage (% 480V) profile (1997 Vs 2007)

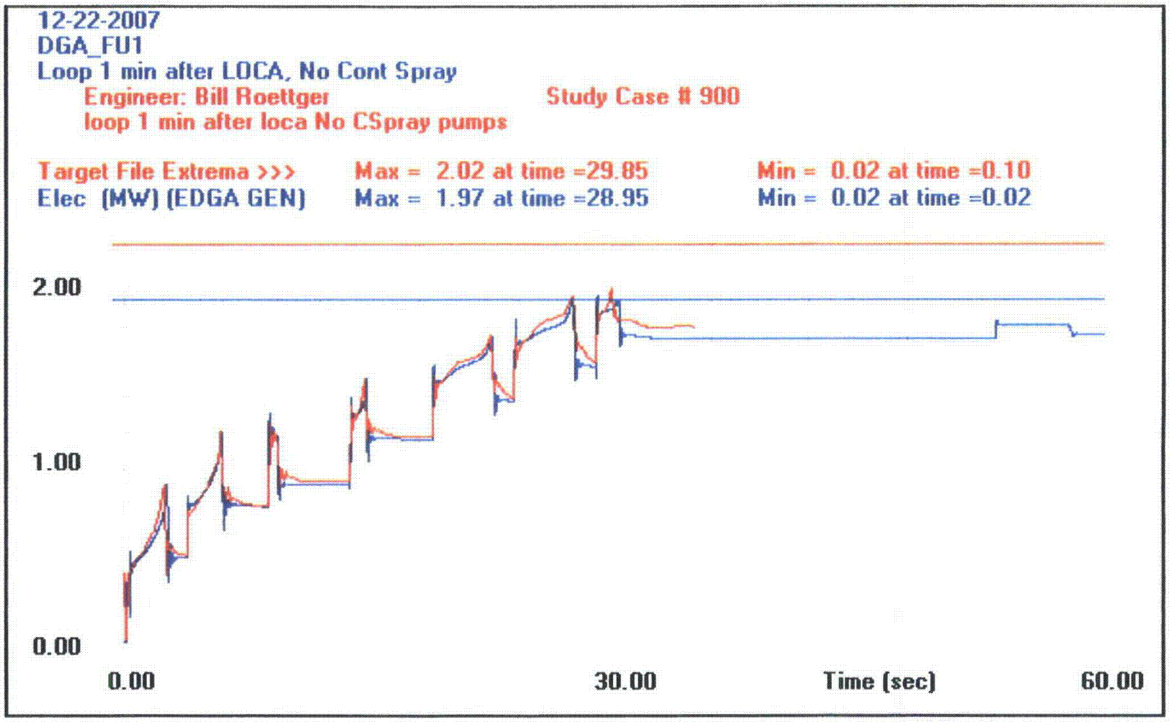


Figure 18, DGA_FU1 DG power profile (1997 Vs 2007)

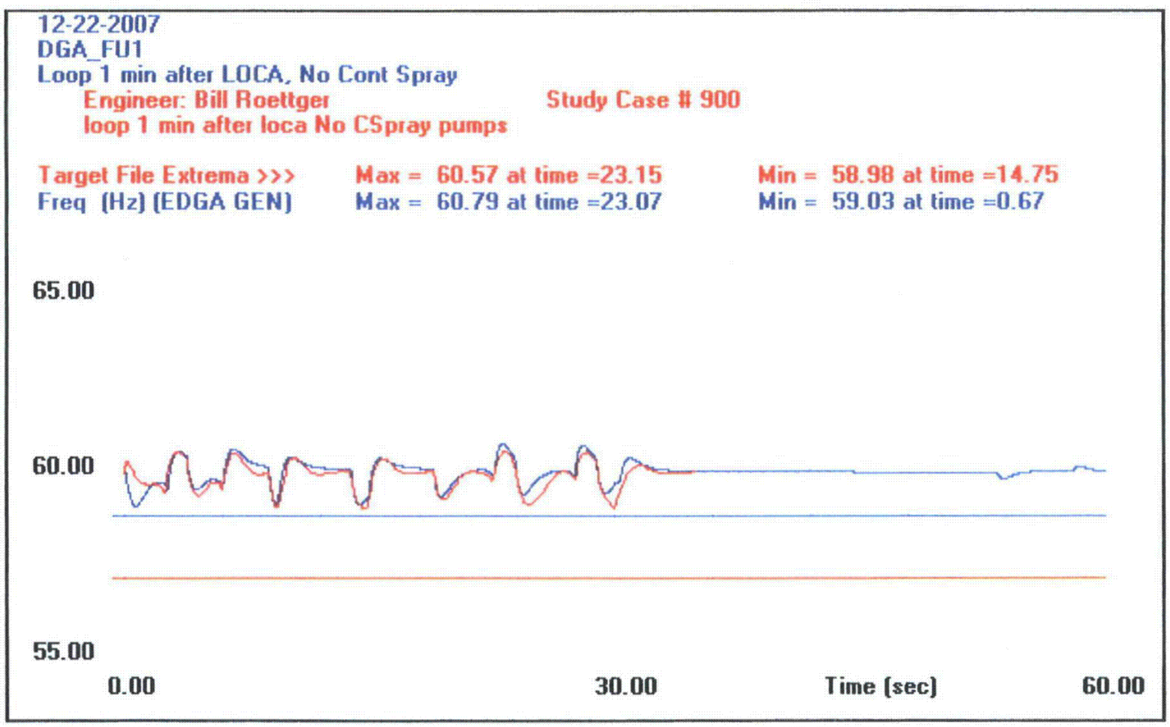


Figure 19, DGA_FU1 Frequency Profile (1997 Vs 2007)

The most significant effect of the recent revisions is associated with the first dip of the voltage profile. The additional 5% voltage dip at this point is related to differences in the modeling of the EDG's initial condition, differences in the MCC loads as well as changes to the SI and EDG cable models along with changes to the SI motor model. These effects are more clearly illustrated in the following figure.

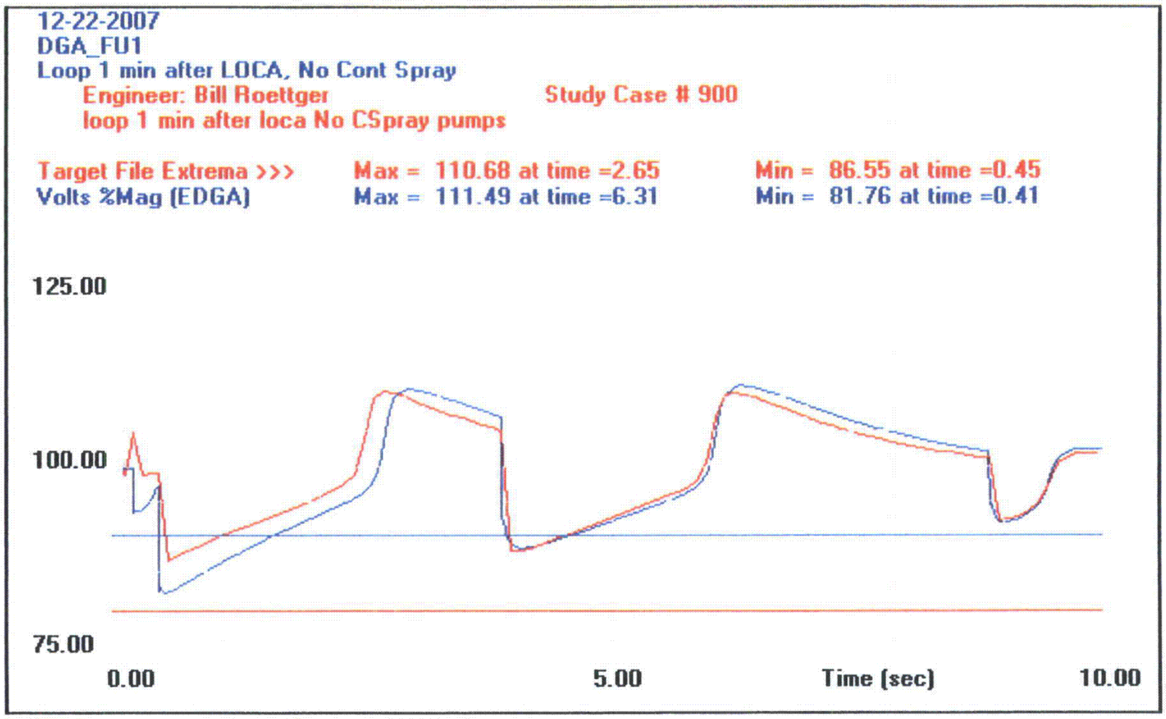


Figure 20, DGA_FU1, DG voltage (% 480V) profile (1997 Vs 2007) - Zoomed

7.5.2 Case DGA_FU2

7.5.2.1 Simulation Description

This case is a repeat of DGA_FU1 with the single exception that the Containment Spray pump comes on with MCC C. This is the most likely time for Spray to come on since the scenario assumes the accident has been in progress for over 1 minute. The Containment Spray breaker will not be tripped by a LOOP condition and therefore the MCC and Spray will come on simultaneously once the EDG breaker closes.

7.5.2.2 Simulation Timer Settings

At time = 0.1 second corresponds to the point in time when the Diesel Generator Breaker closes and is therefore connected to MCC C and CSP1A. All of the Agastat timers were assumed to be at their nominal setting. The complete load sequencing for this simulation is as follows:

Action Summary

Time (Sec.)	Device Type	Device ID	
0.100	Induction Machine	CSP1A Motor	Accelerate
0.100	Tie Protective Device	MCC1C_22C	Close
0.350	Induction Machine	SI1A Motor	Accelerate
3.850	Induction Machine	SI1C Motor	Accelerate
8.850	Induction Machine	RHR1A Motor	Accelerate
13.850	Induction Machine	SWP1A Motor	Accelerate
18.850	Induction Machine	CF1A Motor	Accelerate
23.850	Induction Machine	CF1D Motor	Accelerate
28.850	Induction Machine	AFWP1A Motor	Accelerate
30.100	Tie Protective Device	MCCC_EquivMtr	Open
53.350	SPST Switch	Sw_DynFanN	Close

7.5.2.3 Simulation Results

The results of this simulation are summarized graphically below. These results were generated by running the ETAP results through the post processing program EZFG. The EZFG program read the DGA_FU2.TS1 ETAP output file. A complete listing of the ETAP input data and results are also attached.

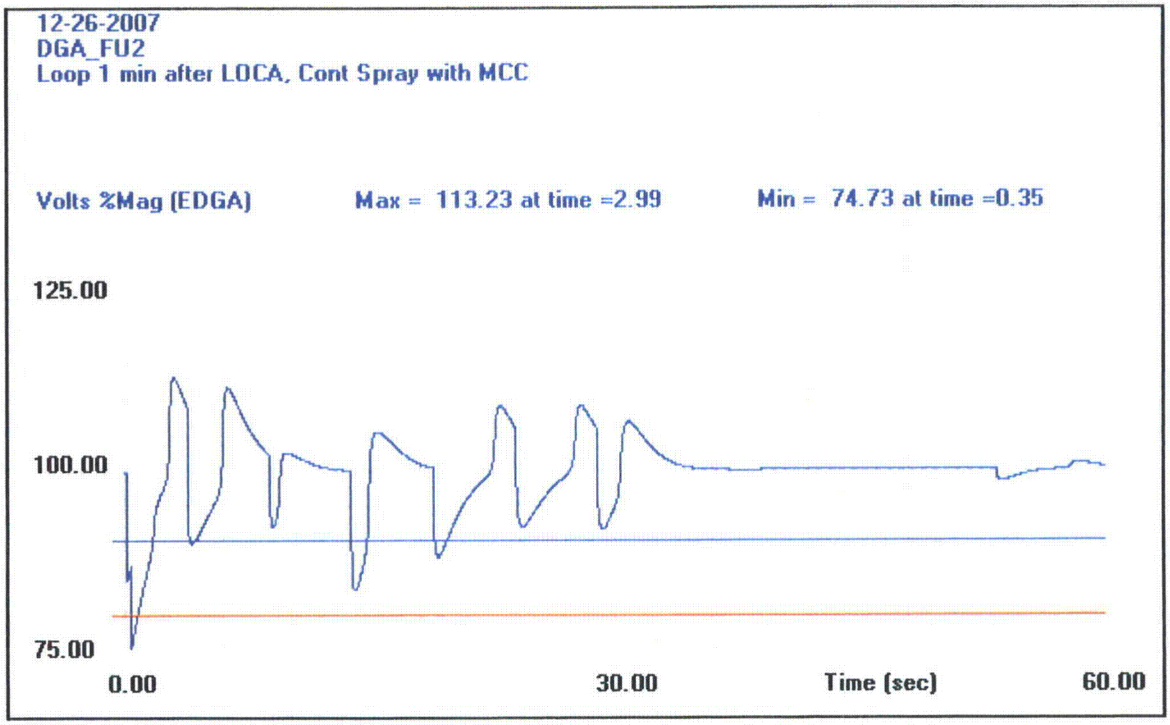


Figure 21, DGA_FU2, DG voltage (% 480V) profile

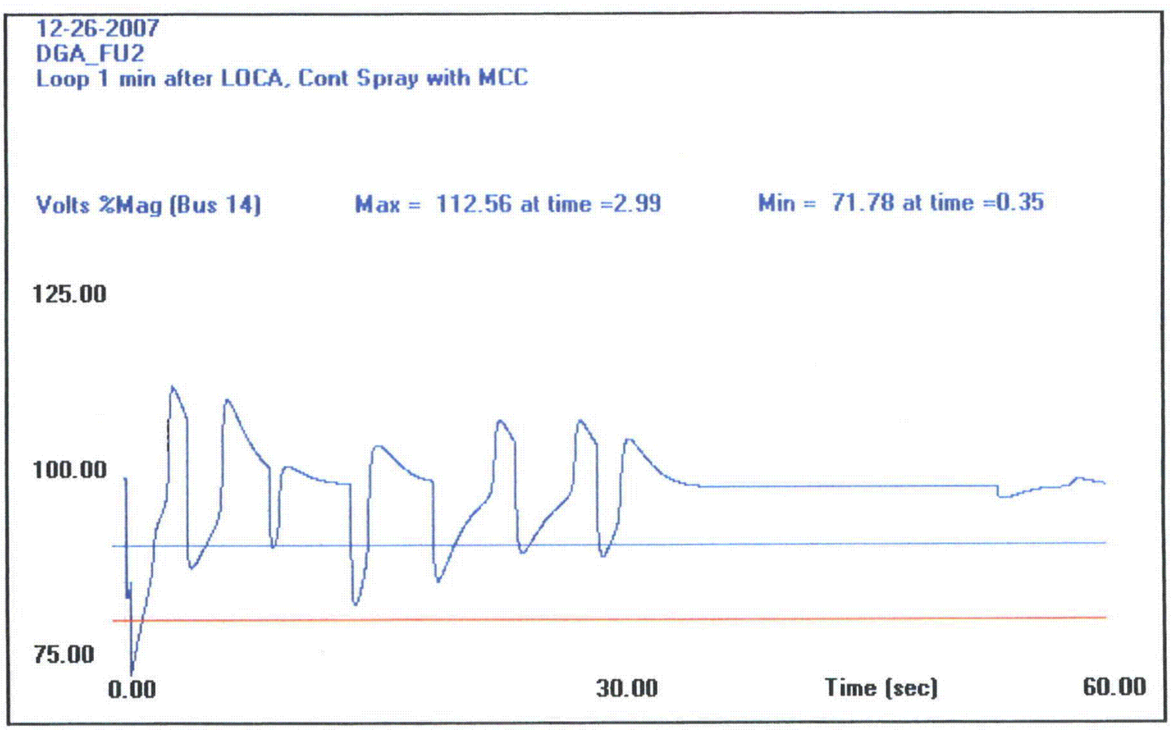


Figure 22, DGA-FU2, Bus 14 voltage (% 480V) profile

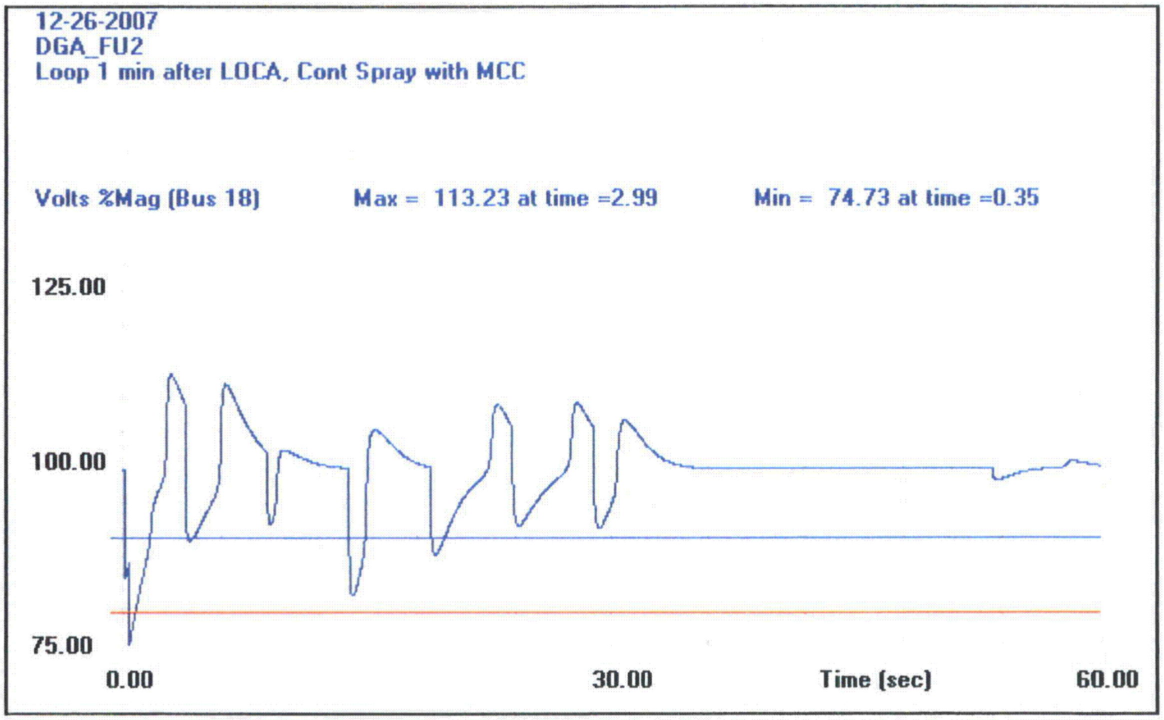


Figure 23, DGA_Fu2, Bus 18 voltage (% 480V) profile

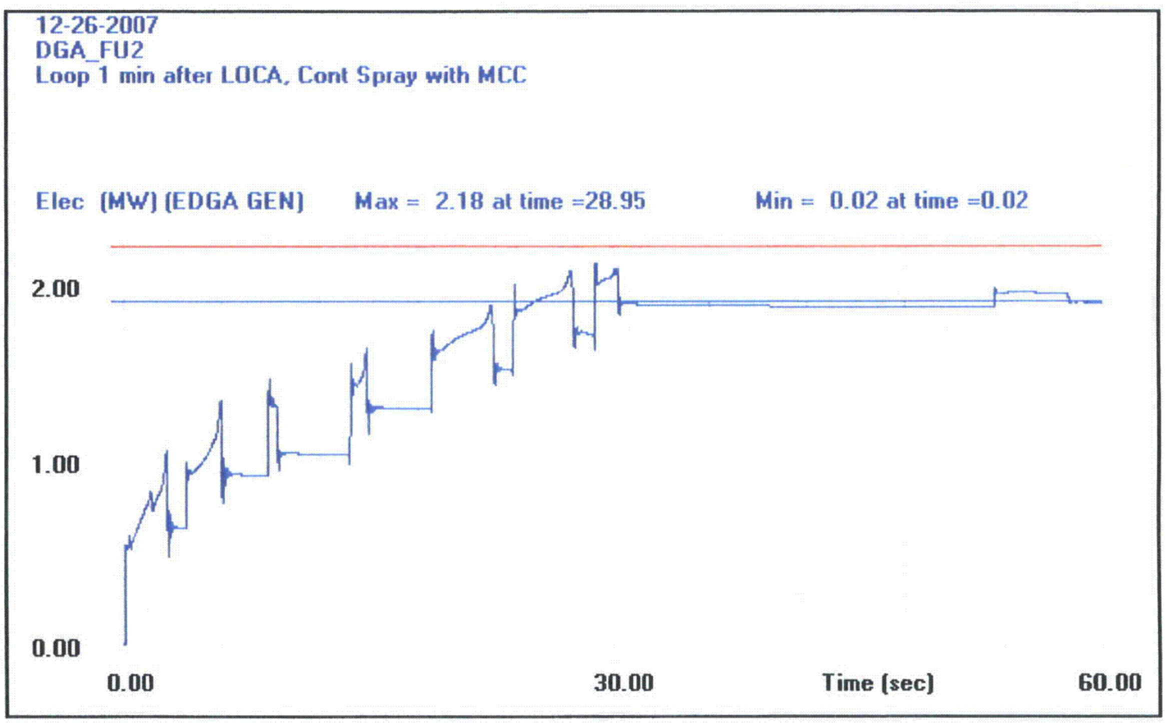


Figure 24, DGA_FU2, DG Power Profile

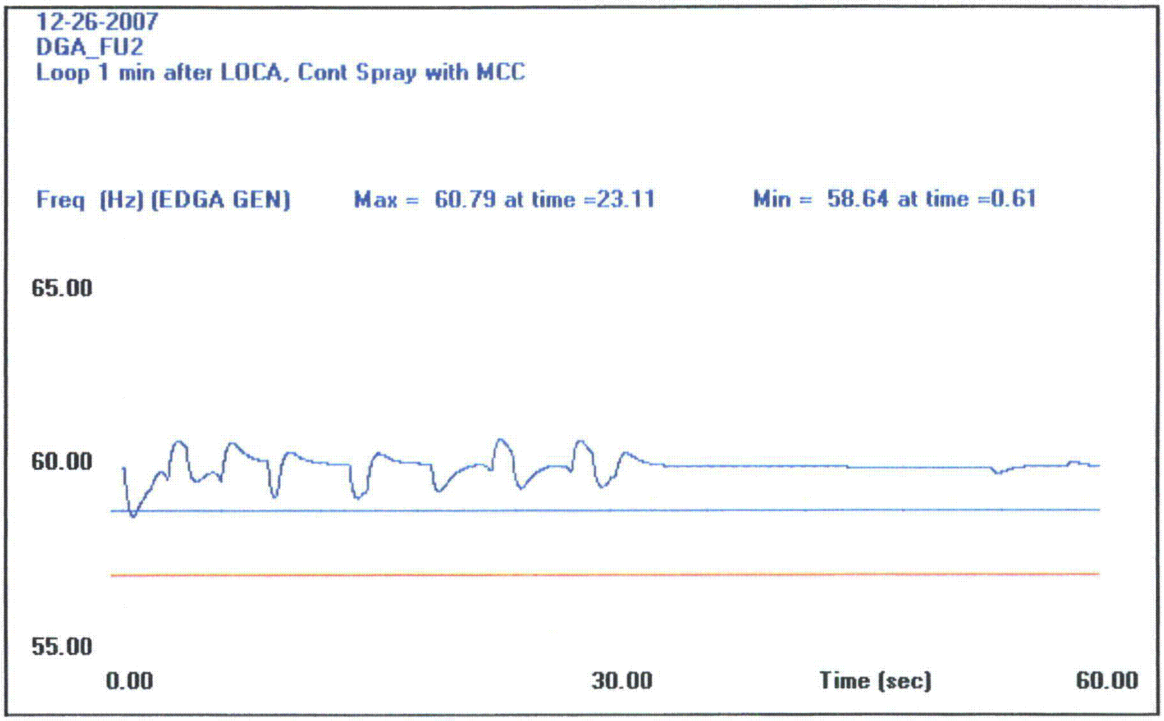


Figure 25, DGA-FU2, DG Frequency Profile

Figure 21 demonstrate that there is a slight Regulatory Guide violation (Vmin at EDG terminals = 74.73% and limit = 75%) however the loss of voltage relays will not inadvertently operate and all of the motors successfully accelerate. The loss of voltage relays on Bus 14 are picked up for 0.78 seconds (minimum operate time = 2.0 seconds) as is more clearly illustrated in the following figure.

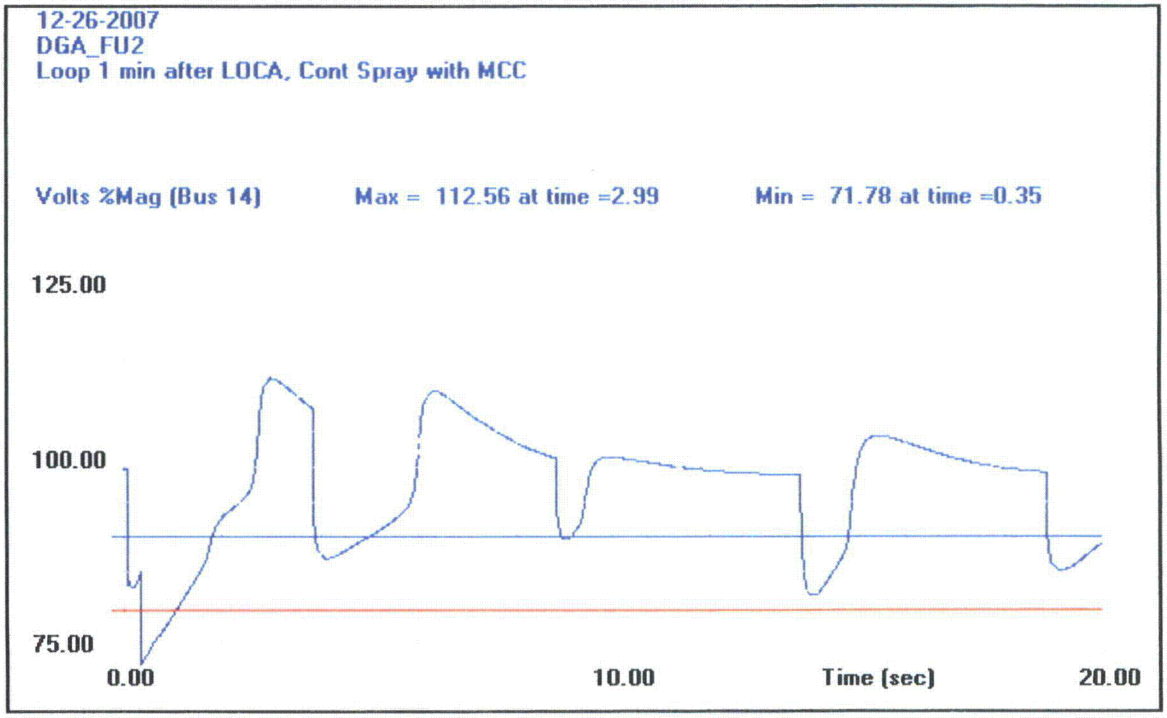


Figure 26, DGA_FU2, Bus 14 Voltage (% 480V) Zoomed

It should be noted that the amount of time "picked up" associated with the LOV relay is calculated by recognizing that the relay can begin timing when the voltage drops to 79.42% of 480V however it may not stop timing until the voltage recovers 1% above this value or 80.21% of 480V.

Figure 24 indicates a final steady state load on EDGA is 1.94 MW which is consistent with the 1938.62 kW value listed in Table 8 of Reference 4.3.2. The final steady state load for this particular case in the previous revision of this calculation was 2.0 MW.

7.5.3 Case DGA_FU3

7.5.3.1 Simulation Description

This case is a repeat of DGA_FU1 with the Containment Spray pump coming on with SW1A. This was determined to be the worst possible time for this random load to come on since this is when the voltage is at a minimum value at a point in time later on in the sequence. It can be noted in DGA_FU1 that the voltage is at its absolute minimum at time = 0.41 seconds (SI1A) however the voltage is nearly as low when the service water is sequenced on and more of the capability of the excitation system has been "used up" as the diesel generator is supporting the previously sequenced loads.

7.5.3.2 Simulation Timer Settings

At time = 0.1 second corresponds to the point in time when the Diesel Generator Breaker closes and is therefore connected to MCC C. All of the Agastat timers were assumed to be at their nominal setting. The complete load sequencing for this simulation is as follows:

Action Summary

Time (Sec.)	Device Type	Device ID	
0.100	Tie Protective Device	MCC1C_22C	Close
0.350	Induction Machine	SI1A Motor	Accelerate
3.850	Induction Machine	SI1C Motor	Accelerate
8.850	Induction Machine	RHR1A Motor	Accelerate
13.850	Induction Machine	CSP1A Motor	Accelerate
13.850	Induction Machine	SWP1A Motor	Accelerate
18.850	Induction Machine	CF1A Motor	Accelerate
23.850	Induction Machine	CF1D Motor	Accelerate
28.850	Induction Machine	AFWP1A Motor	Accelerate
30.100	Tie Protective Device	MCCC_EquivMtr	Open
53.350	SPST Switch	Sw_DynFanN	Close

7.5.3.3 Simulation Results

The results of this simulation are summarized graphically below. These results were generated by running the ETAP results through the post processing program EZFG. The EZFG program read the DGA_FU3.TS1 ETAP output file. A complete listing of the ETAP input data and results are also attached.

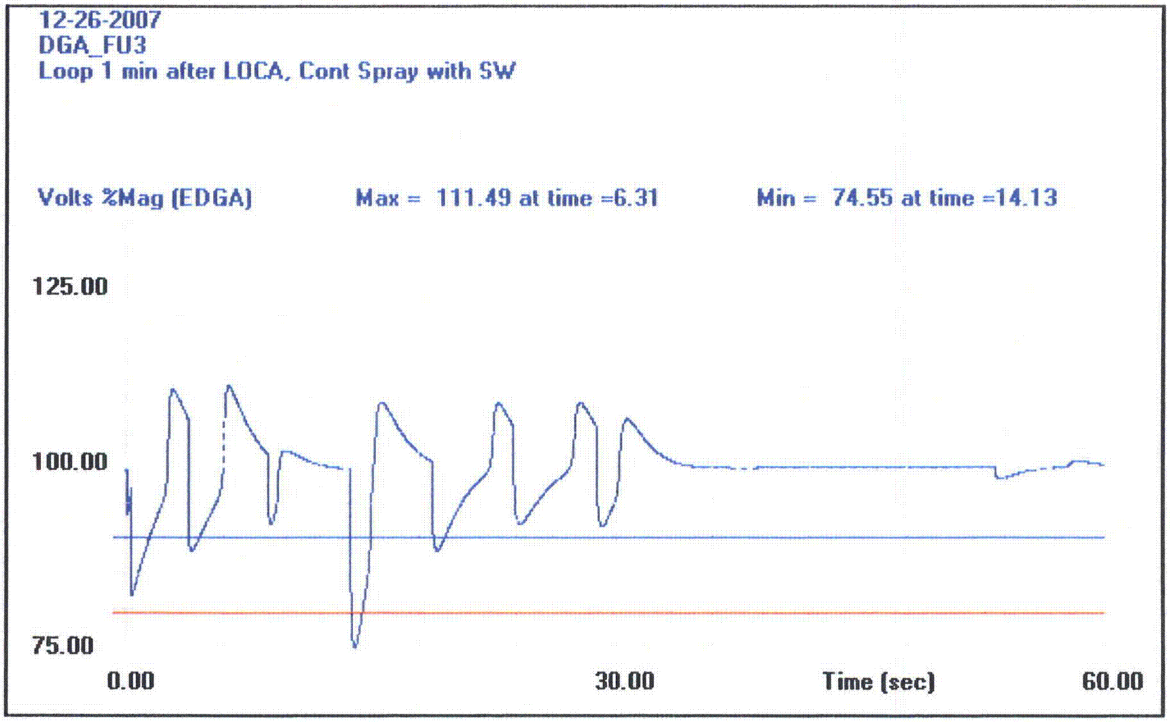


Figure 27, DGA_FU3, DG Voltage (% 480V) profile

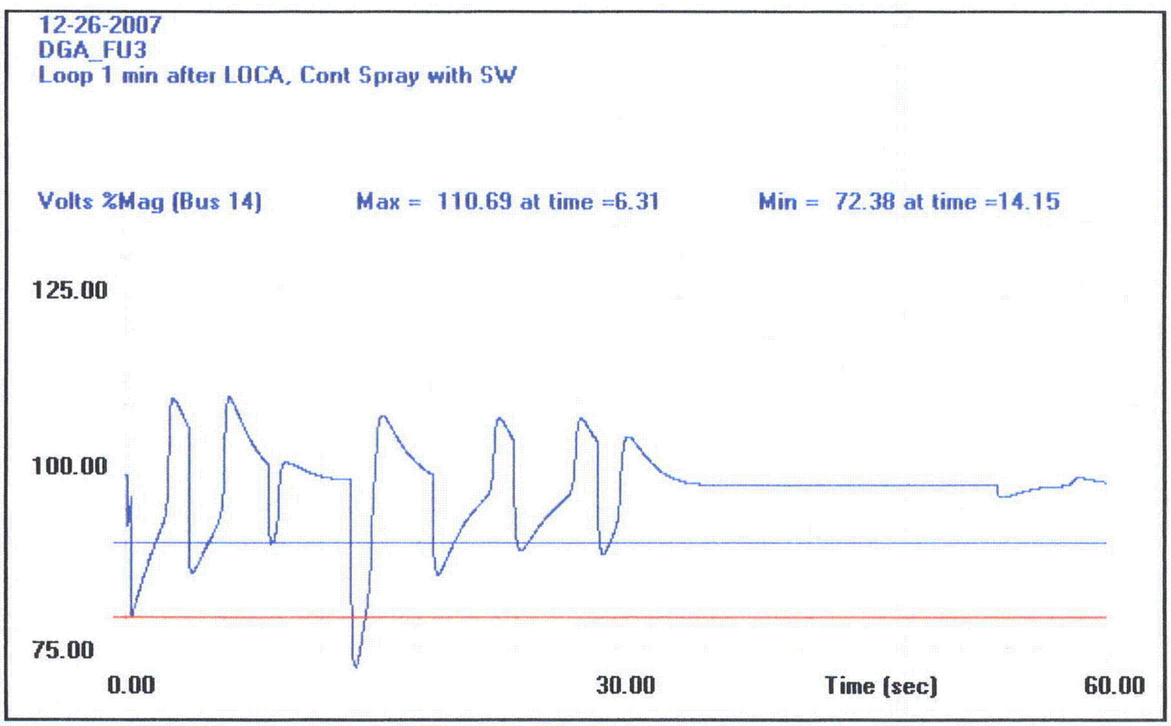


Figure 28, DGA_FU3, Bus 14 voltage (% 480V) profile

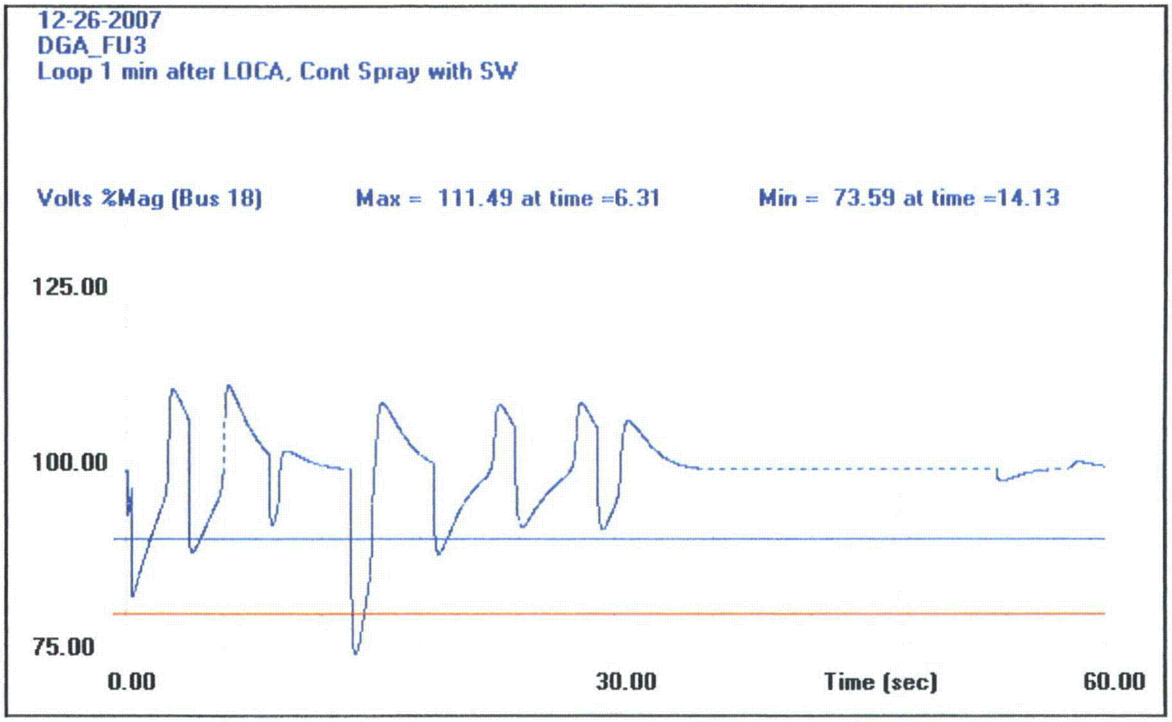


Figure 29, DGA_FU3, Bus 18 voltage (% 480v) profile

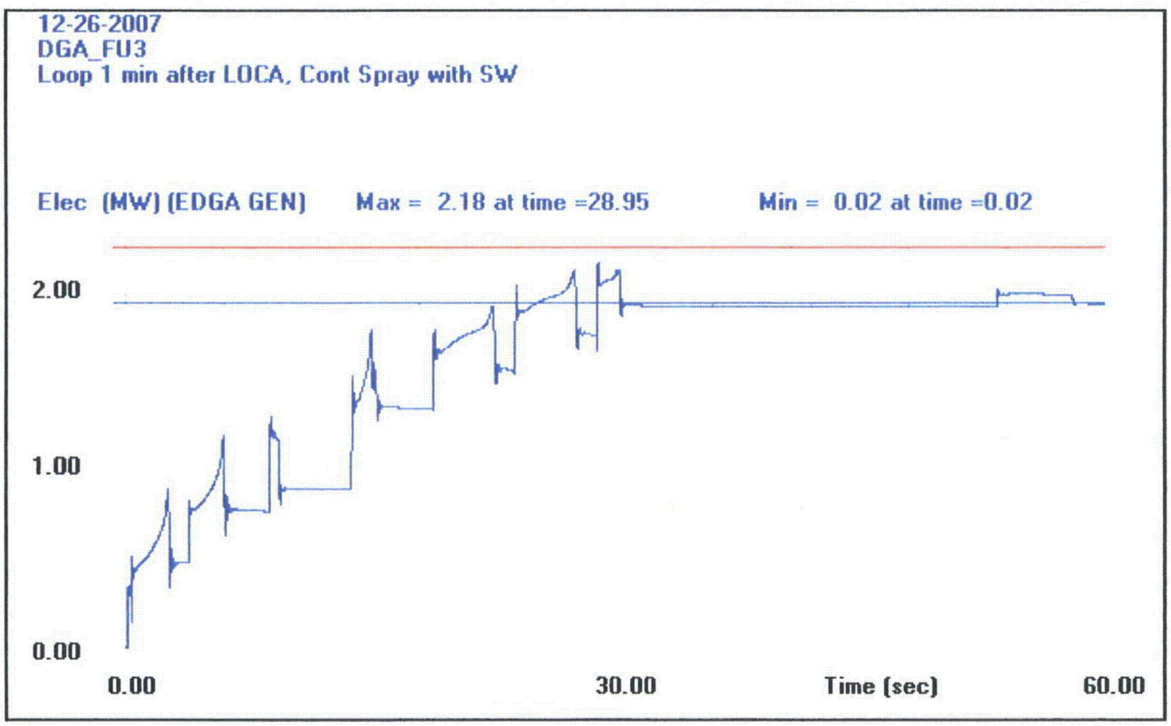


Figure 30, DGA_FU3, DG Power Profile

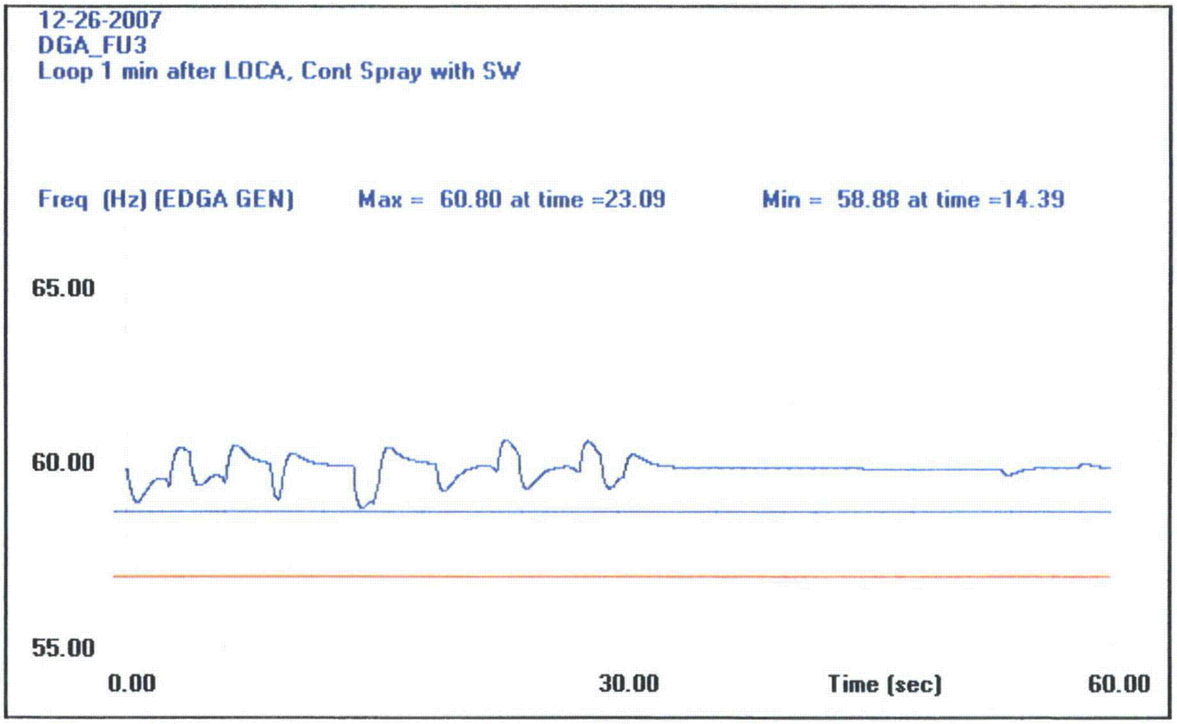


Figure 31, DGA_FU3, DG Frequency Profile

Figure 27 demonstrate that there is a slight Regulatory Guide violation (Vmin at EDG terminals = 74.55% and limit = 75%) however the loss of voltage relays will not inadvertently operate and all of the motors successfully accelerate. The loss of voltage relays on Bus 14 are picked up for 0.88 seconds (minimum operate time = 2.0 seconds) as is more clearly illustrated in the following figure.

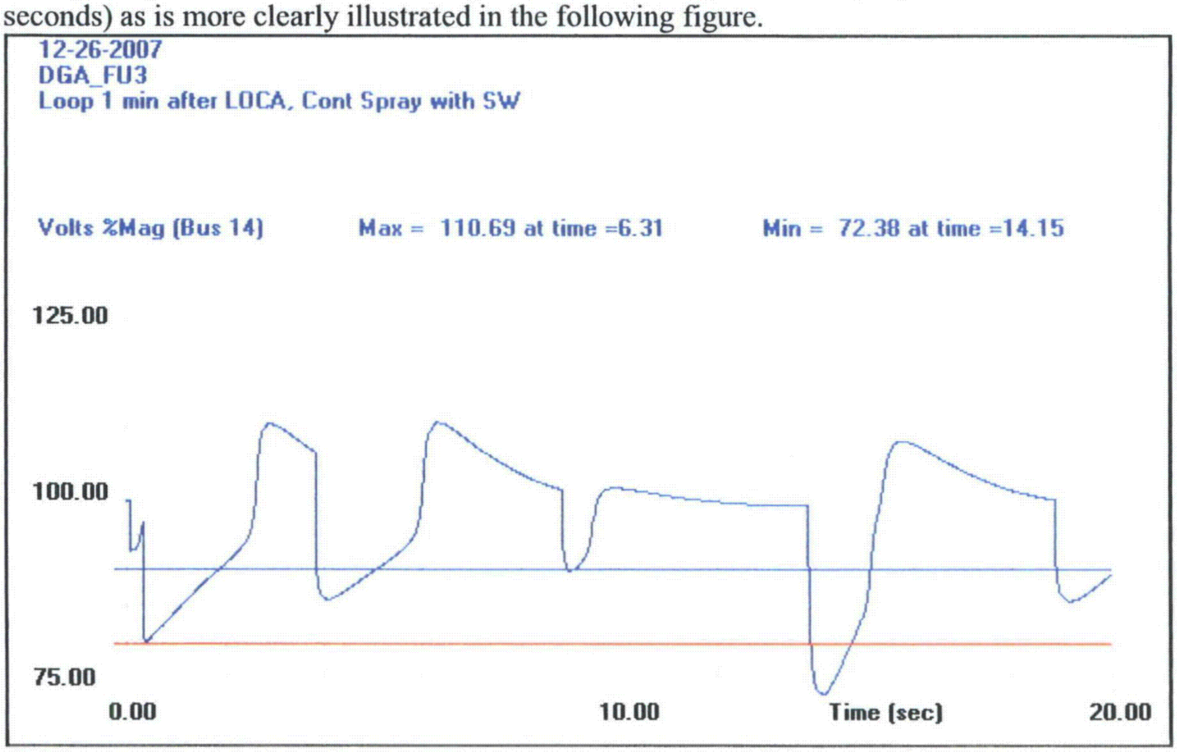


Figure 32, DGA_FU3, Bus 14 voltage (% 480V) profile, Zoomed

ATTACHMENT 3

Pages from DA-EE-92-112-01, Diesel Generator B Dynamic Loading Analysis

R.E. Ginna Nuclear Power Plant, LLC
November 23, 2009

01289.3671

Design Analysis

Diesel Generator B Dynamic Loading Analysis

Rochester Gas & Electric Corporation

89 East Avenue

Rochester, New York 14649

DA-EE-92-112-01

Revision 1

9/27/97
Effective Date

Prepared By: [signature] 9/27/97
Design Engineer — Date

Reviewed By: Theodore H Mattes [signature] 9/27/97
Reviewer — Date

01229.3691

7.4.4.4 The following load profile resulted in a reasonable match of the EDG response and corresponded with the expected MCC loading during the RSSP.

TABLE 7-10
<u>MCC Loading Values Utilized In ETAP Model</u>
<u>To Match RSSP-2.2 Test Results</u>

[illegible]	[illegible]	
	[illegible]	[illegible]
Loading When EDG Breaker Closes (T = 0.0 Seconds to T=0.25 Seconds)	200	375
Continuous Loading Following Start (Time > .25 Seconds)	100	25

7.4.5 Cable Impedance

7.4.5.1 The cable lengths and type were obtained from circuit schedules while the cable impedances are based on the ETAP library values. These values were reviewed and found to be reasonable.

7.4.6 Simulation Acceptance Criteria

7.4.6.1 The ETAP computer program was run for each of the cases outlined in section 2.1. The acceptance criteria was in accordance with IEEE-387 which specifies the diesel generator must be able to start and accelerate the required loads.

7.4.6.2 Regulatory Guide 1.9 specifies during motor starting the minimum frequency should not be less than 0.95 per unit (57 Hz) and should be restored to within 2% of nominal (58.8 Hz) within 60% of each load sequence interval. The minimum voltage should not be less than 0.75 per unit and should be restored to within 10% of nominal within 60% of each load sequence interval.

7.5.1 Case DGB_FU1

7.5.1.1 Simulation Description

This case quantifies the "B" diesel generator loading sequence during the "Injection phase" for the case where the Containment Spray pump does not come on. The timing sequence will be set up to simulate a LOOP after a LOCA. The purpose of this simulation is to identify a baseline case that will be used as the basis for establishing worst case simulations.

Upon SI all of the safeguard loads would be sequenced onto the buses (offsite power available) and start the EDG. A LOOP after LOCA event would result in all loads being tripped with the exception of the MCC's. Then after approximately a 1.3 second time delay the EDG breakers would close and the loads would be resequenced on. A key point associated with this simulation is that the EDG has achieved a steady state condition (ie. V= 1.0 pu) prior to the first load being applied. A simultaneous LOOP LOCA simulation would typically have a less severe initial voltage dip since the first loads are applied prior to the EDG settling out to 1.0 per unit. Field results for a simultaneous LOOP LOCA indicate the EDG initially overshoots and is above 1.1 per unit when the EDG breaker is closed (ie MCC load connected). The simultaneous LOOP LOCA simulation is covered later in this report (case DGB_FU6).

7.5.1.2 Simulation Timer Settings

At time = 0.1 second corresponds to the point in time when the Diesel Generator Breaker closes and is therefore connected to MCC D. The MCC breaker is not tripped by the under voltage relays (LOOP condition). The breaker associated with SI1B closes at time = 0.35 seconds. This 0.25 second delay after the closing of the diesel generator breaker is due to the time delays associated with the resetting of the under voltage relays and breaker closing and was measured during testing. All of the agastat timers were assumed to be at their nominal setting. The complete load sequencing for this simulation is as follows:

Time(sec)	Breaker Closes
0.100	Diesel Generator (both Bus 16 and 17)
0.350	SI 1B
5.850	SI 1C
10.850	RHR 1B
15.850	SW 1D
20.850	CF 1B
25.850	CF 1C
30.850	AFWP 1B

The computer simulation is not an exact representation of the stated scenario because the transients and effects associated with the loads being first sequenced on to the offsite source have been ignored. Ignoring these transients is conservative because many of the valves would have operated to their required state and therefore the MCC load would be less than what was modeled. Ignoring this effect is not considered overly conservative because the voltage dip associated with the MCC loads is not that significant in either magnitude or duration when compared to the motor loads. In addition, the SI1B may still be spinning at about 45% (See attachment A) of rated speed when it is resequenced. While this won't change the magnitude of the initial voltage dip, it should shorten the duration of the dip.

The SI1B motor may have a small amount of residual voltage left when it is reconnected. This residual voltage could cause the voltage dip to be slightly better or worse depending on the exact instant of closure. This effect is considered small since the SI1B motor has an open circuit time constant of about 1.4 second, ref. 4.4.15, and the "dead time" is expected to approach 1.7 seconds (1.3 second timer delay, .25 second delay indicated above and .15 second delay for D/G breaker closing and associated relay operation).

7.5.1.3 Simulation Results

The complete set of input data for this simulation is contained in Attachment J1 along with the initial (time = 0 -) load flow solution. The dynamics of the system as it goes from the initial load flow solution to the final load flow solution is summarized in Figures 1 - 3 of Attachment J1. The minimum voltage was 81.12% and the minimum frequency was 58.80 Hz. Both of these are well above the 75% and 57 Hz criteria. Figure 2 is a plot of the generator power (internal losses included) as a function of time. The peak power capability (2.3 MW) of the engine is above the peak value (2.06 MW) obtained in this simulation. It is evident from each of the figures that all motors successfully accelerate.

The results of this simulation can be used to help determine the worst point in time for the Containment Spray to come on. This "worst case time" scenario will then be incorporated into the DGB_FU3 simulation.

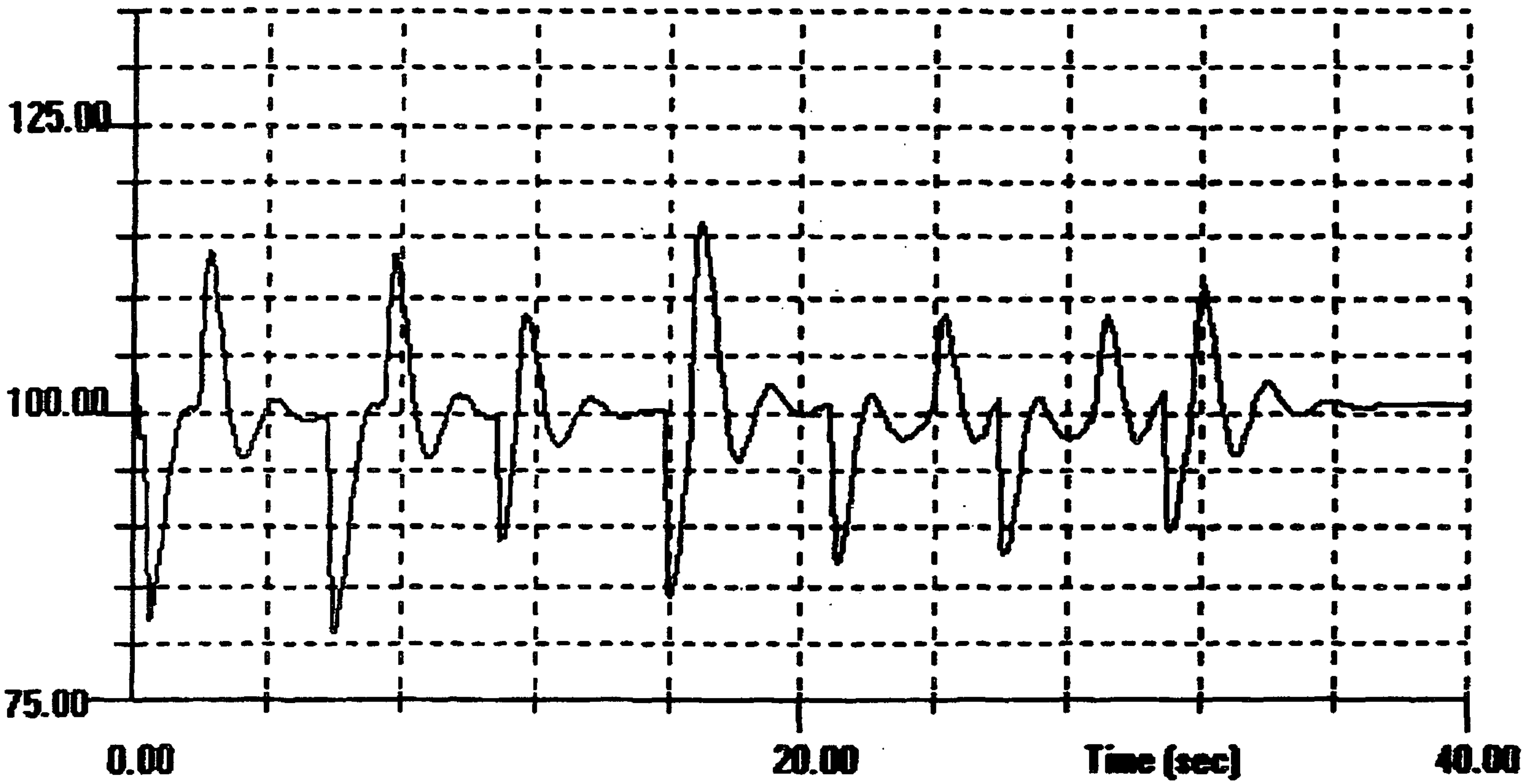
DA-EE-92-112-01

9128.0.2946

Engineer: Bill Roettger **Study Case # 901**

Loop 1 min after loca, No Cont Spray

Vol 2 Mag. (Bus 16) **Max = 116.41 at time =16.95** **Min = 81.12 at time =5.95**



CASE FUl

Attachment J1
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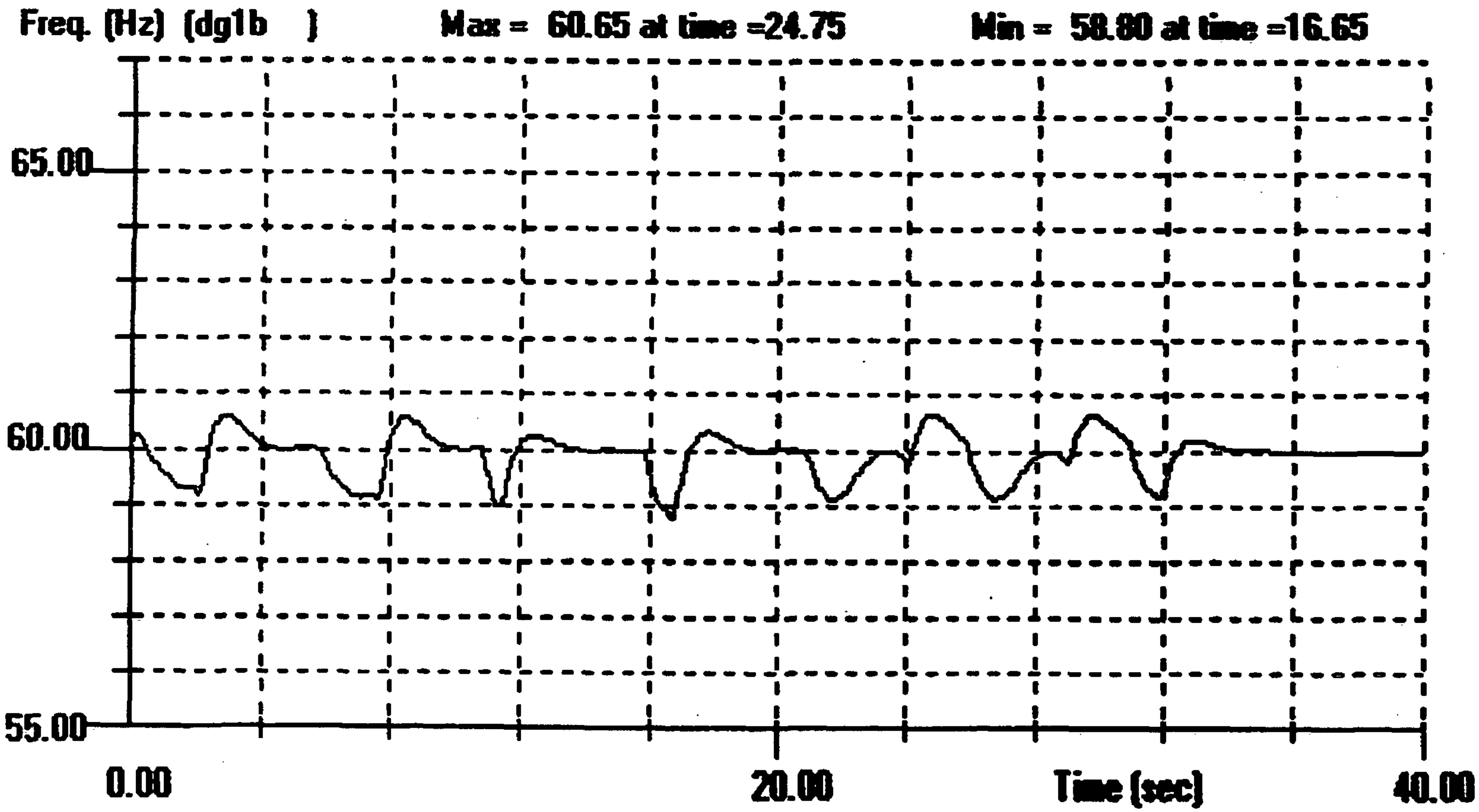
Rev. 1

Engineer: Bill Roettger **Study Case # 901**

Loop 1 min after loca, No Cont Spray



7.5.2 Case DGB_FU2

SEE ATTACHMENT J2 CURVES

7.5.2.1 Simulation Description

This case is a repeat of DGB_FU1 with the single exception that the Containment Spray pump comes on with MCC D. This is the most likely time for Spray to come on since the scenario assumes the accident has been in progress for over 1 minute. The Containment Spray breaker will not be tripped by a LOOP condition and therefore the MCC and Spray will come on simultaneously once the EDG breaker closes.

7.5.2.2 Simulation Timer Settings

Time(sec)	Breaker Closes
0.100	Diesel Generator and Containment Spray
0.350	SI 1B
5.850	SI 1C
10.850	RHR 1B
15.850	SW 1D
20.850	CF 1B
25.850	CF 1C
30.850	AFWP 1B

7.5.2.3 Simulation Results

The complete set of input data for this simulation is contained in Attachment J2 along with the initial (time = 0 -) load flow solution. The dynamics of the system as it goes from the initial load flow solution to the final load flow solution is summarized in Figures 1 - 3 of Attachment J2. The minimum voltage was 76.2% and the minimum frequency was 58.75 Hz. Both of these are above the 75% and 57 Hz criteria. Figure 2 is a plot of the generator power (internal losses included) as a function of time. The peak power capability (2.3 MW) of the engine is above the peak value (2.25 MW) obtained in this simulation. The final steady state load out of the EDG for this simulation is about 2.0 MW which is in close agreement with the steady state analysis (Reference 4.3.2). It is evident from each of the above figures that all motors successfully accelerate.

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Attachment J2
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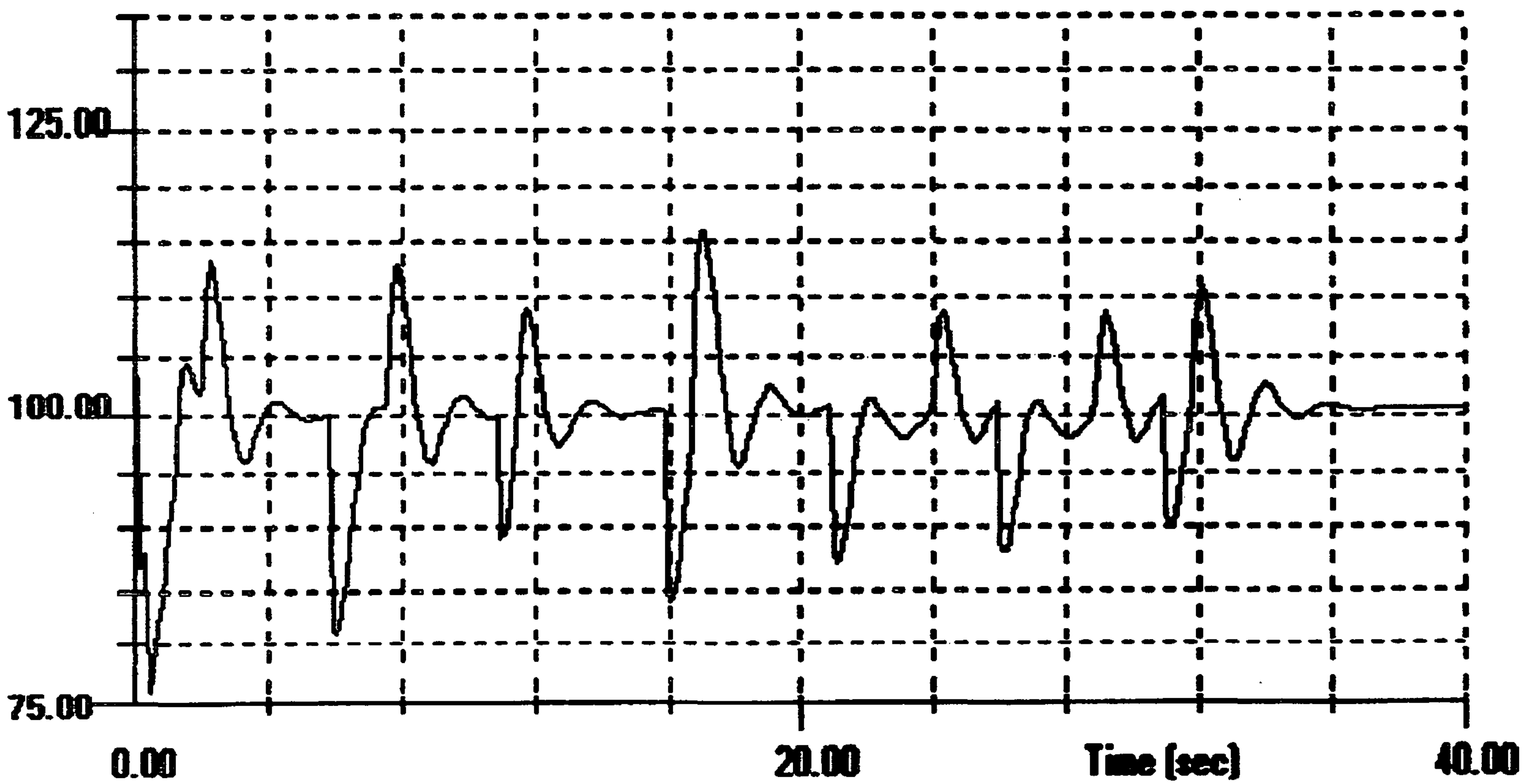
Rev. 1

0123Q.3960

Engineer: Bill Roettger **Study Case # 901**
Loop 1 min after loca, cONT SPRAY ON WITH mcc

Vol %Mag. (Bus 16) **Max = 115.99 at time =16.95** **Min = 76.20 at time =0.45**

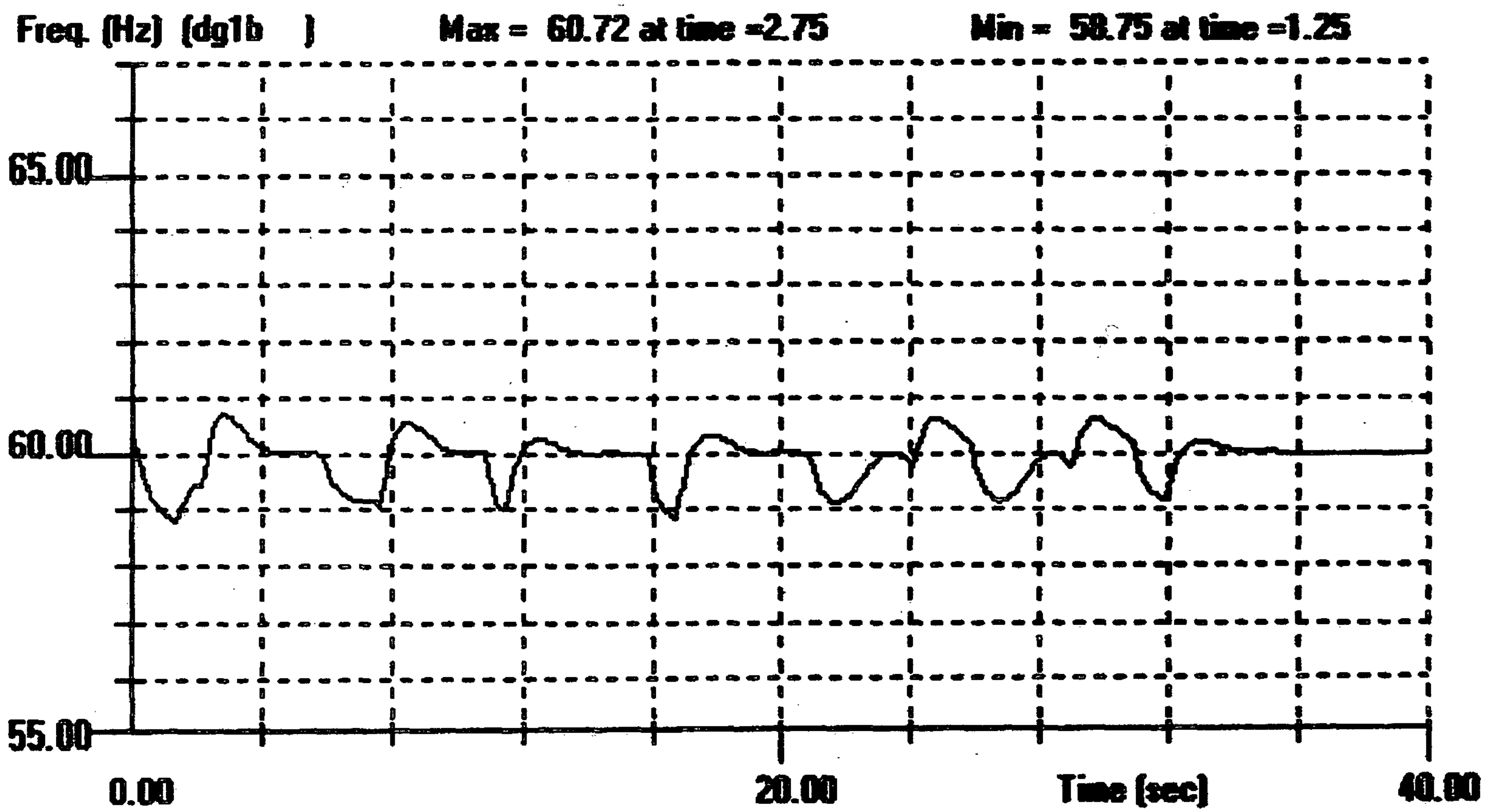


CASE FU2

01239.3971

Engineer: Bill Roettger Study Case # 901

Loop 1 min after loca, cONT SPRAY ON WITH mcc



01289.3695

7.5.3 Case DGB_FU3

SEE ATTACHMENT J3 CURVES

7.5.3.1 Simulation Description

This case is a repeat of DGB_FU1 with the Containment Spray pump coming on with SI1C. This was determined to be the worst possible time for this random load to come on since this is when the voltage is at a minimum (See Figure 1 of Attachment J1).

SEE ATTACHMENT J1 page 1

7.5.3.2 Simulation Timer Settings

Time(sec)	Breaker Closes
0.100	Diesel Generator (both Bus 16 and 17)
0.350	SI 1B
5.850	SI 1C and Containment Spray
10.850	RHR 1B
15.850	SW 1D
20.850	CF 1B
25.850	CF 1C
30.850	AFWP 1B

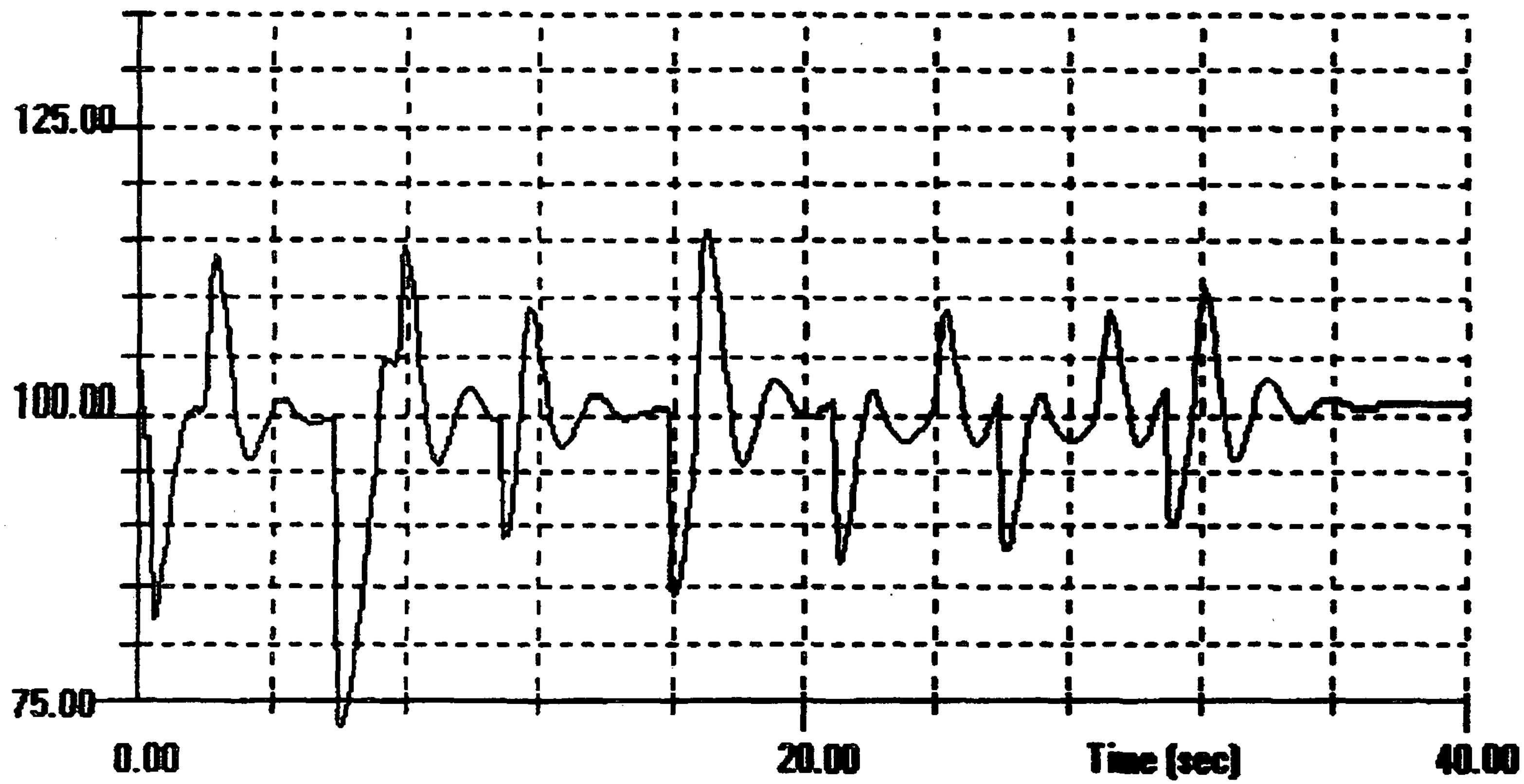
7.5.3.3 Simulation Results

The complete set of input data for this simulation is contained in Attachment J3 along with the initial (time = 0 -) load flow solution. The dynamics of the system as it goes from the initial load flow solution to the final load flow solution is summarized in Figures 1 - 3 of Attachment J3.

The minimum voltage was 72.52% and the minimum frequency was 58.61 Hz. The slight violation of the 75% voltage criteria is considered acceptable since the voltage recovers above 90% within 1.1 second. Figure 2 is a plot of the generator power (internal losses included) as a function of time. The peak power capability (2.3 MW) of the engine is above the peak value (2.25 MW) obtained in this simulation. The final steady state load out of the EDG for this simulation is about 2.0 MW which is in close agreement with the steady state analysis (Reference 4.3.2). It is evident from each of the above figures that all motors successfully accelerate.

Engineer: Bill Roettger **Study Case # 901**
Loop 1 min after loca, Cont Spray with si1e

Vol %Mag. (Bus 16) **Max = 115.98 at time =16.95** **Min = 72.52 at time =6.05**



CASE FU3

Engineer: Bill Roettger **Study Case # 901**
Loop 1 min after loca, Cont Spray with si1c