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NRC-89-0061

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) 10CFR50.63, "Loss of All Alternating Current Power", published in the Federal Register June 21, 1988
 - 3) Regulatory Guide 1.155, "Station Blackout"
 - 4) NUMARC 87-00, "Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors"
 - 5) NRC To NUMARC Letter, Thadani to Rasin, "Approval of NUMARC Document on Station Blackout (TAC 40577)", dated October 7, 1988

Subject: Station Blackout

Detroit Edison has completed its review of actions needed to cope with a station blackout in accordance with 10CFR50.63. The final rule (Reference 2) required submittal of a proposed plant specific station blackout duration, a description of procedures that will be implemented to respond to a station blackout, a list of modifications necessary to meet the requirements, and a proposed schedule for implementation. Per the final rule, the NRC will review this information and then a final schedule will be established.

Regulatory Guide 1.155 (Reference 3) described a method acceptable to the NRC for complying with 10CFR50.63. This Regulatory Guide states that NUMARC 87-00 (Reference 4) also provides guidance acceptable to the NRC for meeting the requirements. Detroit Edison used the guidance in NUMARC 87-00 to perform its evaluation of the ability of

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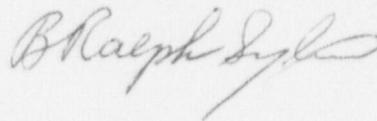
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Fermi 2 to cope with a station blackout event. The enclosed response is modeled after the NUMARC generated "Generic Response to Station Blackout Rule for Plants Using Alternate AC Power". This document was approved by the NRC in Reference 5 with minor revisions that have been incorporated.

If there are any questions regarding this submittal, contact Lynne Goodman at (313) 586-4211.

Sincerely,

A handwritten signature in cursive script, appearing to read "B. Raepher".

Enclosure

cc: R. C. Knop
W. G. Rogers
J. F. Stang
Region III

RESPONSE TO STATION BLACKOUT RULE FOR PLANTS USING ALTERNATE AC POWER

On July 21, 1988, the Nuclear Regulatory Commission (NRC) amended its regulations in 10 C.F.R., Part 50. A new section, 50.63, was added which requires that each light-water-cooled nuclear power plant be able to withstand and recover from a station blackout (SBO) of a specified duration. Utilities are expected to have the baseline assumptions, analyses and related information used in their coping evaluation available for NRC review. It also identifies the factors that must be considered in specifying the station blackout duration. Section 50.63 requires that, for the station blackout duration, the plant be capable of maintaining core cooling and appropriate containment integrity. Section 50.63 further requires that each licensee submit the following information:

1. A proposed station blackout duration including a justification for the selection based on the redundancy and reliability of the onsite emergency AC power sources, the expected frequency of loss of offsite power, and the probable time needed to restore offsite power;
2. A description of the procedures that will be implemented for station blackout events for the duration (as determined in 1 above) and for recovery therefrom; and
3. A list and proposed schedule for any needed modifications to equipment and associated procedures necessary for the specified SBO duration.

The NRC has issued Regulatory Guide 1.155 "Station Blackout" which describes a means acceptable to the NRC Staff for meeting the requirements of 10 C.F.R. 50.63. Regulatory Guide (RG) 1.155 states that the NRC Staff has determined that NUMARC 87-00 "Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout At Light Water Reactors" also provides guidance that is in large part identical to the RG 1.155 guidance and is acceptable to the NRC Staff for meeting these requirements.

Table 1 to RG 1.155 provides a cross-reference between RG 1.155 and NUMARC 87-00 and notes where the RG takes precedence.

Detroit Edison has evaluated the Fermi 2 Plant against the requirements of the SBO rule using guidance from NUMARC 87-00 except where RG 1.155 takes precedence. The results of this evaluation are detailed below. (Applicable NUMARC 87-00 sections are shown in parenthesis.)

A. Proposed Station Blackout Duration

NUMARC 87-00, Section 3 was used to determine a proposed SBO duration of four (4) hours.

The following plant factors were identified in determining the proposed station blackout duration:

1. AC Power Design Characteristic Group is P₂ Based on :
 - a. Expected frequency of grid-related LOOPS - does not exceed once per 20 years (Section 3.2.1, Part 1A, p. 3-3);
 - b. Estimated frequency of LOOP's due to extremely severe weather places the plant in ESW Group 1 (Section 3.2.1, Part 1B, p. 3-4);
 - c. Estimated frequency of LOOP's due to severe weather places the plant in SW Group 3 (Section 3.2.1, Part 1C, p. 3-7);
 - d. The offsite power system is in the I 1/2 Group. (Section 3.2.1, Part 1D, p. 3-10);
 - e. Plant-specific pre-hurricane shutdown requirements and procedures which meet the guidelines of Section 4.2.3 of NUMARC 87-00 are not applicable to Fermi 2 as the plant is not in a hurricane affected area.
2. The emergency AC power configuration group is B based on:
(Section 3.2.2, Part 2C, p. 3-13)
 - a. There are four (4) emergency AC power supplies not credited as alternate AC power sources (Section 3.2.2, Part 2A p. 3-15);
 - b. Two (2) emergency AC power supplies are necessary to operate safe shutdown equipment following a loss of offsite power (Section 3.2.2, Part 2B, p. 3-15);
3. The target EDG reliability is 0.95.

A target EDG reliability of 0.95 was selected based on the following which is consistent with NUMARC 87-00, Section 3.2.4.

- i. Having a nuclear unit average EDG reliability for the last 20 demands greater than 0.90 with all four (4) EDG's considered;

- ii. Having a nuclear unit average EDG reliability for the last 50 demands greater than 0.94 with all four (4) EDG's considered and;
 - iii. Having a unit EDG reliability for the last 100 demands greater than 0.95 for one (1) EDG with over 100 demands.
4. An alternate AC (AAC) power source will be utilized at Fermi 2 which meets the criteria specified in Appendix B to NUMARC 87-00.

The AAC power source is available within one hour of the onset of the station blackout event and has sufficient capacity and capability to operate systems necessary for coping with a station blackout for the required SBO duration of four (4) hours to bring and maintain the plant in safe shutdown. An AC independent coping analysis was performed for the one hour required to bring the AAC power source on line.

The Fermi 2 alternate AC (AAC) power source will be Unit 1 of CTG11, a four unit Combustion Turbine Generator (CTG) peaking unit located within the Fermi Owner Control area at the 120 KV Switchyard. Unit 1 is a 13.8KV, 18,875KVA, 0.85pf self contained outdoor peaker generating unit equipped with a diesel starting motor to provide black start capability. The unit is presently used to support the Dedicated Shutdown System for Appendix R requirements and has been regularly tested under a surveillance procedure and shown to be able to start and be ready to accept loads in 6-12 minutes with a reliability of .95 or better. The attached figure shows the CTG11 Unit 1 and the associated switchgear and equipment that allows the unit to be connected to the Fermi 2 load buses. The unit is normally in standby and thus will not be affected by any offsite power losses or grid disturbances. The unit can be started and connected to the Fermi 2 load busses from the Fermi 2 Control Room via a supervisory control system.

B. Procedure Description

Plant procedures have been reviewed per the guidelines in NUMARC 87-00, Section 4 in the following areas.

1. AC power restoration per NUMARC 87-00, Section 4.2.2;

- a. "Emergency Black Light Restoration Procedures". This procedure provides corporate system restoration philosophy and initial restoration paths for the overall Edison electrical system. Fermi 2 is given a high restoration priority after the available power plants are interconnected to form a skeletal system and some load has been added to stabilize the units. Outside power can be provided to Fermi 2 from several paths. Those paths available would be used first with physical repairs to downed lines later, as tower repair needs are identified. Establishing the skeletal system and tying power plants and other utilities is first priority. As Fermi 2 has five feeds, restoration of at least one line to the site should pose no major problem.
- b. NPP-20.300.01 "Loss of Offsite and Onsite Power". This plant procedure provides direction on restoring offsite power to associated plant buses when either of the switchyards are energized. At this point System Operating Procedures would be utilized to re-establish normal power feeds from the offsite power sources.
- c. Restoration of incoming transmission lines are not covered specifically by a corporate procedure but the Towers Division of The Detroit Edison Company/Wayne - Monroe Division would respond to a lines down incident. The Newport Warehouse, located about ten (10) miles from the plant, stocks replacement parts and conductors for damaged line repairs. Additionally, a computerized supply system is also available to identify other company locations for any additional supplies that may be needed. As noted in a. above restoration of transmission lines necessary to establish a skeletal system would be first priority. As Fermi 2 has five (5) incoming feeds, restoration of one line should not pose a major problem.
- d. The use of portable AC generators has not been considered for restoring power to Fermi 2 due to the availability of the CTG11 peaking generator unit which has black start capability and enough capacity to support any plant loads connectable to the 120 KV switchyard. This includes the Circulating Water Pump House and General Service Water Pump House loads for plant and equipment heat removal as necessary. Refer to the attached figure showing the electrical connections from CTG11 and the 120 KV switchyard.

2. Severe weather per NUMARC 87-00, Section 4.2.3.

Fermi 2 is located in southeast Michigan and as such is not susceptible to the major forces of hurricanes but will be impacted by bad weather at the fringe of the storm. Because Fermi 2 is not in normal hurricane paths there are no procedures for site-specific actions to respond to a hurricane. Procedure NPP-20.000.01 "Acts of Nature" address site-specific actions to be followed for a Tornado watch or warning. The actions include but are not limited to personnel evacuation to safe areas of buildings, closing of exterior doors, suspension of outside activities such as transportation of radioactive materials, chemical unloading, suspension of fuel handling on fifth floor of the Reactor Building, and verification that outside equipment is properly stored.

Plant procedures have been reviewed and changes necessary to meet NUMARC 87-00 will be implemented in the following areas:

1. Station blackout response per NUMARC 87-00, Section 4.2.1;
2. Procedure changes associated with any modifications required after assessing coping capability per NUMARC 87-00, Section 7.

The following is a brief description of procedures to be revised and the associated procedure changes. The expected date when these changes will be incorporated into the respective procedures is April 14, 1990.

NPP-20.300.01 "Loss of Offsite and Onsite Power"

- a. Add requirement to open control room and relay room cabinet doors and control room partition doors to increase air transfer to improve cooling of equipment in cabinets.
- b. Add requirement to bypass equipment area high temperature trips for HPCI and RCIC turbines. Area high temperature sensors are set at 150°F to detect steam leakage in area.
- c. Add information to make operators aware that after about thirty (30) minutes a loss of control air system pressure will affect Control Room indication of drywell pressure, torus pressure and torus level. The indications will return for Division I instruments when the Division I control air compressor is re-started from the AAC.

- d. Add an enclosure to indicate instrumentation fed from the station UPS system and 2PC battery system that would be lost as the battery output voltages decrease.
 - e. Add requirement to de-energize full core display panel should the AAC fail to start to keep the display from being damaged due to heat build up.
 - f. Revise the order of power bus restoration to move up the re-energization of the 2PC battery chargers to support extending battery capability and supporting the output voltage profile.
2. SOP 23.324 "Supervisory Control 120kv Switchyard and CTG11 Generators"
- a. Add instructions for logging attempted starts and an applicable evaluation to track and ensure the AAC (CTG11-1) reliability remains high.

C. Proposed Modifications and Schedule

The Fermi 2 Non-Class IE BOP-2PC 260/130 volt battery was found to perform marginally after 1/2 hour. This battery will be scheduled to be tested during the first refueling outage this fall and the time for its replacement in the future determined based on the test results.

The AAC source has the capacity and capability to power the equipment necessary to cope with a SBO in accordance with NUMARC 87-00, Section 7 for the required coping duration determined in accordance with NUMARC 87-00, Section 3.2.5. AAC source is not considered available within ten minutes of the onset of Station Blackout.

1. Condensate Inventory For Decay Heat Removal (Section 7.2.1)

It has been determined from Section 7.2.1 of NUMARC 87-00 that 72,820 gallons of water are required for decay heat removal for a four (4) hour coping duration for Station Blackout. The minimum permissible condensate storage tank level per technical specifications provides 150,000 gallons of water, which exceeds the required quantity for coping with a four (4) hour Station Blackout. No plant modifications or procedure changes are needed to utilize this water source.

2. Class IE and Non-IE Battery Capacities (Section 7.2.2)

Fermi 2 requires Class IE as well as Non-IE batteries to support operation of the AAC for Station Blackout. A battery capacity calculation has been performed pursuant to NUMARC 87-00, Section 7.2.2 to verify that required Class IE and Non-Class IE batteries have sufficient capacity to meet Station Blackout loads for one hour. The Class IE batteries were determined to be adequate to meet Station Blackout loads for one hour. The Non-Class IE batteries that support the AAC source, switchgear and associated control functions were determined to be adequate to meet Station Blackout loads for one hour with the following exception:

The Fermi 2 Non-Class IE BOP-2PC 260/130 volt battery was calculated to perform marginally after one-half hour. The battery is not discharged at this point although output voltage will be low due to the large emergency oil pump loads on the system. These large emergency oil pumps will be switched off the battery between one-half and one and one-half hours into the Station Blackout event as their associated rotating equipment stops. The 2PC battery is needed during the first one-half hour to start the AAC Source and switch its output into the Fermi 2 plant load buses. After one-half hour this battery would be used to place other BOP plant loads into service to aide in recovery such as lighting, HVAC systems and plant cooling water systems not required for station blackout.

The 2PC battery will have a battery capacity test performed during the first refueling outage this fall. Based on the results, the time of its replacement in the future will be determined.

3. Compressed Air (Section 7.2.3)

No air-operated valves are relied upon to cope with a Station Blackout for one hour.

Note that the two (2) low low set relief valves and five (5) ADS Safety Relief Valves (SRV's) are operated by pressurized nitrogen. Each valve has an accumulator sized to provide five (5) actuations of the relief valve on loss of the nitrogen supply.

4. Effects of Loss of Ventilation (Section 7.2.4)

- A. The steady state ambient air temperature has been calculated for the following dominant areas of concern:

<u>AREA</u>	<u>TEMPERATURE</u>
HPCI Room	180 ^o F/82 ^o C
RCIC Room	158 ^o F/70 ^o C
Main Steam Tunnel	241 ^o F/116 ^o C
Drywell	291 ^o F/144 ^o C (1 hour)
	313 ^o F/156 ^o C (2 hours)
	334 ^o F/168 ^o C (3 hours)

- B. Control Room Complex

The assumption in NUMARC 87-00, Section 2.7.1 that the control room will not exceed 120^oF during a Station Blackout has been assessed. The control room at Fermi 2 does not exceed 120^oF during a Station Blackout. Therefore, the control room is not a dominant area of concern.

- C. HVAC systems serving the following dominant areas of concern are not available during the first hour:

HPCI Room
RCIC Room
Main Steam Tunnel
Drywell

The HVAC System for the Drywell is not available during the first hour, but will be reestablished when AAC Source is available. The Drywell is a dominant area of concern not from an equipment operability concern but to ensure that Drywell temperature would not exceed the design limit of 340^oF. Fermi 2 has a Mark 1 Containment.

The HVAC System for the Control Center Complex which is not identified as a dominant area of concern is not available during the first hour of the Station Blackout event.

Reasonable assurance of the operability of Station Blackout response equipment in the above dominant area(s) has been assessed using Appendix F to NUMARC 87-00 and/or the Topical Report. The following associated procedure changes are required to provide reasonable assurance for equipment operability:

NPP-20.300.01 "Loss of Offsite and Onsite Power"

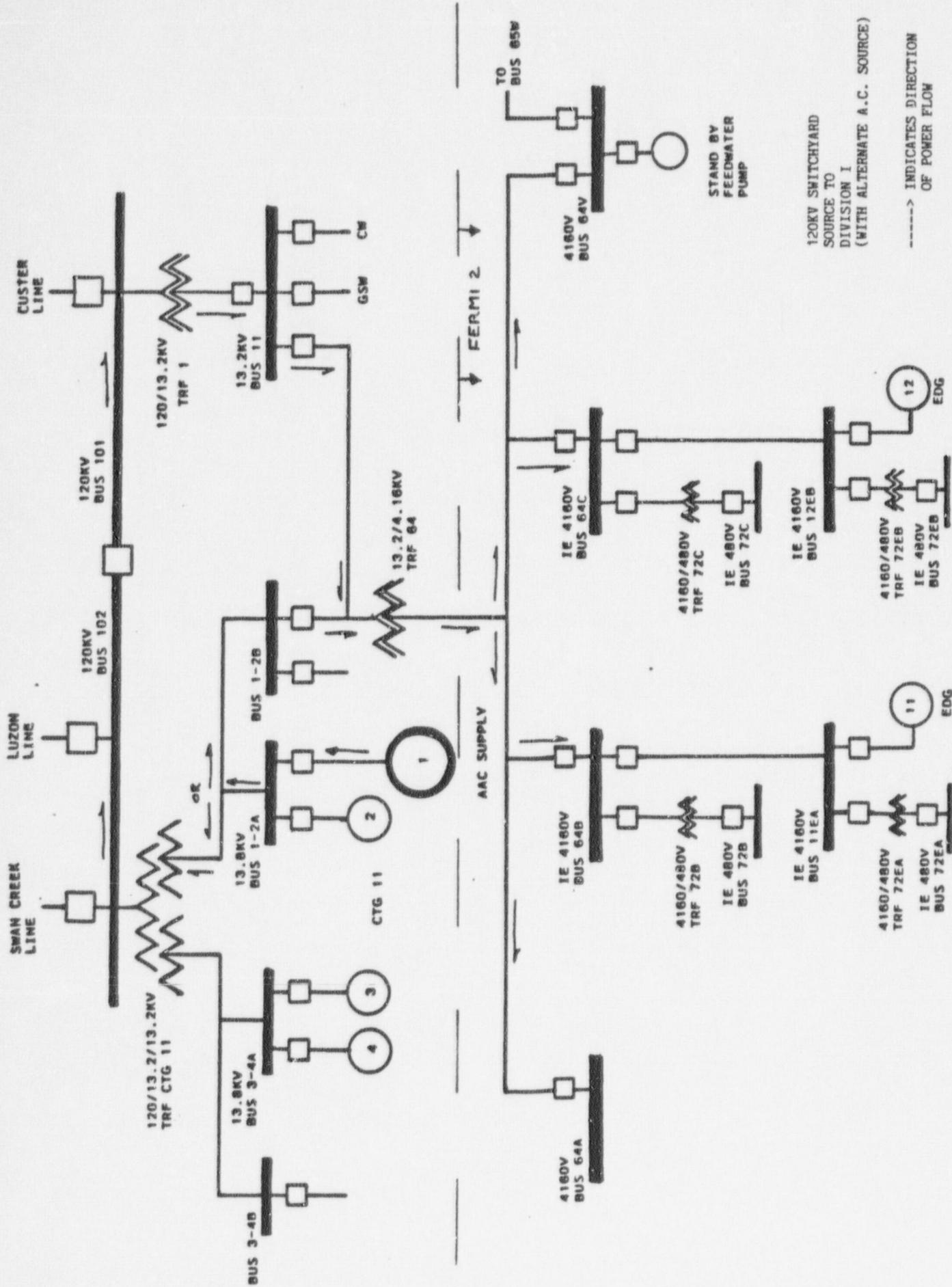
1. Since equipment inside instrumentation and control cabinets are exposed to their own electrical heat loads, doors of cabinets containing energized equipment within the Control and Relay Rooms relied upon to cope with a station blackout should be opened within thirty (30) minutes of the Station Blackout onset, per NUMARC 87-00, Section F.5. This action includes the partition doors in the Control Room behind control panels H11-P602 and P804. An increase in air transfer is provided by opening cabinet doors, thus, keeping the instrumentation inside cooler.
2. Both the HPCI and RCIC rooms have equipment area high temperature sensors which are capable of causing isolation of the HPCI or RCIC systems. Calculations have shown that temperatures will exceed the setpoint limits of 150^oF. The systems will isolate unless operator action is taken. The equipment area high temperature signals will be disabled.
5. Containment Isolation (Section 7.2.5)

The plant list of containment isolation valves has been reviewed to verify that valves which must be capable of being closed or that must be operated (cycled) under Station Blackout conditions can be positioned (with indication) independent of the preferred and blacked-out unit's Class IE power supplies. No plant modifications and/or associated procedure changes were determined to be required to ensure that appropriate containment integrity can be provided under SBO conditions.
6. Reactor Coolant Inventory (Section 2.5)

The ability to maintain adequate reactor coolant system inventory to ensure that the core is cooled has been assessed for a four hour coping duration. The generic analyses listed in Section 2.5.2 of NUMARC 87-00 were

used for this assessment and are applicable to the specific design of Fermi 2. The expected rates of reactor coolant inventory loss under SBO conditions do not result in more than a momentary core uncover in a SBO of four (4) hour duration. Therefore, makeup systems in addition to those currently available under SBO conditions are not required to maintain core cooling under natural circulation (including reflux boiling).

The procedure changes identified in Parts A, B and C above will be completed within 1 year after the notification provided by the Director, Office of Nuclear Reactor Regulation in accordance with 10 C.F.R. 50.63(c) (3).



120KV SWITCHYARD
SOURCE TO
DIVISION I
(WITH ALTERNATE A.C. SOURCE)

-----> INDICATES DIRECTION
OF POWER FLOW

FERMI 2

AAC SUPPLY

STAND BY
FEEDWATER
PUMP

12
EDG

11
EDG

CUSTER
LINE

LUZON
LINE

SWAN CREEK
LINE

120KV
BUS 101

120KV
BUS 102

120/13.2/13.2KV
TRF CTG 11

120/13.2KV
TRF 1

13.8KV
BUS 3-4A

13.8KV
BUS 1-2A

13.2KV
BUS 11

CTG 11

13.2/4.16KV
TRF 64

4160V
BUS 64A

IE 4160V
BUS 64B

IE 4160V
BUS 64C

4160V
BUS 64V

4160/480V
TRF 72B

4160/480V
TRF 72C

4160/480V
TRF 72EA

4160/480V
TRF 72EB

IE 4160V
BUS 11EA

IE 4160V
BUS 12EB

IE 480V
BUS 72EA

IE 480V
BUS 72EB