Florida
Power
CORPORATION
Crystal River Unit 3
Docket No. 50-302

July 8, 1996
3F0796-03

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

Subject: Post-accident Monitoring Instrumentation

Reference: FPC to NRC letter, 3F0296-02, dated February 1, 1996

Dear Sir:

Florida Power Corporation (FPC) has been conducting an in-depth review of Emergency Operating Procedures (EOP's) for Crystal River 3 (CR-3). This review is described in detail in the reference letter. As part of this review, it was determined that two plant process variables should be re-classified to Type A variables in accordance with Regulatory Guide (RG) 1.97 for post-accident monitoring instrumentation. The purpose of this correspondence is to describe FPC's action plan to upgrade the design of these instruments. In addition, Type A variables are required to be included in the CR-3 technical specification for post-accident monitoring instrumentation. The changes in type classification have been implemented under 10 CFR 50.59 with a technical specification change request to be submitted to the NRC by October 1, 1996. In the interim, FPC has implemented administrative controls for these variables identical to the LCO and surveillance requirements in effect for other post accident monitoring instrumentation.

The "degrees of subcooling" (subcooling margin) variable is currently listed in FPC's commitment to RG 1.97 as Type B; that is, one of "those variables that provide information to indicate whether plant safety functions are being accomplished." Review of the EOP's has revealed this variable should be listed as Type A because of the way the information from the monitors is utilized in some of the procedural steps. A Type A variable is one of "those variables that provide primary information needed to permit the control room operating personnel to take the specified manually controlled actions for which no automatic control is provided and that are required for safety systems to accomplish their safety functions for design basis events." Subcooling margin is used as a criterion for manual initiation of high pressure injection, tripping of reactor coolant pumps, and selection of the steam generator high level setpoint on the Emergency

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Feedwater Initiation and Control System, as well as other actions which could be considered to meet the criteria for a Type A variable.

Similarly, the "decay heat removal flow" variable is currently listed in FPC's commitment to the Regulatory Guide as Type D; that is, one of "those variables that provide information to indicate the operation of individual safety systems and other systems important to safety." The review of the EOP's has revealed that this variable should also be listed as Type A as it is used to ensure adequate net positive suction head is available for the decay heat removal (low pressure injection mode) and reactor building spray pumps after suction for these pumps is swapped from the borated water storage tank to the reactor building sump during post-LOCA cooldown.

RG 1.97 indicates that Type A variables should be monitored by instrumentation designed to Category 1 criteria. It also provides guidance on design and qualification criteria for Category 1, 2, and 3 instrumentation. The decay heat removal flow instrumentation satisfies all of the design attributes recommended by the Regulatory Guide except for recording. FPC will install a modification to add inputs to the plant computer to provide the recording function. Because this modification will involve work inside critical instrumentation cabinets, it must be installed while the plant is not operating. Thus, the modification will be installed during the first outage of sufficient duration following completion of the engineering and procurement activities but no later than Refuel 11, currently scheduled for the Spring of 1998. Decay heat removal flow recording is currently available on the plant computer, however, the signal is not from Category 1 instrumentation.

FPC has carefully reviewed the design of the existing subcooling margin monitors to determine which of the Type A design criteria are met, which ones are not met and how any differences might affect the ability of the instruments to perform their intended function. The results of the review indicated interim corrective actions were necessary to consider the "subcooling margin monitor" function to be OPERABLE. A summary of the review is provided in Attachment 1 to this letter and includes the details of the investigation and the results achieved. These interim actions are complete.

In order to determine appropriate additional corrective action, FPC is conducting an evaluation to determine which modifications would provide a commensurate safety benefit, and result in a design that more closely matches the guidance in RG 1.97 applicable to Category 1 instrumentation. The conclusions of this evaluation will be communicated to the NRC by October 1, 1996. The modifications will be completed during the next refueling outage currently scheduled for the Spring of 1998.

FPC will submit a technical specification change request to add subcooling margin and decay heat removal flow to the post-accident monitoring instrumentation technical specification. In the interim, FPC has put administrative controls in place which will assure that the subcooling margin and decay heat removal flow instrumentation are considered as part of the minimum compliment of instrumentation necessary to satisfy Limiting Condition for Operation (LCO) 3.3.17 for post-accident monitoring instrumentation. Required Actions A and B will be applicable for either function with one channel inoperable. That is, restore the channel to OPERABLE status within 30 days or submit a Special Report.

Required Actions C and E will be applicable for either function with two channels inoperable. That is, restore one channel to OPERABLE status within 7 days or be in MODE 3 within 6 hours and MODE 4 within 12 hours. The associated surveillance requirements will also be considered applicable.

The approach used in this notification of FPC's change in commitment for RG 1.97 is based on discussions with the CR-3 Project Manager and NRR technical staff on April 3 and April 24, 1996. No specific approval is required or requested.

Sincerely,

P. M. Beard, Jr.
Senior Vice President
Nuclear Operations

Attachment

PMB:AEF

xc: Regional Administrator, Region II
Senior Resident Inspector
NRC Project Manager

Design and Qualification of the Crystal River 3 Subcooling Margin Instrumentation

1.0 Description and Purpose

An in-depth review of Emergency Operating Procedure (EOP's) is in progress. As part of this review, it was determined that the use of "degrees of subcooling" (subcooling margin) in the EOP's was consistent with a RG 1.97 Type A variable. FPC had previously specified "degrees of subcooling" as a RG 1.97 Type B variable. Due to the way the variable is used in the EOP's, it should be listed as a Type A variable. RG 1.97 specifies that instrumentation that monitors Type A variables should be designed to Category 1 criteria. The design guidance in RG 1.97 for Category 1 devices is equivalent to safety-related devices. Many of the components associated with the subcooling margin indication are non-safety related. The purpose of this review is to determine and document the OPERABILITY status of the "degrees of subcooling" function for CR-3.

The subcooling margin monitoring instrumentation is comprised of two channels of instruments each having inputs as follows and as illustrated on Attachment 1:

Two Reactor Coolant System (RCS) hot leg temperature signals
Two RCS cold leg temperature signals
Six incore thermocouple signals
Two RCS pressure signals

RCS Temperature

One of the hot leg temperature signals for each subcooling margin monitor channel is initiated from a safety-related input. The other is non-safety related. The safety-related hot leg temperature signal for each channel goes through the remote shutdown auxiliary cabinet in the respective 4160 volt engineered safeguards switchgear room before going to the non-safety related non-nuclear instrumentation (NNI) cabinets in the main control room. From there, the signal goes to the subcooling margin calculation module in the "B" 4160 volt engineered safeguards switchgear room. The digital monitor on the main control board is driven from this device. The non-safety related hot leg temperature signal for each channel goes directly to the NNI cabinets in the main control room and then to the subcooling margin calculation module.

The non-safety related RCS cold leg temperature signals also go directly to the NNI cabinets and from there to the subcooling margin calculation module in the "B" engineered safeguards 4160 volt switchgear room. The RCS cold leg temperature signal is not referenced in any of the emergency or abnormal operating procedures and therefore has no safety significance.

The incore thermocouple signals go into the remote multiplexer cabinet in the control complex. The raw signals go from there to the NNI cabinets

where they are processed and auctioneered before proceeding to the subcooling margin calculation module.

RCS Pressure

The safety-related RCS pressure signals are buffered out of the engineered safeguards cabinets in the main control room. The signals are processed in the NNI cabinets before being fed to the subcooling margin calculation module.

2.0 Safety Classification

SR/NSR - As identified on the attached figures, portions of the subcooling margin monitoring instrumentation are safety-related. One of the two RCS hot leg temperature signals is safety-related through the remote shutdown auxiliary cabinet. Here, a safety-related signal conditioner passes the signal to non-safety related components in the NNI cabinets. The RCS pressure signals are safety-related through the engineered safeguards cabinets. There, safety-related signal conditioners pass the signal to non-safety related components in the NNI cabinets. The incore detectors are classified as safety-related for pressure boundary only. The remaining instruments are classified as non-safety related devices.

EQ - The sensing devices for RCS pressure, hot leg temperature, associated cables, connections, and building penetrations are all qualified to the requirements of 10 CFR 50.49 (EQ). This meets the intent of the RG 1.97 recommendation. The incore thermocouple circuits are not qualified to the requirements of 10 CFR 50.49. No other equipment associated with the subcooling margin monitor is located in the Reactor Building.

Seismic - The safety-related portions of the system are all seismically qualified. The main control board and subcooling margin calculation module cabinet are also seismically qualified. The subcooling margin calculation module cabinet was also evaluated as part of the resolution of Unresolved Safety Issue A-46 (USI A-46) for CR-3. The cabinet was identified as an outlier because of an unanchored device inside the cabinet. The device will be anchored in accordance with FPC's outlier resolution program. The remote shutdown auxiliary cabinets and NNI cabinets have also been evaluated as part of the resolution of USI A-46. The remote shutdown auxiliary cabinets were determined to be seismically adequate. Two of the four NNI cabinets were determined to be seismically adequate. The remaining two cabinets are not bolted together and were therefore classified as outliers. This deficiency will be corrected in accordance with FPC's USI A-46 outlier resolution program. The remote multiplexer cabinets have also been evaluated against the criteria of FPC's USI A-46 resolution program. There are no active components associated with the subcooling margin monitors in these cabinets and the portions of the cabinets associated with the subcooling margin monitor signals were determined to be seismically adequate.

Redundancy - Two independent channels of subcooling margin information are provided. The two channels are electrically independent although not

physically separated at all locations. No single active component failure can result in the loss of both channels.

Power Source - The instrumentation is powered from safety-related vital buses powered by inverters. The AC power for the inverters is supplied from the safety-related station standby emergency diesel generators and DC for the inverters is supplied from the safety-related station batteries. Power supplies for the NNI cabinets associated with one of the subcooling margin monitors are auctioneered between VBDP-1 (Regulated Instrument Bus 3A) and VBDP-5 (Vital Bus 3C). Power supplies for the NNI cabinets associated with the other subcooling margin monitor are auctioneered between VBDP-6 (Vital Bus 3D) and VBDP-7 (Computer 120vac distribution panel).

3.0 Description of Identified Concern

It has been determined that the use of "degrees of subcooling" was not evaluated correctly when FPC committed to the implementation of RG 1.97 for post-accident monitoring instrumentation. The "degrees of subcooling" variable is listed in FPC's commitment to RG 1.97 as Type B; that is, one of

> "those variables that provide information to indicate whether plant safety functions are being accomplished."

The review of the EOP's has revealed that this variable should be listed as Type A because of the way the information from the monitors is utilized in some EOP steps. A Type A variable is defined as one of

> "those variables that provide primary information needed to permit the control room operating personnel to take the specified manually controlled actions for which no automatic control is provided and that are required for safety systems to accomplish their safety functions for design basis events."

Subcooling margin is used as a criterion for manual initiation of high pressure injection, tripping of reactor coolant pumps, and selection of the steam generator high level setpoint on the Emergency Feedwater Initiation and Control System, as well as other actions which could be considered to meet the criteria for a Type A variable.

The subcooling margin monitors are fully qualified and operational with no loss of function as a RG 1.97 Type B variable with Category 2 instruments when the RCS hot leg temperature signals are selected as the input. With the incore thermocouples selected as the temperature input, the instruments meet the criteria for a Category 3 device. The RG 1.97 specifies Type A variables should be monitored by Category 1 devices. In general, Category 1 provides for full qualification, redundancy, continuous real-time display and requires onsite (standby) power. The subcooling margin monitors do not meet all of the qualification requirements for Category 1 instrumentation.

4.0 Impact Analysis and Reliability Considerations

The subcooling margin monitoring instrumentation is comprised of two redundant channels that have inputs for RCS hot leg temperature, RCS cold leg temperature, RCS pressure and incore thermocouple signals. The primary sensors, penetrations and cabling for RCS hot leg temperature and RCS pressure meet the qualification requirements of 10 CFR 50.49. The incore thermocouples do not meet the requirements of 10 CFR 50.49. The remaining instrumentation is not located in a harsh environment.

The instrumentation is powered from safety-related vital buses powered by inverters. The AC power for inverters is supplied from the safety-related station standby emergency diesel generators and DC power for the inverters is supplied from the safety-related station batteries. The power supplies for the NNI cabinets, although not safety-related, are auctioneered with a safety-related vital bus and a redundant supply fed from a non-safety related regulated instrument bus.

The instrumentation has been calibrated on a refueling interval frequency by approved plant calibration procedures and is presently in calibration and functional. The present calibration program is consistent with the requirements of a Category 1 device.

As described in Sections 1 and 2, the present configuration meets most, but not all, of the requirements of a Category 1 instrument. The system could best be described as Type A, Category 1 with exceptions. The major safety significant deficiency is the lack of environmental qualification of the signals from the incore thermocouples inside the Reactor Building. These instruments are relied upon to make Type A decisions for design basis events. Therefore, there must be reliable signals available to the operator to base these decisions upon. Without equipment that is qualified for the harsh environment which may exist inside the Reactor Building following a LOCA, one cannot conclude the subcooling margin monitoring system is adequate to perform its function as-designed and installed.

5.0 Operability Evaluation

Based on the lack of environmentally qualified incore thermocouple signals, and given that a harsh environment will exist following a small break LOCA, and considering that this could lead to a common mode consequential failure of the incore temperature signals, the subcooling margin monitors are considered available but inoperable. The "degrees of subcooling" function is considered OPERABLE but degraded (see Section 6.0 for further clarification).

6.0 Justification for Continued Operation

Interim corrective actions are necessary to justify operation in MODES 1, 2, and 3.

Because all other RG 1.97 Type A variables are included in Technical Specification Table 3.3.17-1, and because the "subcooling margin" variable should be classified as Type A, the subcooling margin monitors should also be administratively controlled as though they were also included in Table

3.3.17-1. This includes the LCO and Surveillance Requirements. The "subcooling margin monitor function" should be considered to be required to be OPERABLE in accordance with the APPLICABILITY for LCO 3.3.17.

Because of the lack of environmental qualification of the incore thermocouple signals to the subcooling margin monitors, additional interim corrective actions were considered necessary. The Safety Parameter Display System (SPDS) has been modified to receive environmentally qualified incore signals in addition to environmentally qualified RCS hot leg temperature and pressure. A programming modification has been made to the SPDS to provide subcooling margin display. With this additional programming, the SPDS can serve as a backup to the subcooling margin monitors.

SPDS Configuration

The SPDS subcooling margin monitoring instrumentation is comprised of two channels of instruments with inputs as follows:

Two Reactor Coolant System (RCS) hot leg temperature signals
Eight incore thermocouple signals per channel
Two RCS wide range pressure signals
One RCS narrow range pressure signal

Two of the hot leg temperature signals originate at two RCS hot leg resistance temperature detectors (RTD's), RC-4A-TE1 and RC-4B-TE4 (see Attachment 2) and go to separate remote shutdown auxiliary cabinets in the respective 4160 volt engineered safeguards switchgear room where they each go through two buffer modules (RC-4A-TY1-1/RC-4A-TY1-3 and RC-4B-TY4-1/RC-4B-TY4-3). These signals are fully qualified up to this point. From there they go into the non-nuclear instrumentation (NNI) cabinets in the main control room and to redundant SPDS computer systems. The SPDS computer systems are interconnected such that all temperature signals are available to both computer systems.

The other two hot leg temperature signals originate at RCS hot leg RTD's and go directly to separate NNI cabinets in the main control room and to the SPDS computer systems. The components associated with these signals, which are located in the Reactor Building, are qualified in accordance with 10 CFR 50.49.

Sixteen fully qualified incore thermocouple signals go into the Reactor Coolant Inventory Tracking System (RCITS) cabinet "B" in the control complex. From there they go to the SPDS computer systems.

The two RCS wide range pressure signals go to separate engineered safeguards cabinets in the main control room. These signals are fully qualified up to this point. From there they go into the NNI cabinets in the main control room and to the SPDS computer systems.

The single RCS narrow range pressure signal goes into the "A" remote shutdown auxiliary cabinet. It is fully qualified up to that point (see discussion on environmental qualification below). From there, it goes directly to the SPDS computer systems.

SPDS Safety Classification

SR/NSR - The two RCS pressure channels for SPDS are safety-related up through an isolation device in the engineered safeguards cabinets in the main control room. Two of the four RCS hot leg temperature channels are safety-related up through an isolation device in a remote shutdown auxiliary cabinet. The 16 incore thermocouple channels are safety-related up through an isolation device in RCITS cabinet B. The remainder of the instrumentation is non-safety related.

EQ - All components located in the Reactor Building are environmentally qualified to the requirements of 10 CFR 50.49. Accidents which create a harsh environment in other areas (steam line breaks) do not require the subcooling margin monitors for mitigation so environmental qualification outside of the Reactor Building is not an issue.

Seismic - The safety-related portions of the system are all seismically designed. The SPDS monitors in the main control room are seismically supported to prevent falling down and damaging safety-related components. The remote shutdown auxiliary cabinets, RCITS cabinet B, and the NNI cabinets have been evaluated as part of the resolution of the Resolution of Unresolved Safety Issue A-46 (USI A-46) for CR-3. The remote shutdown auxiliary cabinets and RCITS cabinet B were determined to be seismically adequate. Two of the four NNI cabinets were determined to be seismically adequate. The remaining two cabinets are not bolted together and were therefore classified as outliers. This deficiency will be corrected in accordance with FPC's USI A-46 outlier resolution program.

The remaining portions of the system are non-seismic. This is not considered to be a significant compromise of safety due to the low seismic risk in the state of Florida and the capability to repair or replace damaged equipment following a seismic event. A seismic event concurrent with a small break LOCA is not within the licensing basis for CR-3.

Redundancy - The SPDS is a two train system with redundant inputs for RCS hot leg temperature (two per train) and incore temperature (eight per train). One RCS wide range pressure is provided from each hot leg. Also, each train can display the subcooling margin based on either "A" or "B" instrumentation. Below RCS pressure of about 505 psig, the SPDS software will normally switch to a low range transmitter for greater accuracy. This is a single signal for both SPDS trains. If the transmitter should fail, the switchover to the low range transmitter will be automatically inhibited.

Power - The safety related portions of the system are powered from redundant safety-related vital buses fed from inverters backed up by the safety-related station batteries and emergency diesel generators. The non-safety related components located in the NNI cabinets are powered through an automatic transfer switch. One of the supplies to the transfer switch is from a vital bus fed from a safety-related inverter backed up by the safety-related station batteries and emergency diesel generators. The other supply to the transfer switch is from a non-safety related regulated instrument bus.

The remainder of the non-safety related components are powered from a vital bus fed from an inverter backed up by the non-safety related station battery. This vital bus and its associated inverter can also be manually aligned to a feed from the safety-related emergency diesel generators following a loss of off-site power.

Accuracy - A calculation was performed which specifies the T-Hot and Incore errors under accident conditions. The guidance in the EOP's requires a minimum subcooling margin to account for instrument inaccuracies. A reconciliation of the EOP guidance with the results of the calculation is provided in the following table.

RCS Press	EOP-3 Guidance	T-Hot Error	Incore Error
> 1500 psig	30°F	20.5°F	33.1°F
≤1500 to >250 psig	50°F	36.9°F	46.6°F
≤250 to > 150 psig	70°F	57.8°F	66.2°F
≤150 psig	SPDS	N/A	N/A
≤200°F	N/A	N/A	N/A

The errors specified are a combination of RCS pressure and temperature (T-hot or incore) worst case string errors. All values are bounded by existing EOP-3 guidance with the exception of the incore error for RCS pressures greater than 1500 psig. The incore signal error above 1500 psig is the predominant effect in this range. Past calibration information was reviewed for the incore signals to the plant computer. The "As Found" data shows that the computer was within +/- 15°F with few outliers for calibrations since 1989. The error calculation conservatively includes both the "As Found" and reference accuracies for the components in the random portion of the error (not including the incore error itself which is a small contributor of roughly 5°F). The error calculation also takes into account the worst case error due to "IR" effects on the cabling and connections in the harsh environment. Based on the SPDS subcooling margin monitor using a high select for the incore temperature and the conservatism in the error calculation there is sufficient margin to maintain the existing 30 degree band presently used in EOP-3 for guidance.

Conclusion - The addition of the SPDS as a backup to the primary subcooling margin monitors will compensate for the most significant vulnerability in the design of the subcooling margin monitor (the lack of environmental qualification of the incore thermocouple signals). The SPDS design does lack some of the design attributes possessed by the subcooling margin monitors. It is believed, however, that the risk of the instrument failure because of the harsh environment is greater than the risk of instrument failure associated with the lack of these design attributes. Therefore, this is viewed as an enhancement of the reliability of the subcooling margin monitor system.

This configuration is considered adequate on an interim basis (until Refuel 11) to use the SPDS as a backup to the primary subcooling margin monitors should the incore signals fail due to the post-LOCA harsh environment. To be considered available for use as a backup, at least one SPDS channel must be OPERABLE (i.e., one SPDS channel backs up either or both subcooling margin monitors). This is being confirmed by the performance of a CHANNEL CHECK in accordance with SR 3.3.17.1. If both SPDS channels are inoperable, then both subcooling margin monitors are considered inoperable.

The acceptability of the use of SPDS as a backup to the now recognized to be Category 1 subcooling margin monitors is based on the premise that guidance has been provided to operators to make them aware of the most significant vulnerability (failure of the incore thermocouple signals). The relative effectiveness of the actual man-machine interface is considerably better with SPDS. This has been verified on the simulator. The actual reliability is expected to be quite high.

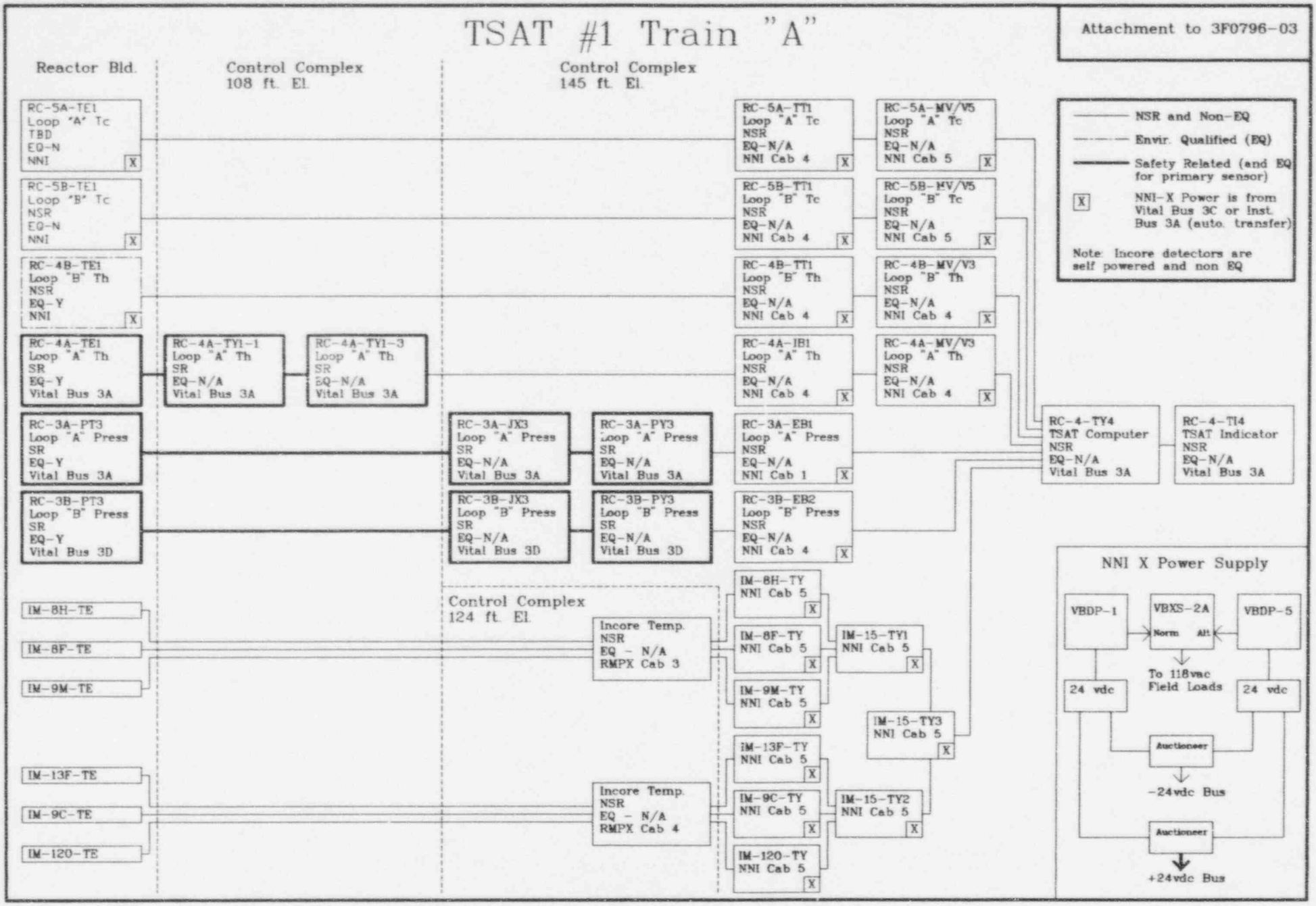
Given the availability of hardware and administrative controls as described above, the "subcooling margin monitor function" is considered OPERABLE but degraded.

7.0 Corrective Action to Obtain Full Qualification

A focused evaluation should be performed to determine what modifications could be made to provide a positive safety benefit and more closely match the design to the guidance of RG 1.97 for Type A variables.

8.0 Attachments and Figures

TSAT #1 Train "A" configuration
TSAT #2 Train "B" configuration
SPDS Train "A" configuration
SPDS Train "B" configuration


TSAT #1 Train "A"
Attachment to 3F0796-03
Reactor Bld.
Control Complex 108 ft. El.
Control Complex 145 ft. El.
Control Complex 124 ft. El.
RC-5A-TE1 Loop "A" Tc TBD EQ-N NNI X
RC-5B-TE1 Loop "B" Tc NSR EQ-N NNI X
RC-4B-TE1 Loop "B" Th NSR EQ-Y NNI X
RC-4A-TE1 Loop "A" Th SR EQ-Y Vital Bus 3A
RC-4A-TY1-1 Loop "A" Th SR EQ-N/A Vital Bus 3A
RC-4A-TY1-3 Loop "A" Th SR EQ-N/A Vital Bus 3A
RC-3A-PT3 Loop "A" Press SR EQ-Y Vital Bus 3A
RC-3B-PT3 Loop "B" Press SR EQ-Y Vital Bus 3D
RC-3A-JX3 Loop "A" Press SR EQ-N/A Vital Bus 3A
RC-3A-PY3 Loop "A" Press SR EQ-N/A Vital Bus 3A
RC-3B-JX3 Loop "B" Press SR EQ-N/A Vital Bus 3D
RC-3B-PY3 Loop "B" Press SR EQ-N/A Vital Bus 3D
IM-8H-TE
IM-8F-TE
IM-9M-TE
IM-13F-TE
IM-9C-TE
IM-120-TE
Incore Temp. NSR EQ - N/A RMPX Cab 3
Incore Temp. NSR EQ - N/A RMPX Cab 4
RC-5A-TT1 Loop "A" Tc NSR EQ-N/A NNI Cab 4 X
RC-5B-TT1 Loop "B" Tc NSR EQ-N/A NNI Cab 4 X
RC-4B-TT1 Loop "B" Th NSR EQ-N/A NNI Cab 4 X
RC-4A-IB1 Loop "A" Th NSR EQ-N/A NNI Cab 4 X
RC-3A-EB1 Loop "A" Press NSR EQ-N/A NNI Cab 1 X
RC-3B-EB2 Loop "B" Press NSR EQ-N/A NNI Cab 4 X
IM-8H-TY NNI Cab 5 X
IM-8F-TY NNI Cab 5 X
IM-9M-TY NNI Cab 5 X
IM-13F-TY NNI Cab 5 X
IM-9C-TY NNI Cab 5 X
IM-120-TY NNI Cab 5 X
RC-5A-MV/V5 Loop "A" Tc NSR EQ-N/A NNI Cab 5 X
RC-5B-MV/V5 Loop "B" Tc NSR EQ-N/A NNI Cab 5 X
RC-4B-MV/V3 Loop "B" Th NSR EQ-N/A NNI Cab 4 X
RC-4A-MV/V3 Loop "A" Th NSR EQ-N/A NNI Cab 4 X
IM-15-TY1 NNI Cab 5 X
IM-15-TY3 NNI Cab 5 X
IM-15-TY2 NNI Cab 5 X
RC-4-TY4 TSAT Computer NSR EQ-N/A Vital Bus 3A
RC-4-TI4 TSAT Indicator NSR EQ-N/A Vital Bus 3A
NSR and Non-EQ
Envir. Qualified (EQ)
Safety Related (and EQ for primary sensor)
X NNI-X Power is from Vital Bus 3C or Inst. Bus 3A (auto. transfer)
Note: Incore detectors are self powered and non EQ
NNI X Power Supply
VBDP-1
VBXS-2A
Norm
Alt
VBDP-5
To 118vac Field Loads
24 vdc
24 vdc
Auctioneer
-24vdc Bus
Auctioneer
+24vdc Bus

TSAT #2 Train "B"

Attachment to 3F0796-03

Reactor Bld.

Control Complex
108 ft. El.

Control Complex
145 ft. El.

RC-5A-TE3
Loop "A" Tc
TBD
EQ-N
NNI [Y]

RC-5B-TE3
Loop "B" Tc
NSR
EQ-N
NNI [Y]

RC-4B-TE4
Loop "B" Th
SR
EQ-Y
Vital Bus 3B

RC-4B-TY4-1
Loop "B" Th
SR
EQ-N/A
Vital Bus 3B

RC-4B-TY4-3
Loop "B" Th
SR
EQ-N/A
Vital Bus 3B

RC-4A-TE4
Loop "A" Th
NSR
EQ-Y
NNI [Y]

RC-3A-PT3
Loop "A" Press
SR
EQ-Y
Vital Bus 3A

RC-3B-PT3
Loop "B" Press
SR
EQ-Y
Vital Bus 3D

RC-3A-JX3
Loop "A" Press
SR
EQ-N/A
Vital Bus 3A

RC-3B-JX3
Loop "B" Press
SR
EQ-N/A
Vital Bus 3D

RC-3A-PY3
Loop "A" Press
SR
EQ-N/A
Vital Bus 3A

RC-3B-PY3
Loop "B" Press
SR
EQ-N/A
Vital Bus 3D

RC-5A-TT3
Loop "A" Tc
NSR
EQ-N/A
NNI Cab 6 [Y]

RC-5B-TT3
Loop "B" Tc
NSR
EQ-N/A
NNI Cab 6 [Y]

RC-4B-IB1
Loop "B" Th
NSR
EQ-N/A
NNI Cab 7 [Y]

RC-4A-TT4
Loop "A" Th
NSR
EQ-N/A
NNI Cab 6 [Y]

RC-3A-EB2
Loop "A" Press
NSR
EQ-N/A
NNI Cab 6 [Y]

RC-3B-EB3
Loop "B" Press
NSR
EQ-N/A
NNI Cab 6 [Y]

RC-5A-MV/V6
Loop "A" Tc
NSR
EQ-N/A
NNI Cab 6 [Y]

RC-5B-MV/V6
Loop "B" Tc
NSR
EQ-N/A
NNI Cab 6 [Y]

RC-4B-MV/V4
Loop "B" Th
NSR
EQ-N/A
NNI Cab 7 [Y]

RC-4A-MV/V4
Loop "A" Th
NSR
EQ-N/A
NNI Cab 6 [Y]

RC-4-TY5
TSAT Computer
NSR
EQ-N/A
Vital Bus 3B

RC-4-TI5
TSAT Indicator
NSR
EQ-N/A
Vital Bus 3B

NSR and Non-EQ

Envir. Qualified (EQ)

Safety Related (and EQ for primary sensor)

[Y] NNI-Y Power is from Vital Bus 3D or VBDP-7 (VBIT-1E) with auto xfer

Note: Incore detectors are self powered and non EQ

Control Complex
124 ft. El.

IM-7E-TE

IM-5K-TE

IM-7M-TE

IM-5D-TE

IM-3F-TE

IM-5O-TE

Incore Temp
NSR
EQ - N/A
RMPX Cab 3

Incore Temp
NSR
EQ - N/A
RMPX Cab 4

IM-7E-TY
NNI Cab 6 [Y]

IM-5K-TY
NNI Cab 6 [Y]

IM-7M-TY
NNI Cab 6 [Y]

IM-5D-TY
NNI Cab 6 [Y]

IM-3F-TY
NNI Cab 6 [Y]

IM-5O-TY
NNI Cab 6 [Y]

IM-16-TY1
NNI Cab 7 [Y]

IM-16-TY3
NNI Cab 7 [Y]

IM-16-TY2
NNI Cab 7 [Y]

NNI Y Power Supply

VBDP-6

VBXS-4A
Norm Alt

VBDP-7

To 118vac Field Loads

24 vdc

24 vdc

Auctioneer

-24vdc Bus

Auctioneer

+24vdc Bus

SPDS TSAT Train "A"

Attachment to 3F0796-03

Reactor Bldg. | Control Complex 108 ft. El. | Control Complex 124 ft. El. | Control Complex 145 ft. El.

RC-4B-TE1 Loop "B" Th NSR EQ-Y NNI [X]

RC-4A-TE1 Loop "A" Th SR EQ-Y Vital Bus 3A

RC-4A-TY1-1 Loop "A" Th SR EQ-N/A Vital Bus 3A

RC-4A-TY1-3 Loop "A" Th SR EQ-N/A Vital Bus 3A

RC-4B-TT1 Loop "B" Th NSR EQ-N/A NNI Cab 4 [X]

RC-4B-MV/V3 Loop "B" Th NSR EQ-N/A NNI Cab 4 [X]

RC-4B-EB3 Loop "B" Th NSR EQ-N/A NNI Cab 5 [X]

RC-4A-IB1 Loop "A" Th NSR EQ-N/A NNI Cab 4 [X]

RC-4A-MV/V3 Loop "A" Th NSR EQ-N/A NNI Cab 4 [X]

RC-4A-TY5 Loop "A" Th NSR EQ-N/A NNI Cab 4 [X]

RC-3A-PT3 "A" WR Press SR EQ-Y Vital Bus 3A

RC-3A-JX3 "A" Press SR EQ-N/A Vital Bus 3A

RC-3A-PY3 "A" Press SR EQ-N/A Vital Bus 3A

RC-3B-PT3 "B" WR Press SR EQ-Y Vital Bus 3D

RC-3B-JX3 "B" Press SR EQ-N/A Vital Bus 3D

RC-3B-PY3 "B" Press SR EQ-N/A Vital Bus 3D

RC-147-PT "A" LR Press SR EQ-Y Vital Bus 3A

RC-147-PY1 "A" LR Press SR EQ-N/A Vital Bus 3A

RC-147-PY2 "A" LR Press SR EQ-N/A Vital Bus 3A

IM-2G-TE SR & EQ

IM-5G-TE SR & EQ

IM-8E-TE SR & EQ

IM-10C-TE SR & EQ

IM-9H-TE SR & EQ

IM-10M-TE SR & EQ

IM-3L-TE SR & EQ

IM-4N-TE SR & EQ

RC-165K-TY1 Incore Temp. SR Vital Bus 3B

RC-165K-TY2 Incore Temp. SR Vital Bus 3B

RC-165C-TY1 Incore Temp. SR Vital Bus 3B

RC-165C-TY2 Incore Temp. SR Vital Bus 3B

RC-165A-TY1 Incore Temp. SR Vital Bus 3B

RC-165A-TY2 Incore Temp. SR Vital Bus 3B

RC-165I-TY1 Incore Temp. SR Vital Bus 3B

RC-165I-TY2 Incore Temp. SR Vital Bus 3B

RC-165F-TY1 Incore Temp. SR Vital Bus 3B

RC-165F-TY2 Incore Temp. SR Vital Bus 3B

RC-165E-TY1 Incore Temp. SR Vital Bus 3B

RC-165E-TY2 Incore Temp. SR Vital Bus 3B

RC-165L-TY1 Incore Temp. SR Vital Bus 3B

RC-165L-TY2 Incore Temp. SR Vital Bus 3B

RC-165M-TY1 Incore Temp. SR Vital Bus 3B

RC-165M-TY2 Incore Temp. SR Vital Bus 3B

"A" SPDS Computer VBDP-7

To "B" Side SPDS Display

"A" SPDS Display VBDP-7

From "B" Side SPDS Display

NSR and Non-EQ

Envir. Qualified (EQ)

Safety Related (and EQ for primary sensor)

[X] NNI-X Power is from Vital Bus 3C or Inst. Bus 3A (auto. transfer)

NNI X Power Supply

VBDP-1

VBXS-2A (Norm / Alt)

VBDP-5

To 118vac Field Loads

24 vdc

24 vdc

Auctioneer

-24vdc Bus

Auctioneer

+24vdc Bus

SPDS TSAT Train "B"

Attachment to 3F0796-03

Reactor Bldg. | Control Complex 108 ft. El. | Control Complex 124 ft. El. | Control Complex 145 ft. El.

RC-4A-TE4 Loop "A" Th NSR EQ-Y NNI [Y]

RC-4B-TE4 Loop "B" Th SR EQ-Y Vital Bus 3B

RC-4B-TY4-1 Loop "B" Th SR EQ-N/A Vital Bus 3B

RC-4B-TY4-3 Loop "B" Th SR EQ-N/A Vital Bus 3B

RC-3A-PT3 "A" Press SR EQ-Y Vital Bus 3A

RC-3B-PT3 "B" Press SR EQ-Y Vital Bus 3D

RC-147-PT "A" NR Press SR EQ-Y Vital Bus 3A

RC-147-PY1 "A" NR Press SR EQ-N/A Vital Bus 3A

RC-147-PY2 "A" NR Press SR EQ-N/A Vital Bus 3A

IM-7F-TE SR & EQ

IM-8L-TE SR & EQ

IM-13G-TE SR & EQ

IM-11G-TE SR & EQ

IM-6C-TE SR & EQ

IM-6O-TE SR & EQ

IM-10O-TE SR & EQ

IM-13L-TE SR & EQ

RC-165B-TY1 Incore Temp. SR Vital Bus 3B

RC-165B-TY2 Incore Temp. SR Vital Bus 3B

RC-165G-TY1 Incore Temp. SR Vital Bus 3B

RC-165G-TY2 Incore Temp. SR Vital Bus 3B

RC-165J-TY1 Incore Temp. SR Vital Bus 3B

RC-165J-TY2 Incore Temp. SR Vital Bus 3B

RC-1650-TY1 Incore Temp. SR Vital Bus 3B

RC-1650-TY2 Incore Temp. SR Vital Bus 3B

RC-4A-TT4 Loop "A" Th NSR EQ-N/A NNI Cab 6 [Y]

RC-4A-MV/V4 Loop "A" Th NSR EQ-N/A NNI Cab 6 [Y]

RC-4A-EB3 Loop "A" Th NSR EQ-N/A NNI Cab 6 [Y]

RC-4B-IB4 Loop "B" Th NSR EQ-N/A NNI Cab 7 [Y]

RC-4B-MV/V4 Loop "B" Th NSR EQ-N/A NNI Cab 7 [Y]

RC-4B-TY5 Loop "A" Th NSR EQ-N/A NNI Cab 6 [Y]

RC-3A-JX3 "A" Press SR EQ-N/A Vital Bus 3A

RC-3A-PY3 "A" Press SR EQ-N/A Vital Bus 3A

RC-3B-JX3 "B" Press SR EQ-N/A Vital Bus 3D

RC-3B-PY3 "B" Press SR EQ-N/A Vital Bus 3D

RC-165D-TY1 Incore Temp. Sk Vital Bus 3B

RC-165D-TY2 Incore Temp. SR Vital Bus 3B

RC-165H-TY1 Incore Temp. SR Vital Bus 3B

RC-165H-TY2 Incore Temp. SR Vital Bus 3B

RC-165N-TY1 Incore Temp. SR Vital Bus 3B

RC-165N-TY2 Incore Temp. SR Vital Bus 3B

RC-165P-TY1 Incore Temp. SR Vital Bus 3B

RC-165P-TY2 Incore Temp. SR Vital Bus 3B

"B" SPDS Computer VBDP-7

To "A" Side SPDS Display

"B" SPDS Display VBDP-7

From "A" Side SPDS Display

NSR and Non-EQ

Envir. Qualified (EQ)

Safety Related (and EQ for primary sensor)

[Y] NNI-Y Power is from Vital Bus 3D or VBDP-7 (VBIT-1E) with auto. xfer

NNI Y Power Supply

VBDP-6

VBXS-4A Norm Alt

VBDP-7

To 118vac Field Loads

24 vdc

24 vdc

Auctioneer

-24vdc Bus

Auctioneer

+24vdc Bus