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Nuclear Operations

July 17, 1991
NRC-91-0086

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D. C. 20555

References:
1) Fermi 2
NRC Docket No. 50-341
NRC License No. NPF-43

2) Detroit Edison Station Blackout Submittal to NRC, NRC-89-0061, dated April 17, 1989

3) NUMARC Letter "Station Blackout (SBO) Implementation: Request for Supplemental SBO Submittal to NRC," dated January 4, 1990

4) Detroit Edison Letter, NRC-90-0060, "Detroit Edison Response for Supplemental SBO Submittal to NRC," dated March 29, 1990

5) NRC Letter, "Fermi-2 Conformance to Station Blackout Rule 10CFR50.63 (TAC No. 68545)," dated June 12, 1991

Subject: Station Blackout Rule Implementation

This letter provides a response to the six recommendations contained within the NRC Station Blackout Safety Evaluation as requested by Reference 5. A discussion of each recommendation and the proposed resolution of each recommendation is provided below.

1. **NRC Recommendation:**

Test the alternate AC source to show that it can be started and connected to the safe shutdown loads within one hour. Describe how the Combustion Turbine Generator meets the criteria of NUMARC 87-00, Appendix B.

Detroit Edison Response:

Testing has been performed which has demonstrated various aspects of the alternate AC capability. However, Detroit Edison has determined that a new test should be performed to demonstrate the

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ability to black start and connect safe shutdown loads within one hour. This testing will consist of the following:

1. Isolate CTG 11 buses and all AC power feeds into CTG 11-1. Black start CTG 11-1 and demonstrate the ability to energize the de-energized output buses. Document the time required to perform these operations. Fermi 2 buses will continue to be supplied by offsite power during this test.

2. Perform a timed walkdown (simulation) of the control switch manipulations required to energize safe shutdown loads subsequent to energizing the CTG buses (step 1). This walkdown would be performed at the unit control panels or at the simulator as determined appropriate.

The summation of times provided in steps 1 and 2 above will demonstrate the ability to black start and to connect safe shutdown loads within the 1 hour time requirement. The monthly CTG 11-1 surveillance test demonstrates the ability of CTG 11-1 to supply a load. Testing in this manner demonstrates the ability to black start the CTG and to connect safe shutdown loads within one hour without deenergizing all Division I essential buses and making 2 EDGs inoperable. Division I buses could not be fully deenergized during plant operation and deenergizing all Division I buses and making 2 EDGs inoperable during an outage is contrary to shutdown risk initiatives. The proposed test can be conducted during plant operation.

A description of how CTG 11-1 meets the criteria of NUMARC 87-00 is contained in Detroit Edison Design Calculation DC-4986. A copy of that design calculation is attached.

2. **NRC Recommendation:**

Verify and confirm that the Condensate Storage Tank Inventory is adequate for decay heat removal Reactor Coolant System leakage, and reactor vessel depressurization, should it be needed.

Detroit Edison Response:

The design calculation on CST inventory was reperformed using the 18 gpm per pump seal leakage plus the 25 gpm maximum allowable Technical Specification leakage for a total 61 gpm leak rate. Decay heat parameters remain unchanged. Additionally, reactor vessel depressurization was assumed to be required. The results of that calculation indicate that 126,480 gallons are required which is less than the 150,000 gallons HPCI/RCIC Condensate Storage tank reserve capacity provided by that tank's standpipe suction design. It should be noted that our original submittal indicates that this 150,000 gallons is required by the plant

Technical Specifications. Since our Technical Specifications are based on the GE Standard Technical Specifications (STS) Revision 4 (1982), a specific requirement to maintain a minimum of 150,000 gallons in the CST during all operating conditions does not exist as it did in earlier versions of the STS. Our Technical Specifications refer to this 150,000 gallon minimum capability only in terms of being part of the 300,000 gallon CST inventory required in operating conditions 4 and 5 without an operable suppression chamber. The 150,000 gallon minimum CST inventory is, however, guaranteed by that tank's standpipe design. This design feature is a design basis for the CST tank as described in Section 9.2.6 of our UFSAR.

3. **NRC Recommendation:**

Verify equipment operability in the relay room and the HPCI room at the calculated temperatures during a Station Blackout event.

Detroit Edison Response:

Equipment in the HPCI and RCIC rooms has been evaluated and determined to be operable at the calculated temperatures of 180°F and 158°F respectively. Initial evaluation of relay room equipment indicates that the equipment will be able to operate at 122.3°F which is the maximum temperature calculated for that room under SBO conditions. The design calculation revision required to document and support that determination is expected to be complete by July 31, 1991.

4. **NRC Recommendation:**

Verify that the SBO equipment is covered by an appropriate Quality Assurance Program consistent with the guidance of Regulatory Guide (RG) 1.155.

Detroit Edison Response:

A Quality Assurance program consistent with the guidance of Regulatory Guide 1.155 is in place for Station Blackout equipment. Quality Assurance activities have been implemented as were determined appropriate for the existing equipment consistent with the guidance in Appendix A of that Regulatory Guide.

5. **NRC Recommendation:**

An Emergency Diesel Generator (EDG) reliability program should be developed in accordance with the guidance of RG 1.155, Section 1.2. If an (EDG) reliability program currently exists, the program should be evaluated and adjusted in accordance with RG 1.155.

Detroit Edison Response:

An EDG reliability program has been integrated within other existing programs and plant procedures and is consistent with the guidance of RG 1.155, Section 1.2. The target reliability of the EDGs is 95% which is consistent with the plant category and coping durations in the regulatory guide. Monthly surveillance testing is performed as required by Fermi 2 Technical Specification 4.8.1.1.2.a. EDG start logs and history logs are maintained by the Technical Engineering group. Preventive Maintenance (PM) for EDGs is prescribed under the PM Program to ensure that the target EDG reliability is achieved. Any valid EDG failure must be reported and evaluated under the Deviation Event Report (DER) program. Start/Failure logs are maintained and reviewed periodically to ensure the 95% availability is maintained. Responsibilities for the major program elements have been identified and a management oversight program is in place to ensure that the reliability program is functioning properly.

6. **NRC Recommendation:**

Provide a means to ensure that valves which must be capable of being closed or that must be operated (cycled) under SBO conditions can be positioned independent of the AC power supply with indication other than by observation of a valve's stem position. Any valve needing additional position indication should be identified and the means proposed to obtain such indication should be included in appropriate procedures.

Detroit Edison Response:

Valves necessary for containment isolation or which must be operated (cycled) during a 4 hour SBO event can be positioned (with indication) independent of the preferred and blacked out unit Class 1E emergency power supply. Means of closure include manual operation, DC-powered operation, Alternate AC-powered operation and air-operated valves that fail close on loss of air, as discussed as acceptable in NUMARC 87-00. Valve position can be determined by either control panel indicating lights or by mechanical valve position indicators at the valve. These mechanical indicators consist of arrows indicating valve position, stem travel rod indicators and dial gauge indication.

Verification and documentation supporting the above information will be included with all other documentation maintained in support of the Station Blackout Rule Response.

The testing proposed in response to Recommendation 1 above will not require a unit shutdown. That testing will, however, require that a procedure be written and approved to control and document test

activities and results. Detroit Edison will complete this demonstration of SBO capability by January 31, 1992. The design calculation required to support relay room SBO equipment operability will be complete by July 31, 1991. All other activities that have been determined necessary to meet the SBO rule have been completed.

If there are any questions regarding this submittal, please contact Mr. Robert J. Salmon at (313) 586-4273.

Sincerely,

Attachment

cc: C. E. Carpenter, Jr.
A. B. Davis
R. W. DeFayette
S. Stasek

DESIGN CALCULATION COVER SHEET

PART 1: DESIGN CALCULATION IDENTIFICATION

A) Design Calculation Number: DC-4986
B) Volume Number: I
C) Revision: Ø
D) PIS Number: R1100
E) QA Level: 1M
F) ASME Code Classification: [X] NA
G) Certification Required: [ ] Yes [X] No
H) Lead Discipline: ELECTRICAL
I) Incorporation Code: F
J) Title: DEFINITION OF ALTERNATE AC POWER FOR SBO
K) Revision Summary: ORIGINAL CALCULATION

PART 2: PREPARATION AND APPROVAL

A) Prepared By: L. B. COLLINS
Sign: [signature] Date: 2-28-89

B) Checked By: R. W. Gondek
Sign: [signature] Date: 3-3-89

C) Verified By: R. W. Gondek
Sign: [signature] Date: 3-3-89

D) Approved By
Sign: J. R. Green [signature] Date: 3-6-89

ARMS - INFORMATION SERVICES

DSN ______ Rev ______ Date ______
DTC ______ File 1801 Recipient ______

Form NEP-CM1-20 Att 1 081688

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Purpose:

The purpose of this design calculation is to document the review of the CTG11-1 for use as an Alternate AC power source (AAC) for responce to a Station Blackout event. This review is based on the criteria presented in NUMARC 87-00 Appendix B as a method to satisfy Regulatory Guide 1.155 article 3.3.5 requirements.

Conclusions:

CTG 11-1 meets the criteria necessary to be considered an Alternate AC power source for a station blackout event.

References:

- Regulatory Guide 1.155 - August '88 - Station Blackout [Excerpts on Page 26]
- NUMARC 87-00 - November 1987 - Guidelines and Technical Bases for NUMARC Initiatives Addressing

Station Blackout at Light Water Reactors [Appendix B on Pages 27, 28, 29]

- Dwg 6SD721-2500-1 Rev P - One Line Diagram Plant 4160 V. & 480 V. System Service Unit 2
- Dwg 6A721-2100 REV J Plot Plan - Plant Area North End.
- Dwg 6A721-2101 Rev E Plot Plan - Plant Area South End
- Dwg 6A721-2102 Rev T Site Key Plan
- Dwg 6SD721-2500-2 Rev D One Line Diagram 13.8 KV
- Dwg 5E721F-21 Rev I Plan of Control Conduits & Underground power cables CTG #11
- Dwg 6E721F-1 Rev S Installation Ground Mass and Plan of Mat and control conduits 120KV Yd.
- Dwg 6SD721F-24 Rev D O.L.D. 480VAC, 120/240VAC & 125VDC BUSES CTG#11
- Dwg 6SD721-8 Rev S 125VDC Control and 250VDC Power Distribution

- DWG 6I721-2016-14 Rev B Schematic Diagram EF1-EF2 Supervisory cont System 130-24 vdc. Power supply.
- DWG 6SD721-2530-12 Rev Y One Line Diagram 260/130 v BOP Battery 2PC Distribution.
- DWG 6SD721-2530-10 Rev V One Line Diagram 260/130 v ESS DUAL Battery 2PA Distribution - Division I
- DWG 6SD721-2530-11 Rev T One Line Diagram 260/130 v ESS DUAL Battery 2PB Distribution - Division II
- Vendor Manual VME8-3 General Electric Gas Turbine Power Plant GEI-90676.
- Vendor Manual VME8-1.0 Model 38TD8 1/8 Emergency Diesel Generator.
- NPP-MA1-01 Rev Ø Plant "Work Control" Procedure

- NPP-CT1-06 Rev ∅ Plant "Post Maintenance Testing" Procedure
- NPP-OP1-08 Rev 2 Plant "Control of Equipment" procedure
- NPP-24.324.01 Rev 20 Surveillance Procedure "Combustion Turbine Generator 11 Unit 1 Monthly Operability Check."
- RA-LG-88-0113 "Appendix R Alternative Shutdown Technical Specifications"
- Dwg 6SD721F-23 Rev 'E' O.L.D 13.8KV BUS C.T.G. #11

DISCUSSION:

Reg. Guide 1.155 section 3.2.5 states that "Onsite or nearby alternate ac (AAC) power sources that are independent and diverse from the normal Class IE emergency ac power sources will constitute an acceptable station blackout coping capability provided an analysis is performed that demonstrates the plant has this capability from the onset of station blackout until the AAC power source or sources are started and lined up to operate all equipment necessary to cope with station blackout for the required duration." The reg. guide further states that consideration be given to timely operator actions and that the AAC shall satisfy the requirements stated in section 3.3.5 of the reg. guide. Table 1 of Reg. Guide 1.155 cross references section 3.3.5 to the NUMARC 87-00 Appendix's B and C.

Appendix B provides the criteria that should be met for an AAC to be acceptable for SBO. The criteria presented in the Appendix B will be reviewed in this design calculation to show that CTG 11-1 is acceptable as an AAC and thus will shorten the time in an AC-Independent state (to one hour) for which the plant must show it can cope. Once power is available the plant would transition to the Alternate AC state and provide decay heat removal until offsite or emergency AC power becomes available.

Appendix A of NUMARC 87-00 defines Alternate AC Power as follows:

ALTERNATE AC POWER SOURCE - An alternating current (AC) power source that is available to and located at or nearby a nuclear power plant and meets the following requirements:

(i) is connectable to but not normally connected to the preferred or on-site emergency AC power systems;

(ii) has minimal potential for common cause failure with off-site power or the on-site AC power sources;

(iii) is available in a timely manner after the onset of station blackout; –

(iv) has sufficient capacity and reliability for operation of all systems necessary for coping with a station blackout and for the time required to bring and maintain the plant in safe shutdown (Hot Shutdown or Hot Standby, as appropriate); and,

(v) is inspected, maintained, and tested periodically to demonstrate operability and reliability as set forth in Appendix B.

{ Excerpt from NUMARC 87-00 Appendix A }

EVALUATION OF CTG 11-1 VS APPENDIX B CRITERIA

[APPENDIX B IS INCLUDED AS PAGES 27, 28, 29 OF THIS DESIGN CALCULATION FOR REFERENCE]

Criteria	Discussion
B1	CTG 11 [illegible] unit peaking generation unit was purchased and installed in the early 19[illegible]0's as a peaker for the Detroit Edison Company. It has been purchased and maintained as a peaking unit since by off site Detroit Edison personnel. Recently, due to the use of the CTG 11-1 unit to support the dedicated shutdown system, CTG 11-1 has been upgraded to QA level IM placing higher significance on the operation and maintenance of the unit. The CTG 11 feeds directly into the 120 KV switchyard which then can feed Fermi 2 - 4160

volt buses through various system service transformers [refer to Figure 1 page 12 or SD-2500-1].

B2 As the CTG 11 is located south of the 120 KV switchyard at Fermi 1 it is at least one quarter mile from the Fermi 2 main building complex and from the RHR building which houses the EDG's.

[Reference A-2100, 2101, 2102 dwgs]

The CTG 11 is a self contained outdoor unit with its own fuel tank located near by.

Because of the physical seperation and independance of the CTG 11 from the plant and plant power sources there are no Fermi 2 plant events

that will impact the operation of the CTG 11. These events include fire, pipe whips, jet impingement, water spray, flooding due to a pipe break, radiation, pressurization or elevated temperatures or humidity caused by a high or medium energy pipe break and missiles caused by mechanical rotating equipment failures or on high energy systems.

The units have not been seismically qualified but need not be for the SBO event AAC power source use.

B3 The CTG 11 is protected against the effects of likely weather-related events by the following:

(1) The four turbine-generator units are outdoor units designed

to withstand most likely weather related events.

(2) The output switchgear (Bus 1-2A, Bus 3-4A) is General Electric Outdoor Metal Clad Switchgear designed to be weather resistant.

(3) The electrical power cables between the generator and switchgear are direct buried underground, between the switchgear and transformer CTG-11 are underground, between the transformer CTG 11 and switchgear Bus 1-2B overhead but inside a protective housing (about 15' long), between the switchgear and transformer 64 are underground, and between the transformer and plant buses mostly underground except for

the cable bus section up the side of the reactor building. The cable bus section is inside a housing and designed for outdoor use.

B4 Physical separation of the AAC is provided by the location of CTG 11-1 at the Fermi I area physically remote from the RHR Bldg and Reactor/Turbine Bldg complex as noted in B2 above. The CTG 11-1 feeds power directly to the 120 KV switchyard which is independent of all plant buses and the EDG's.

B5 Because the CTG 11 is a self contained generation unit connected to the

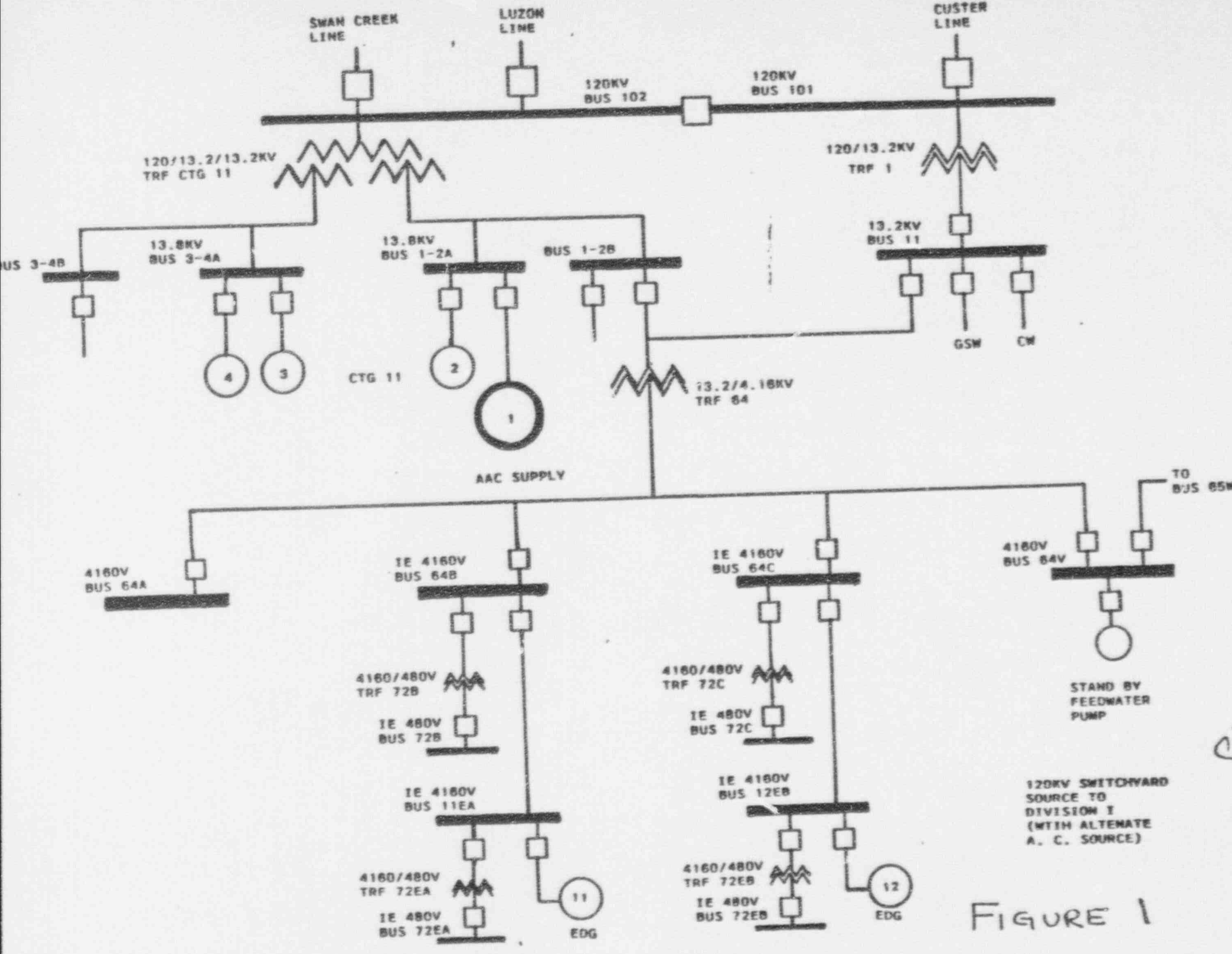

FIGURE 1

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120 KV switchyard and is physically separated from the EDG's and all safety related equipment, a failure of the CTG will not adversely affect the Class IE AC power systems. Connection of the unit to the Class IE equipment will be by the normal system service transformer 64 feed from the 120 KV offsite switchyard not directly to any plant bus (refer to Figure 1 pg 12)

B6 Electrical isolation of the AAC power from any plant Class IE buses is provided by multiple circuit breakers

one of which is a class IE breaker. Refering to figure 1 and dwg SD-2500-1 you can note that the following breakers are between the AAC and the Class IE buses:

- Output breaker of the CTG,
- Input breaker to transformer 64.
- Output breaker from transformer 64 to plant IE buses. [B6, C6]

The breakers in the feeds to Buses 64B and 64C are part of that Class IE switchgear and are class IE breakers

B7. CTG 11 is a normally shutdown peaking unit available to support the Fermi plant needs. As such it is not normally connected either directly or indirectly to the prefered

or on-site emergency AC power system and therefore would not be affected by the blackout. The AAC can be manually started from the Fermi 2 Control Center through the supervisory control system designed for that purpose. The CTG 11 is not automatically started for either loss of offsite power or any type of grid disturbance. Starting of the CTG 11 must be initiated by Operator action.

B8 Minimal Potential for Common Cause Failure -

(a) The CTG 11 Control circuits are fed from a d.c power source

located within the CTG equipment and that provides power only to the CTG11. (Refer to dwg SD-F-24) The supervisory control equipment at Fermi 1 and all Fermi 1 switchgear breakers are powered from the 125 Vdc power system in Fermi 1. (Refer to dwg SD-8). The supervisory control equipment at Fermi 2 is powered by the 2PC BOP d.c power system. (Refer to dwg I-2016-14 and SD-2530-12).

Refering to the class 1E power system it can be determined that Division I equipment recieves its d.c power from the 2PA d.c power system (Refer to SD-2530-10) and that Division II equipment

receives its d.c power from the 2PB d.c power system (Refer to SD-2530-11).

The dc power source to the AAC and its control from the Fermi II Control Room via the supervisory control system is independant from the preferred and Class IE power systems.

(b) CTG 11-1 is a black start capable unit that is started by a diesel driven starting motor connected directly to the CTG 11-1 turbine and controlled and started from the CTG battery. There is no air start system that might be common with any Class IE power supply. (Reference SD-F-24 and VME8-3 section 7). Although

the CTG does not have an air start system it is equipped for blackstart and is independent of the EDG's.

(C) The AAC receives its fuel from a fuel oil storage tank located just west of the CTG unit and totally independent of any of the fuel tanks for the on site EDG's. Being an independent tank located over one quarter mile from the RHR Building housing the EDG's the two fuel sources will not interact and cause a possible common problem (Refer to A-2102).

(d) Emergency AC Power sources at Fermi II are Colt Industries diesel driven generators with an engine manufactured by Fairbanks Morse Engine Division. The CTG is a General Electric Gas Turbine

driven generator with the engine manufactured by General Electric. (Refer to VME8-1 and VME8-3). Being of different manufacture and different type engine the two sources should not be prone to similar failures.

(e) The AAC and EDG's should not be vulnerable to a single weather related or active failure that could take out all the a.c sources do to the physical seperation of the units and the fact that the EDG's are housed in the RHR Building designed to protect them from all expected weather conditions at the plant. (Refer to UFSAR Section 9.2.5). Also the CTG and EDG's do not use any common electrical starting power air systems or loss of voltage sensing equipment. The CTG is operator action

starting from the Control Room while the EDG's auto start on loss of Class IE bus potential.

(f) The AAC power system is capable of operating independent of availability of ~~site~~ offsite power or EDG power as the CTG is self contained and has blackstart capability. (Refer to VM) Cooling system is a closed cooling water system located within the CTG housing.

(g) The QA level of the CTG and associated power train equipment has been upgraded to QA-1M (Refer to CECO and SD-2500-1) so that hereafter it will be maintained and operated to those QA Level 1 requirements commensurate with its importance to safety. All work associated with the CTG and associated power train equipment will be done to applicable plant procedures: Two of these NPP-MA1-01

"Work Control" and NPP-CT1-06 "Post Maintenance Testing" will ensure that approparate testing is performed after any maintenance. NPP-OP1-08 "Control of Equipment" also requires the Operations personnel to review the equipment to determine any Surveillance Testing Requirements or Post-Maintenance Testing necessary. (Refer to NPP-OP1-~~08~~ item 6.2)

B9. CTG 11-1 is an 18,875 KVA .85PF unit which once started can feed the other three CTG 11 units 2, 3 and 4 to give a total capabil of 75,500 KVA at .85 PF which is more than enough to support all plant equipment fed from the 120 KV switchyard. Normal plant load through system service transformers

64 is less than 20,000 KVA rating of the transformer (Refer to SD-2500-1, SD-F-23). Emergency loads to be supported by the Division I EDG's are less than the combined capacities of EDG 11 and 12 which is about 8000 KVA or less than the 18,875 KVA capacity of CTG 11-1. The CTG 11-1 is large enough to support the expected loads. NPP-24.324.01 Surveillance Procedure verifies the operation of CTG 11-1 to regulate output correctly by starting and loading the CTG 11-1.

B10 The CTG 11-1 is part of the Fermi II Technical Specifications covered systems in Section 8.1.1.1 and 8.1.2.2 because of its support to the dedicated shutdown system which supports 10CFR 50 App R

consideration (Reference Tech Specs 8.1.1.1 and 8.1.2.2 and NPP-24.324.01). The unit is started monthly per the surveillance procedure. The present revision of of the surveillance procedure records time to load (synchronize) but has no acceptance criteria. A procedure revision will be required to add acceptance criteria for starting time.

B11. The CTG 11-1 has been upgraded to QA-IM and is presently covered by plant surveillance and preventive maintenance procedures. Plant Maintenance is working on reviewing the maintenance on the unit and will develope any necessary maintenance procedures needed to maintain the CTG 11-1 and associated equipment at a high

level of relibility and availability. These procedures are being developed seperate from this calculation.

B12. The actual powering of the plant Division I equipment from the CTG's with out offsite power has not been demonstrated but the start and load capabilities are demonstrated by the monthly surveillance procedure. ~~If necessary~~ The black start/load of the CTG will be developed and demonstrated during an available refuel outage

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B13. CTG 11-1 is a Standby System thus a reliability of .95, on demand should be maintained. The Technical Group in NP-SE-89-0009 indicated a 95.1% reliability to date and with

develope a tracking system similar to that of the EDG's

Summary -

Based on the above discussion of which some is engineering judgement and observation, the CTG 11-1 is considered acceptable as an alternate AC power source. Some minor procedure changes will be required in the area of surveillances and preventive maintenance.

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3.2.5. Consideration should be given to using available non-safety-related equipment, as well as safety-related equipment, to cope with a station blackout provided such equipment meets the recommendations of Regulatory Positions 3.3.3 and 3.3.4. Onsite or nearby alternate ac (AAC) power sources that are independent and diverse from the normal Class 1E emergency ac power sources (e.g., gas turbine, separate diesel engine, steam supplies) will constitute an acceptable station blackout coping capability provided an analysis is performed that demonstrates the plant has this capability from the onset of station blackout until the AAC power source or sources are started and lined up to operate all equipment necessary to cope with station blackout for the required duration.

In general, equipment required to cope with a station blackout during the first 8 hours should be available on the site. For equipment not located on the site, consideration should be given to its availability and accessibility in the time required, including consideration of weather conditions likely to prevail during a loss of offsite power.

If the AAC source or sources meet the recommendations of Section 3.3.5 and can be demonstrated by test to be available to power the shutdown buses within 10 minutes of the onset of station blackout, no coping analysis is required.

3.2.6. Consideration should be given to timely operator actions inside or outside the control room that would increase the length of time that the plant can cope with a station blackout provided it can be demonstrated that these actions can be carried out in a timely fashion. For example, if station battery capacity is a limiting factor in coping with a station blackout, shedding nonessential loads on the batteries could extend the time until the battery is depleted. If load shedding or other operator actions are considered, corresponding procedures should be incorporated into the plant-specific technical guidelines and emergency operating procedures.

3.3.5. If an AAC power source is selected specifically for satisfying the requirements for station blackout, the design should meet the following criteria:

1. The AAC power source should not normally be directly connected to the preferred or the blacked-out unit's onsite emergency ac power system.

2. There should be a minimum potential for common cause failure with the preferred or the blacked-out unit's onsite emergency ac power sources. No single-point vulnerability should exist whereby a weather-related event or single active failure could disable any portion of the blacked-out unit's onsite emergency ac power sources or the preferred power sources and simultaneously fail the AAC power source.

3. The AAC power source should be available in a timely manner after the onset of station blackout and have provisions to be manually connected to one or all of the redundant safety buses as required. The time required for making this equipment available should not be more than 1 hour as demonstrated by test. If the AAC power source can be demonstrated by test to be available to power the shutdown buses within 10 minutes of the onset of station blackout, no coping analysis is required.

4. The AAC power source should have sufficient capacity to operate the systems necessary for coping with a station blackout for the time required to bring and maintain the plant in safe shutdown.

5. The AAC power system should be inspected, maintained, and tested periodically to demonstrate operability and reliability. The reliability of the AAC power system should meet or exceed 95 percent as determined in accordance with NSAC-108 (Ref. 11) or equivalent methodology.

An AAC power source serving a multiple-unit site where onsite emergency ac sources are not shared between units should have, as a minimum, the capacity and capability for coping with station blackout in any of the units.

At sites where onsite emergency sources are shared between units, the AAC power sources should have the capacity and capability to ensure that all units can be brought to and maintained in safe shutdown (i.e., those plant conditions defined in plant technical specifications as Hot Standby or Hot Shutdown, as appropriate). Plants have the option of maintaining the RCS at normal operating temperatures or at reduced temperatures.

Plants that have more than the required redundancy of emergency ac sources for loss-of-offsite-power conditions, on a per nuclear unit basis, may use one of the existing emergency sources as an AAC power source provided it meets the applicable criteria for an AAC source. Additionally, emergency diesel generators with 1-out-of-2-shared and 2-out-of-3-shared ac power configurations may not be used as AAC power sources.

EXCERPTS FROM REG. GUIDE 1.155

APPENDIX B. ALTERNATE AC POWER CRITERIA

This appendix describes the criteria that must be met by a power supply in order to be classified as an Alternate AC power source. The criteria focus on ensuring that station blackout equipment is not unduly susceptible to dependent failure by establishing independence of the AAC system from the emergency and non-Class 1E AC power systems.

AAC Power Source Criteria

B.1 The AAC system and its components need not be designed to meet Class 1E or safety system requirements. If a Class 1E EDG is used as an Alternate AC power source, this existing Class 1E EDG must continue to meet all applicable safety-related criteria.

B.2 Unless otherwise provided in this criteria, the AAC system need not be protected against the effects of:

(1) failure or misoperation of mechanical equipment, including (i) fire, (ii) pipe whip, (iii) jet impingement, (iv) water spray, (v) flooding from a pipe break, (vi) radiation, pressurization, elevated temperature or humidity caused by high or medium energy pipe break, and (vii) missiles resulting from the failure of rotating equipment or high energy systems; or

(2) seismic events.

B.3 Components and subsystems shall be protected against the effects of likely weather-related events that may initiate the loss of off-site power event. Protection may be provided by enclosing AAC components within structures that conform with the Uniform Building Code, and burying exposed electrical cable run between buildings (i.e., connections between the AAC power source and the shutdown busses).

B.4 Physical separation of AAC components from safety related components or equipment shall conform with the separation criteria applicable for the unit's licensing basis.

Connectability to AC Power Systems

B.5 Failure of AAC components shall not adversely affect Class 1E AC power systems.

B.6 Electrical isolation of AAC power shall be provided through an appropriate isolation device. If the AAC source is connected to Class 1E buses, isolation shall be provided by two circuit breakers in series (one Class 1E breaker at

the Class 1E bus and one non-Class 1E breaker to protect the source).

B.7 The AAC power source shall not normally be directly connected to the preferred or on-site emergency AC power system for the unit affected by the blackout. In addition, the AAC system shall not be capable of automatic loading of shutdown equipment from the blacked-out unit unless licensed with such capability.

Minimal Potential for Common Cause Failure

B.8 There shall be minimal potential for common cause failure of the AAC power source(s). The following system features provide assurance that the minimal potential for common cause failure has been adequately addressed.

(a) The AAC power system shall be equipped with a DC power source that is electrically independent from the blacked-out unit's preferred and Class 1E power system.

(b) The AAC power system shall be equipped with an air start system, as applicable, that is independent of the preferred and the blacked-out unit's preferred and Class 1E power supply.

(c) The AAC power system shall be provided with a fuel oil supply, as applicable, that is separate from the fuel oil supply for the onsite emergency AC power system. A separate day tank supplied from a common storage tank is acceptable provided the fuel oil is sampled and analyzed consistent with applicable standards prior to transfer to the day tank.

(d) If the AAC power source is an identical machine to the emergency onsite AC power source, active failures of the emergency AC power source shall be evaluated for applicability and corrective action taken to reduce subsequent failures.

(e) No single point vulnerability shall exist whereby a likely weather-related event or single active failure could disable any portion of the onsite emergency AC power sources or the preferred power sources, and simultaneously fail the AAC power source(s).

(f) The AAC power system shall be capable of operating during and after a station blackout without any support systems powered from the preferred power supply, or the blacked-out unit's Class 1E power sources affected by the event.

(g) The portions of the AAC power system subjected to maintenance activities shall be tested prior to returning the AAC power system to service.

Availability After Onset of Station Blackout

B.9 The AAC power system shall be sized to carry the required shutdown loads for the required coping duration determined in Section 3.2.5, and be capable of maintaining voltage and frequency within limits consistent with established industry standards that will not degrade the performance of any shutdown system or component. At a multi-unit site, except for 1/2 Shared or 2/3 emergency AC power configurations, an adjacent unit's Class 1E power source may be used as an AAC power source for the blacked-out unit if it is capable of powering the required loads at both units.

Capacity and Reliability

B.10 Unless otherwise governed by technical specifications, the AAC power source shall be started and brought to operating conditions that are consistent with its function as an AAC source at intervals not longer than three months, following manufacturer's recommendations or in accordance with plant-developed procedures. Once every refueling outage, a timed start (within the time period specified under blackout conditions) and rated load capacity test shall be performed.

B.11 Unless otherwise governed by technical specifications, surveillance and maintenance procedures for the AAC system shall be implemented considering manufacturer's recommendations or in accordance with plant-developed procedures.

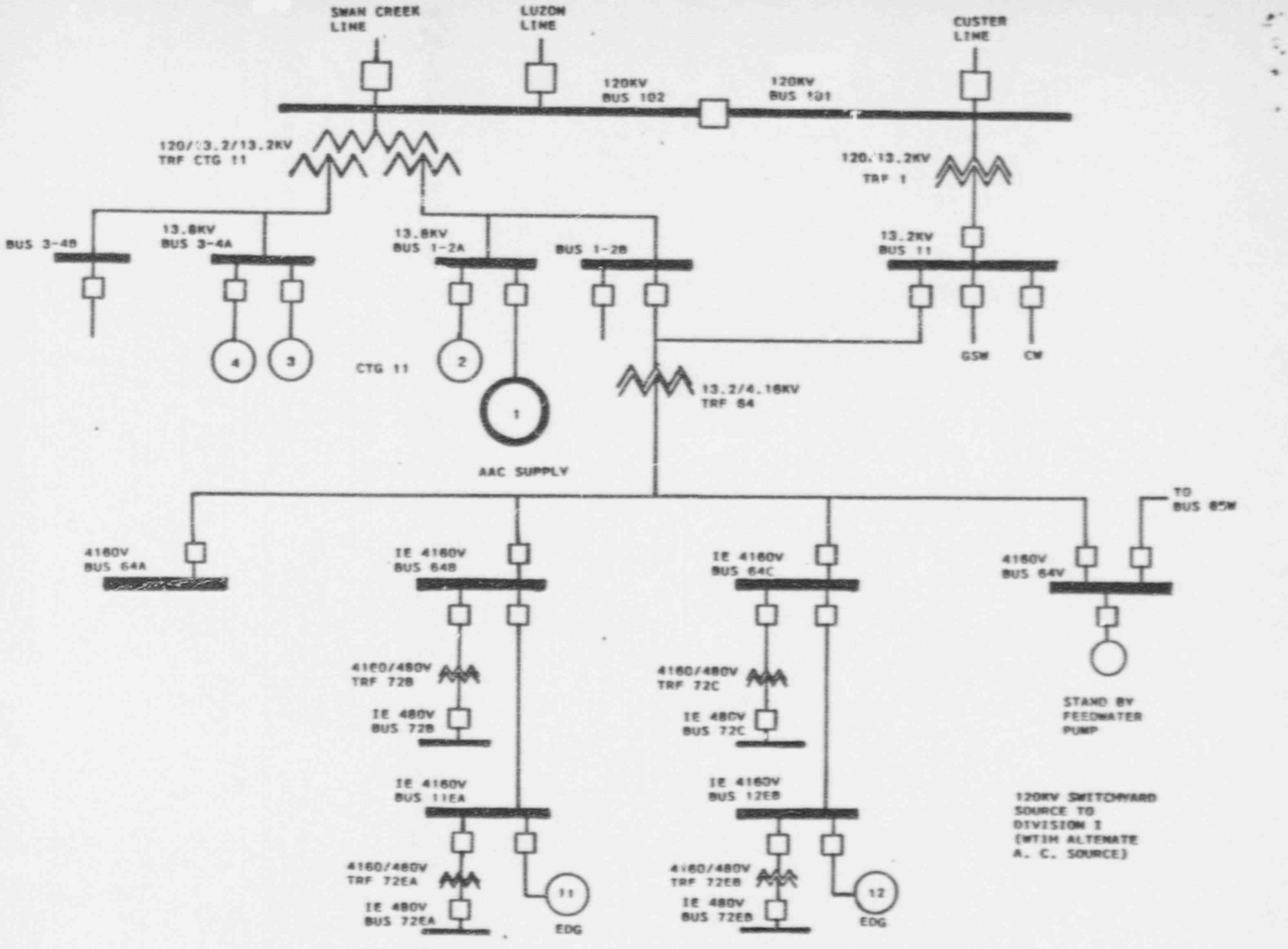
B.12 Unless otherwise governed by technical specifications, the AAC system shall be demonstrated by initial test to be capable of powering required shutdown equipment within one hour of a station blackout event.

B.13 The Non-Class 1E AAC system should attempt to meet the target reliability and availability goals specified below, depending on normal system state. In this context, reliability and availability goals apply to the overall AAC system rather than individual machines, where a system may comprise more than one AAC power source.

(a) Systems Not Normally Operated (Standby Systems)
System reliability should be maintained at or above 0.95 per demand, as determined in accordance with NSAC-108 methodology (or equivalent).

(b) Systems Normally Operated (Online Systems)

Availability	AAC systems normally online should attempt to be available to its associated unit at least 95% of the time the reactor is operating.
Reliability	No reliability targets or standards are established for online systems.



SWAN CREEK LINE
LUZON LINE
CUSTER LINE
120KV BUS 102
120KV BUS 101
120/13.2/13.2KV TRF CTG 11
120/13.2KV TRF 1
BUS 3-4B
13.8KV BUS 3-4A
13.8KV BUS 1-2A
BUS 1-2B
13.2KV BUS 11
4
3
CTG 11
2
1
GSW
CW
13.2/4.16KV TRF 64
AAC SUPPLY
TO BUS 65W
4160V BUS 64A
IE 4160V BUS 64B
IE 4160V BUS 64C
4160V BUS 64V
4160/480V TRF 72B
IE 480V BUS 72B
4160/480V TRF 72C
IE 480V BUS 72C
STAND BY FEEDWATER PUMP
IE 4160V BUS 11EA
IE 4160V BUS 12EB
4160/480V TRF 72EA
IE 480V BUS 72EA
11
EDG
4160/480V TRF 72EB
IE 480V BUS 72EB
12
EDG
120KV SWITCHYARD SOURCE TO DIVISION I (WTIH ALTENATE A. C. SOURCE)