TOLEDO EDISON

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License No. NPF-3

Docket No. 50-346

Serial No. 899

February 2, 1983

Mr. John F. Stolz, Chief
Operating Reactors Branch No. 4
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. Stolz:

This is in response to your letter dated December 27, 1982 (log No. 1165) relating to plant computer system and NNI-X power failure. Your letter requested information on operability of plant computer system in the event of unavailability of YAU or YBU and the implications of a loss of NNI-X power supply transient. Attachment 1 provides Toledo Edison's response to your letter as relating to the Davis-Besse Nuclear Power Station Unit 1.

Very truly yours,

RPC:SCJ:HA

cc:
DB-1 NRC Resident Inspector

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Attachment 1 to Toledo Edison Letter to the NRC on Plant Computer System and Loss of NNI-X

Item 1: Toledo Edison Company letter dated July 8, 1981 committed to providing automatic transfer to a redundant power source for the control room annunciator system. We understand that this commitment is fully implemented. Toledo Edison Company also committed to a similar provision for the plant computer system which was to be implemented when the new plant computer was installed. We understand that the new computer was installed during the last refueling outage.

Toledo Edison Company is requested to describe how the commitment for the plant computer system has been implemented. Specifically, does the computer system remain functionally operable (CPU, I/O units, etc.) from the control room in the event either power supply (YAU or YBU) is unavailable? If the commitment is not yet fully implemented, describe the extent to which the present system operability is independent of a single power source, the nature of your intended actions to complete implementation, your schedule for completion; and the compensatory measures in force in the interim.

Response: The overall replacement of the plant computer system has several phases. Phase one was completed during 1982, when the central processor and all peripherals except the multiplexers were replaced.

In 1982, Toledo Edison installed two separate processors, each powered from an independent uninterruptible power supply (YAU or YBU) source. Power for the operator displays and peripherals has been divided equally between YAU and YBU. Both processors are normally running in a master/slave mode with a direct communication link between them.

During loss of YAU or YBU, after a 5 second period, the powered processor becomes the master and transfers all operator peripherals to its I/O buss. The computer multiplexers have not been upgraded to meet the single power failure criteria. Toledo Edison intends to provide this protection when the multiplexers are replaced.

The additional modifications providing the single failure protection for the plant computer system will be implemented in accordance with an integrated schedule approach that will maximize resources. The compensatory measure in force in the interim consists of reliance on manual computation in the event of loss of a single power source.

No direct or indirect reactor protection or process control action is taken by the computer system. The primary function of the system is to provide information to assist the operator in efficient operation of the plant. Should the computer be completely out of service for any reason, the capability of plant operation or safe shutdown under automatic or manual control is not impaired.

Item 2: It is our understanding that a large fraction of the non-nuclear instrumentation is powered from the NNI-X supply and the remainder from the NNI-Y supply. Therefore, if the NNI-Y supply fails, a minor plant transient would occur and that a plant trip might be avoidable. Accordingly, control room readout devices are switched to NNI-X powered transmitters to provide sufficient information to the reactor operator. However, if NNI-X supply fails, the plant transient is more significant and a plant trip is unavoidable.

Toledo Edison Company is requested to describe the transient that occurs (in terms of RCS pressure, temperatures and flows, etc.) if NNI-X is lost. Identify the control room indicators remaining to permit identification of the transient, track the course of the event. Identify those plant systems necessary to mitigate the transient. Identify any systems that are expected to be unavailble during the event. Provide your basis for acceptability of this event in lieu of plant modifications or other compensatory actions to lessen the effects of the disproportionate NNI loading on the NNI-X power supply.

Response: The NNI cabinets are provided with automatic transfer switches that select a redundant source of AC power if the normal source is lost. This feature, plus redundant DC power supplies, makes a loss of power unlikely.

A loss of NNI-X AC/DC power supply causes main feed water flows in both loops to be BTU limited to approximately zero feed water flow. The reactor coolant system average temperature (Tave) input to the Integrated Control System (ICS) fails mid-scale to 570°F resulting in continuous withdrawal of control rods. The above actions culminate in a high pressure condition in the reactor coolant system causing a reactor trip. The main and startup feed water flow control will be lost and the secondary side inventory will begin to rapidly boil off. Manual or automatic initiation of the Steam and Feedwater Rupture Control System (SFRCS) will restore secondary side cooling, and safety grade secondary side level control.

Davis-Besse Unit 1 experienced a loss of NNI-X AC power on January 18, 1983. This transient was very similar to the one described above. Further detailed evaluation of this transient is continuing.

The loss of NNI-X AC/DC results in the failure of a significant number of controlling signals which results in a unit trip and possible SFRCS actuation. The following are the pertinent controlling signals and the resulting effects as a result of loss of NNI-X AC and NNI-X DC:

A. Loss of NNI-X AC

1. Tave Integrated Control System input fails to 570°F causing control rods to continuously withdraw since normal Tave is maintained at 582°F.

2. Selected turbine header pressure signal fails to 900 psig causing turbine load increase as normal turbine header pressure is maintained at 870 psig.

3. Loop and selected T_H signals fail to 570°F causing both loop main feed water flows to be BTU limited to approximately zero feed water flow (loss of main feed water flow to both steam generators). To compensate for this, the loop and selected T_H signals are procedurally transferred to NNI-Y.

4. Reactor trip on high pressure.

5. Post trip response is off-normal due to failure of steam generator low level limits and failure of makeup flow control valve MU32 "as is" (approximately 25% open normally).

6. Possible SFRCS actuation on low steam generator level due to failure of steam generator low level limit control by the Integrated Control System. (Start up range level signal to the ICS is failed at center scale and will not actuate steam generator low level limit control unless action is taken by the operator). The SFRCS actuation will restore adequate secondary side cooling and level control.

7. Possible initiation of Safety Features Actuation System (SFAS).

The following automatic functions will become inoperable following loss of NNI-X AC:

1. Automatic pressurizer level control is inoperable due to makeup flow control valve MU32 failing "as is" and inaccurate pressurizer level control signal to MU32. To alleviate this situation, operator is procedurally directed to use the MU32 bypass valve (MU211) utilizing the control room pressurizer level indication. The control room pressurizer level indicators will indicate the existing uncompensated pressurizer level.

2. Automatic seal injection flow control is inoperable due to seal injection valve (MU19) failing "as is".

3. The seal injection flow interlock will not function to prevent the start of a reactor coolant pump without seal injection flow, however, the reactor coolant pumps will not trip resulting from this loss of function.

4. Pressurizer low level heater cutoff will not function. However, manual control of the safety grade heaters from the control room will not be impaired.

5. Steam Generator low level limit control will not function due to steam generator startup range level signals to the Integrated Control System failing to 125 inches. However, the control room and auxiliary shutdown panel steam generator start up range level indicators will be available and will display the existing steam generator water levels.

6. All automatic feed water flow control (both main and startup) will be inoperable due to failed signals and/or faulty temperature compensation. However, essential auxiliary feed water controls in the control room and controls at the auxiliary shutdown panel will be available.

B. Loss of NNI-X DC

1. Tave Integrated Control System input fails to 570°F causing control rods to continuously withdraw since normal Tave is maintained at 582°F.

2. Selected turbine header pressure signal fails to 900 psig causing the turbine to continuously pick up load.

3. Loop and selected T_H signals fail to 570°F causing both loop main feed water flows to be BTU limited to approximately zero feed water flow (loss of main feed water flow to both steam generators).

4. If open, the pressurizer spray valve (RC2) and the PORV (RC2A) will close. The PORV can, however, be manually opened if required.

5. If energized, pressurizer heaters will turn off. Manual control of the safety grade heaters from the control room will not be impaired.

6. Reactor trip on high pressure.

7. Makeup flow control valve MU32 will fail to 50% open.

8. Possible SFRCS actuation on low steam generator level due to failure of steam generator low level limit control by the Integrated Control System (start up range level signal to the Integrated Control System is failed at center scale will not actuate low level limit control, and cannot be regained without NNI-X DC power). This will restore adequate secondary side cooling and level control.

9. Possible initiation of Safety Features Actuation System.

The following automatic functions will become inoperable following loss of NNI-X DC:

1. Automatic pressurizer level control is inoperable due to makeup flow control valve MU32 failing to 50% open and inaccurate pressurizer level control signal to MU32. To alleviate this situation, operator is procedurally directed to use the MU32 bypass valve (MU211) utilizing the control room pressurizer level indication. The control room pressurizer level indicators will indicate the existing uncompensated pressurizer level.

2. Automatic seal injection flow control is inoperable due to seal injection valve MU19 failing to 50% open (approximately the normal position for this valve).

3. The seal injection flow interlock will not function to prevent the start of a reactor coolant pump with out seal injection flow, however, the reactor coolant pumps will not trip resulting from this loss of function.

4. Pressurizer low level heater cutoff will not function. However, no damage will be imparted to the heaters since they will be de-energized. In addition, manual control of the safety grade heaters from the control room will not be impaired.

5. Pressurizer heaters will not function in the automatic mode, however, manual control of the safety grade heater banks can be regained in the control room.

6. Neither the pressurizer spray valve (RC2) nor the PORV (RC2A) will open automatically. The PORV can, however, be manually opened if required.

7. Steam generator low level limit control will not function due to steam generator startup range level signals to the Integrated Control System failing to 125 inches. The safety grade control room and auxiliary shutdown panel startup level indicators will display existing steam generator levels.

8. All automatic feed water flow control (both main and startup) is inoperable due to failed signals and/or faulty temperature compensation. However, essential auxiliary feed water controls in the control room and controls at the auxiliary shutdown panel will be available.

9. Decay Heat/Low Pressure Injection pump 1-2 high and low flow alarms are inoperable.

10. High Pressure Injection pump 1-2 high and low flow alarms are inoperable.

11. Loop 2 high and low reactor coolant pressure alarms are inoperable.

To avoid a severe plant transient caused by a loss of NNI-X, there are sufficient alarms to alert the operator about such failure which may permit operator action that could avoid a potential SFRCS actuation. This will result in a reduced cooldown rate of the reactor coolant system which will slow the transient to a more controllable rate under the limiting circumstances. The alarms are:

A. NNI-X AC:

1. ICS/NNI 118 V AC PWR TRBL Annunicator Alarm
2. Loss of X-AC NNI Power Indicating Light on Control Room Panel
3. Computer point Q696-NNI X 118 V AC PWR TRBL
4. ICS S/G 1 and ICS S/G 2 on BTU Limit Annunicator alarms
5. Zero volts indicated on Uninterruptible Instrument busses YAU and YBU
6. On all X-NNI powered recorders, the pens fail "as is" and paper motion stops
7. All X-powered indicators fails toward, but not necessarily at, center scale.

B. NNI-X DC:

1. Loss of X-DC NNI Power Indicating Light on Control Room Panel
2. NNI 24 VDC Bus Trip Annunicator alarm
3. Computer Point Q715 - NNI-X DC Bus Trip
4. RC Loop 2 Hot Leg Flow Low Annunciator alarm
5. RC Hot Leg Total Flow Low Annunicator alarm
6. ICS S/G 1 and ICS S/G 2 on BTU Limit Annunciator alarm
7. ICS RC Flow Runback In Effect Annunciator alarm
8. All indicators and recorders displaying X signals fail toward, but not necessarily at, center scale.

Based on the above, we feel that there are sufficient alarms and indications available to the operator to take appropriate immediate as well as supplementary actions as required to mitigate the transient. In order to enhance the overall reliability of the NNI-X AC and DC power supplies, Toledo Edison has undertaken several measures. These include:

1. Providing automatic transfer of the AC source to an alternate uninterruptible power source when the primary source has been lost.

2. Providing two NNI-X DC power supplies which are supplied from separate uninterruptible AC sources. Each DC power supply can supply the full load of the system.

3. Another modification, in the design stage, is to provide independent fuses (see attached figure) to the AC circuits such that failure in one portion of NNI-X will not cause a total NNI-X failure, and no more than one critical component will be lost.

The system modifications completed heretofore, and those under evaluation provide sufficient compensatory measures to enable appropriate operator actions to ensure acceptable system response in relation to the severity of overall transient.

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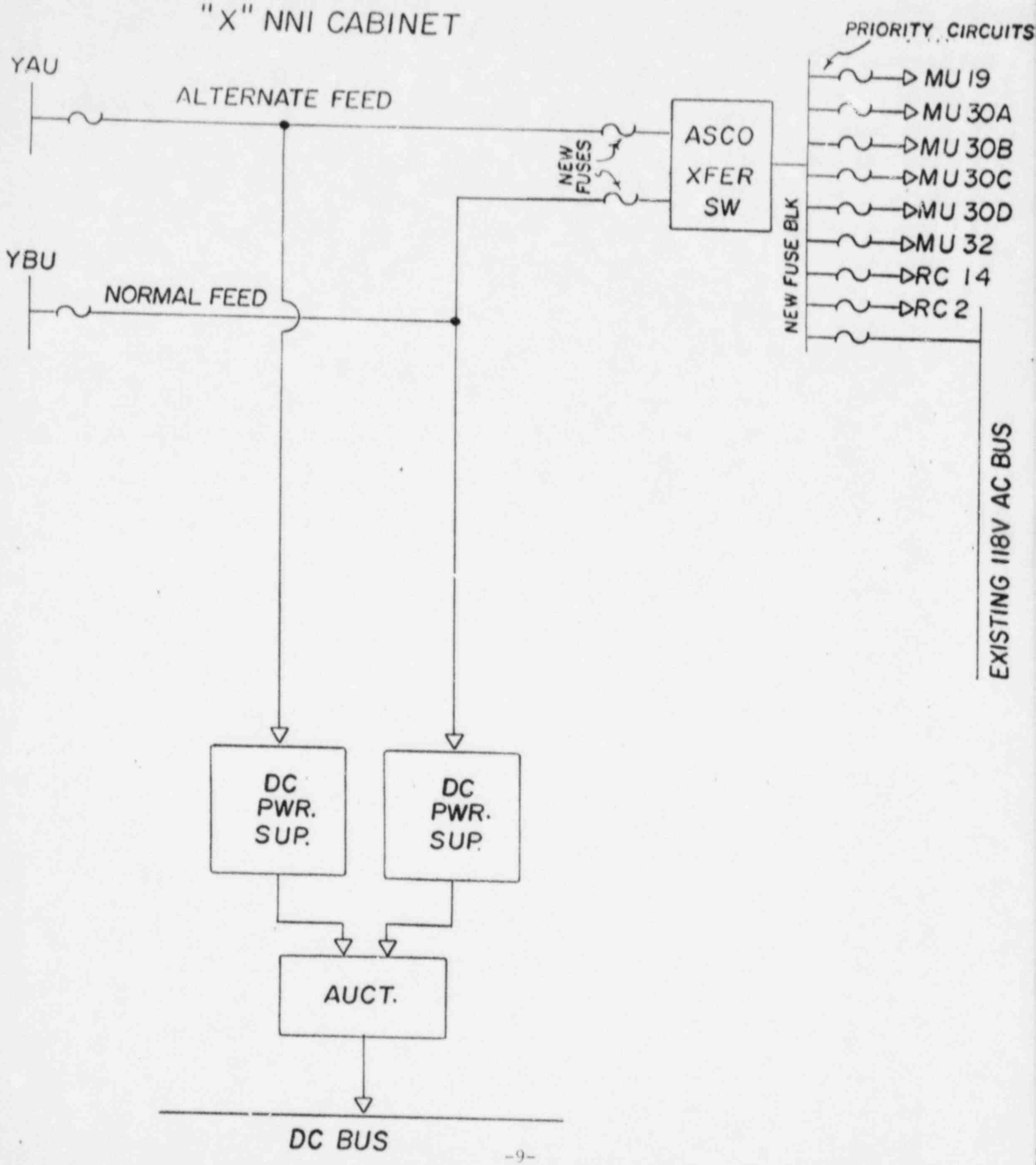
"X" NNI CABINET
PRIORITY CIRCUITS
YAU
ALTERNATE FEED
YBU
NORMAL FEED
NEW FUSES
ASCO
XFER
SW
NEW FUSE BLK
MU 19
MU 30A
MU 30B
MU 30C
MU 30D
MU 32
RC 14
RC 2
EXISTING 118V AC BUS
DC
PWR.
SUP.
DC
PWR.
SUP.
AUCT.
DC BUS