Florida Power
CORPORATION

November 22, 1988
3F1188-11

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

Subject: Crystal River Unit 3
Docket No. 50-302
Operating License No. DPR-72
Additional Information on ATWS Design

Dear Sir:

Florida Power Corporation is confident that the meeting held on October 13, 1988 and subsequent teleconferences have significantly reduced the number of unresolved issues and clearly identified the actions necessary to achieve final approval of the CR-3 ATWS mitigation design.

FPC recommends the momentum gained by the last several weeks of meaningful interaction be used to bring the issues to resolution now. FPC remains committed to a Refuel VII installation schedule provided the conceptual design is finalized by December 1, 1988 to support our detailed design and outage planning efforts. The current schedule for submittal of the final design to the NRC is June 15, 1989. Without resolution of the outstanding issues now, FPC will continue to work toward a Refuel VII installation; however, any significant change resulting from the detailed design review by the NRC would be too late in our planning process to allow installation during the Refuel VII outage. The ATWS mitigation system has the potential to increase reactor trip induced plant transients if careful integration of the design is not maintained. The approach taken by FPC in developing our design meets the ATWS rule and at the same time maintains our commitments to improving overall plant safety. The resolution of the open issues now would also provide a significant benefit to the efforts of the other B&W Owners as they develop their designs to comply with 10CFR50.62.

FPC is scheduled to meet with the Staff during the week of November 28, 1988 to resolve any remaining issues so that we can maintain our commitment to Refuel VII installation.

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FPC is hereby submitting the attached electrical system assessment (Attachment 1) which we agreed to provide to support resolution of the independence issue. This assessment should be accepted as additional demonstration of the reliability of the design beyond the requirements of the rule. Further, we have provided additional information on diversity where such information was readily available (Attachment 2). Following the October 20, 1988 teleconference discussions about independence and diversity, FPC re-evaluated portions of the CR-3 ATWS design described in our September 28, 1988 letter. Attachment 3 discusses three design changes we have elected to make to the ATWS design to obtain additional diversity, electrical independence, and design simplification.

It appears that four issues could warrant final resolution:

(1) INDEPENDENCE - This fundamental term of nuclear power plant design is best defined as physically separate and electrically isolated (IEEE-384). It has been suggested that this definition may be inadequate either for ATWS in particular or in general. If a new definition is warranted it should be pursued through appropriate processes, not in the review of particular designs.

(2) DIVERSITY - The ATWS rulemaking and associated guidance require that equipment with diversity to the extent reasonable and practicable be utilized. A number of means to provide assurance of highly diverse equipment have been suggested. The examples provided are among the means available, but do not constitute requirements. As noted, component or hardware diversity can be achieved by using equipment from different manufacturers or equipment with dissimilar functional designs. Substantial diversity is achieved simply in the vintage of the equipment. Regardless, the burden is on the licensee to provide reasonable and practicable diversity as we have and will in our final design.

(3) ISOLATION - In the BWOG generic SER and subsequent discussions it was suggested the very extensive guidance now available to assure isolation capability be applied. We understand the current position is to assure new applications of existing equipment are bounded by the original design criteria. We will provide this assurance.

(4) EFIC INTERFACE - As noted below, FPC believes that B&W plants have a critical safety need for continuing to utilize EFIC, or equivalent capabilities at the other B&W units, to control EFW once initiated. The definition of final actuation device implied in recent conversations coupled with the expanded definition of independence could produce a conflict with this essential need. The CR-3 design, in all it safety systems, does not limit final actuation devices to pumps, valves, fan's, etc. There are always critical interlocks, controls, etc. that are, in practical

effect, part of the actuation device. In this situation, EFIC is essentially a final actuation device as far as AMSAC is concerned. The sketch used at the August 17, 1988 meeting, and incorporated in the staff's proposal in the NRC letter dated September 19, 1988, which showed AMSAC initiating EFW was described as and always meant to include EFIC as an integral part of the actuation device. It was not shown schematically as EFIC because 5 of the 8 B&W units utilize a system of a different name.

The EFIC System was installed in response to several regulatory and reliability needs. NUREG-0737, Item II.E.1.2 required safety-grade initiation and control of EFW. Generic Issue 124 and NUREG-0737, Item II.E.1.1 required assessment and improvements in EFW reliability. The system, as designed, upgrades the reliability of several functions and adds additional capabilities. These include Feed-Only-Good-Generator, Main Feedwater Line Isolation, Main Steamline Isolation, EFW pump runout protection, EFW overfill protection, automatic initiation of natural circulation, etc. It is a highly integrated, complex component of our overall improvement in the EFW System. FPC and the NRC devoted significant resources to the design, installation, and review of EFIC. Therefore, FPC would consider any initiation of EFW apart from EFIC to be a significant reduction in the overall margin of safety of CR-3. Further, had 10CFR50.62 not required direct turbine trip, FPC would have strongly suggested that EFIC is itself a completely adequate ATWS mitigation system.

FPC considers the closure of these and any other issues would be of great mutual benefit to the NRC and the other B&W licensees. If we can facilitate such closure in any way, we will be pleased to do so. We remain encouraged that we are progressing toward ultimate resolution in a time frame to support installation in our upcoming refueling outage.

Sincerely,

Rolf C. Widell
Director, Nuclear Operations Site Support

RCW:KRW:sdr

xc: Regional Administrator, Region II

Senior Resident Inspector

Attachment 1 to 3F1188-11

CR-3 EFIC POWER SUPPLY
CONFIGURATION & OPERATIONAL CHARACTERISTICS

1. CR-3 Emergency Feedwater System Configuration

The CR-3 Emergency Feedwater (EFW) System consists of two redundant and diverse powered flow loops each containing an Emergency Feedwater Pump (EFP), control valves, and isolation valves. The A loop EFP has an electric motor drive powered from a Diesel backed bus. The A loop control valves and isolation valves are DC powered from the station batteries. The B loop EFP has a steam turbine drive with the motor operators and control circuitry for the steam valves DC powered from the station batteries. Each loop by itself is adequate to provide EFW to cool the plant.

Initiation and control of flow through the redundant EFW flow loops is provided automatically by the Emergency Feedwater Initiation and Control (EFIC) System. The EFIC System is a four channel safety grade system employing one-out-of-two-taken-twice logic. The EFIC system is configured such that the A flow loop initiate logic is in Channel A and the B flow loop initiate logic is in Channel B. Channel A provides a signal to start the A EFP, a signal to open one of the redundant B EFP steam valves (ASV-204) and signals to the A loop control valves. Channel B provides the signal to open the other B EFP steam valve (ASV-5), and signals to the B loop control valves. Channels C and D provide signals to open the B and A loop isolation valves respectively. These isolation valves are normally open and will fail "as is" on loss of power. The EFIC system utilizes an energize-to-actuate design.

2. EFIC Power Supply Configuration (Ref: Figure 1 to Attachment 1)

Each EFIC Channel is powered from a separate 120 VAC 1E vital bus which is supplied via a battery backed inverter. Each inverter output is backed up by 120 VAC from a regulating transformer through a Static Transfer Switch. The regulated transformers are supplied from Diesel backed 3-phase 480 VAC busses.

3. EFIC System Power Specifications

The EFIC system voltage and frequency specifications for vital AC (logic) power are:

Voltage 120VAC $\pm$ 5%
Frequency 60 Hz $\pm$ 2%

The internal DC logic power supplies have an input power specification of 105 to 132 VAC at 57 to 63 HZ.

4. Loss of Power Effects on EFIC

The EFIC system is designed as a single failure proof system. Failure of one of the 1E vital busses to zero volts will result in the system reverting to a one-out-of-two trip configuration. Failure of more than one 1E vital bus may result in failure of EFIC to provide automatic emergency feedwater initiation signals due to the energize-to-actuate design. However, manual EFW initiation and control capability will still exist in the Control Room using DC power from the station batteries. Loss of any vital bus would be annunciated in the Control Room as described in Item 6 below.

5. EFIC Operation With An Undervoltage Condition

Satisfactory EFIC operation has been demonstrated by test at supply voltages as low as 50 VAC. Low voltage protection circuits have been added to EFIC Channels A and B which will interrupt the vital bus supply if the vital bus voltage drops below approximately 72 VAC. The EFIC system will then respond as described under loss of power in Section 4 above.

6. Vital Bus Power Supplies - System Operation

Inverter Output Specifications

Output Voltage	118 VAC ± 2%
Output Frequency	60 Hz ± 1%

Inverter Alarms

AC Undervoltage	114 VAC
Battery Overvoltage	140 VDC
Battery Undervoltage	105 VDC
Inverter Failure	

Static Switch Transfer 45 VAC ± 2%

Static Switch Alarms

Switch Transferred
Switch Failed

Each inverter is supplied with 125 VDC from a station battery and 3-phase 480 VAC from a Diesel backed bus. The 480 VAC is rectified and then diode auctioneered with the 125 VDC from the station battery. This DC output from the diode auctioneering circuit is used to create the 60 Hz inverter output. During normal operation the inverter frequency is synchronized to the AC source. On loss of the AC supply, the inverter frequency is controlled by an internal oscillator which has a specified frequency of 60 Hz ± 1/2%. Thus, loss of either the station battery or the 480 volt bus will not cause the loss of the inverter output. Abnormal inverter status is annunciated in the Control Room by the alarms listed above.

Each inverter output is routed to two automatic static transfer switches, one of which supplies power to a RTS channel with the other one supplying power to an EFIC channel. (Note: On the simplified FPC power distribution sketch (Figure 1) these two static transfer switches and the downstream busses which they feed are shown as one.)

The static switch is designed such that the inverter output is the normally selected supply with automatic transfer to the backup Diesel backed bus on conditions indicative of an inverter failure. The inverter has internal monitoring circuitry which will send a transfer signal to the static switch if an undervoltage or overcurrent condition is detected. The static switch will not allow transfer to a dead bus alternate source if undervoltage or overcurrent conditions occur.

Each static transfer switch has internal fusing which is coordinated such that downstream faults will blow the fuse in the inverter feed and force transfer to the backup AC source prior to causing degradation of the inverter output. Thus, a fault in either the RTS or EFIC systems will not be propagated into the other system by means of inverter failure. Abnormal static switch status is annunciated in the Control Room via the alarms listed above. Frequency synchronization at the static switch of the inverter output with the backup AC source is not annunciated in the Control Room, but is indicated locally at the switch and monitored administratively every eight hours.

7. Conclusions

1. Failure of the EFIC system to initiate at least one loop of Emergency Feedwater will require failure of two inverters co-incident with loss of offsite power. This is not considered a credible event for the following reasons:

   a. During normal operation, each inverter is actively supplying power to a vital bus with backup power available through the static switch from an offsite power bus which is Diesel backed. The operators will be immediately made aware of any change to this configuration through Control Room alarms.

   b. Loss of offsite power has no effect on inverter operation other than to remove the external synchronization signal in which case the inverter reverts to its internal synchronization source.

2. Power supply faults in either the RTS or EFIC will not propagate into the other system through inverter degradation.

3. The RTS and EFIC both use a one-out-of-two-taken-twice design. Failure of one channel cannot prevent either system from performing its designed function.

Attachment 2 to 3F1188-11

The following information is provided to address NRC concerns with the FPC plant specific ATWS submittal which surfaced during the NRC-FPC teleconferences of October 7 and October 20, 1988. These concerns were in the areas of Diversity from the existing RPS, Electrical Independence from the existing RPS and Safety Related Interfaces. In addition the NRC, in the October 20, 1988 teleconference, requested that additional information be provided to show how the MFWP Control Oil Pressure Switch logic, resident in the RTS cabinets which currently initiates EFIC, would interface with the new AMSAC logic circuitry.

I. Diversity

The Safety Evaluation of Topical Report "Design Requirements for DSS and AMSAC" (B&W ATWS SER), paragraph 5.1 states the ATWS diversity requirements as follows:

"For the DSS, equipment diversity to the extent reasonable and practicable to minimize the potential for common cause (mode) failures is required from the sensors to, and including the components used to interrupt control rod power. The diversity of the DSS equipment from existing RPS equipment shall include all signal conditioners, bistable, logic channels, logic power supplies, and SCR de-gating relays.

For the AMSAC, equipment diversity to the extent reasonable and practicable to minimize the potential for common cause (mode failures) is required from the sensors to, but not including the final actuation device, i.e., existing circuit breakers may be used for the auxiliary feedwater initiation, but signal conditioners, bistables, logic channels, and logic power supplies, must be diverse from the existing RPS equipment.

The sensors for the DSS and AMSAC need not be of a diverse design or manufacturer."

The NRC provided further direction in this area during the October 20, 1988 teleconference by stating that "adequate diversity is best achieved by the use of components from different manufacturing processes, the use of mechanical versus electronic devices, AC versus DC equipment, or equipment employing different principles of operation."

FPC has re-evaluated the diversity of the ATWS Conceptual Design using this additional guidance as follows:

<u>ATWS Logic (Bailey Meter Co. Model 820) vs. RTS Logic (Bailey Meter Co. Model 880)</u>

FPC has determined that adequate diversity will exist between the RTS and the ATWS logic circuitry as presented in the FPC Conceptual Design Document based on the following:

Manufacturing Processes: The Bailey Model 820 equipment is a commercial product line while the Bailey Model 880 equipment was manufactured specifically for use in 1E Nuclear Instrumentation Systems. Although manufactured at the same facility, different procedures were used for the product lines.

System Design: The Bailey Model 880 product line was designed specifically for use in Nuclear Instrumentation Systems. The Bailey Model 820 equipment utilizes (+) and (-) 24 VDC power supplies while the Bailey Model 880 equipment utilizes (+) and (-) 15 VDC power supplies. The power supply system used in the Bailey Model 820 equipment incorporates Lambda power supplies with individual regulator chips located in each module. The Model 880 equipment is powered by regulated power supplies designed and built by Bailey specifically for use in the 880 system.

Circuit Function: Of the three types of Bailey Model 820 modules included in the ATWS Logic (Auxiliary Relay, Auctioneer and Signal Monitor), only the Signal Monitor has a similar modular function in the RTS trip logic (Bistable).

Physical Construction: The Model 820 Signal Monitor utilizes all printed circuit construction with a single printed circuit board while the Model 880 Bistable utilizes multiple printed circuit boards which plug into a mother board and a significant amount of discrete interconnect wiring. In addition the primary active components in each module (operational amplifier comparator) are different devices. The back plane wiring is soldered in the Model 880 system while the Model 820 equipment uses wire wrap construction.

Failure Mode: The Bailey Model 820 equipment fails to 50% of scale on loss of power while the Bailey Model 880 equipment fails to 0% of scale.

<u>DSS Signal Conditioning and Isolation (Foxboro Spec 200) vs. RTS High RC Pressure Signal Conditioning and Isolation (Bailey Model 880)</u>

The RC pressure signals for both the DSS and RTS are developed using Rosemount 4-20 ma current transmitters.

This is acceptable since transmitter diversity is not required by the ATWS rule. The RTS signal loop utilizes a Lambda power supply and provides a voltage input to a Bailey Model 880 Buffer Amplifier via a precision dropping resistor. The DSS signal loop will have power, input signal isolation, and signal conditioning provided integrally by Foxboro Spec 200 nest modules.

FPC has determined that adequate diversity will exist between the RTS and ATWS RC Pressure signal loops as presented in the FPC Conceptual Design Document based on the following:

Manufacturing Processes: Although both the Bailey Model 880 equipment and the Foxboro nuclear grade Spec 200 equipment are manufactured specifically for use in 1E Nuclear Instrumentation Systems, they are manufactured by two different companies at two different manufacturing facilities utilizing independent manufacturing procedures.

System Design: The Bailey Model 880 signal loop utilizes a discrete Lambda 28 VDC power supply while the Foxboro equipment utilizes a 30 VDC Foxboro power supply integral to the Foxboro signal conditioning nest. The transmitter providing the RC Pressure signal to the Foxboro equipment is powered via the Foxboro input isolator/signal conditioner module.

Circuit Design: The Bailey Model 880 Buffer Amplifier converts a 2 to 10 volt signal, developed by applying the transmitter current to an external 500 ohm dropping resistor, to a 0 to 10 volt signal by utilizing an operational amplifier in conjunction with a reference power supply. The Foxboro isolator/signal conditioner converts the 4-20 ma transmitter current to a 0-10 VDC signal by utilizing a chopper network in conjunction with transformer coupling for isolation.

AMSAC Signal Conditioning and Isolation (Bailey Model 820) vs. RTS Anticipatory Reactor Trip Circuitry-ARTS (Bailey Model 880)

FPC has determined, based on the following, that adequate diversity will exist between the RTS ARTS trip circuitry for loss of Main Feedwater, which is generated by loss of Main Feedwater Pump control oil pressure, and the main Feedwater Flow signal circuitry for AMSAC, as presented in the FPC Conceptual Design Document.

Manufacturing Processes and System Design: The diversity of the Bailey Model 820 equipment vs. the Bailey Model 880 equipment is described above in the section on the diversity of Model 820 vs. Model 880 logic circuitry.

Principal of Operation: The loss of Main Feedwater input to the RTS is completely digital utilizing pressure switch inputs and contact isolators. The AMSAC Main Feedwater flow signal, signal conditioning, and isolation will utilize the analog principle of operation.

AMSAC Signal Conditioning and Isolation (Gamma Metrics) vs. RTS Reactor Power Instrumentation (Bailey 880)

FPC has determined that adequate diversity will exist between the RTS Reactor Power Instrumentation channels and the Gamma Metrics Neutron Flux channels as presented in the FPC Conceptual Design Document based on the following:

Manufacturing Processes: Although the Bailey Model 880 equipment and the Gamma Metrics equipment are both manufactured specifically for use in 1E Nuclear Instrumentation Systems, they are manufactured by two different companies at two different manufacturing facilities utilizing independent manufacturing and QA procedures.

Principle of Operation: The RTS system utilizes an Uncompensated Ion Chamber to develop a Reactor power level signal while the Gamma Metrics equipment utilizes a fission chamber.

Construction Technology: The Bailey Model 880 equipment utilizes discreet component technology while the Gamma Metrics equipment utilizes Large Scale Integration technology.

Emergency Feedwater Initiation and Control (EFIC) System

As presented in the FPC ATWS Conceptual Design document, AMSAC will initiate Emergency Feedwater by utilizing circuitry resident in the EFIC cabinets. This same EFIC circuitry is presently utilized by the ARTS Circuitry to initiate Emergency Feedwater should ARTS detect a tripped condition of both Main Feedwater Pumps.

The NRC stated in the teleconference on October 20, 1988 that the final actuation devices for the purposes of AMSAC are the Emergency Feedwater Pumps and the Emergency Feedwater control valves and that the FPC Conceptual Design was therefore not in compliance with the ATWS rule which requires diversity up to the final actuation device.

Application of the ATWS rule to the CR-3 plant configuration using this definition of Final Actuation Device will require bypassing a 1E single-failure-proof system, EFIC, which was designed and installed to meet NUREG-0737 and IEEE 279, with a non-1E non-single-failure-proof system, AMSAC. It is FPC's position that such a design will result in a reduction of the margin of safety for operation of Crystal River Unit 3 and therefore should not be implemented.

It is also FPC's position that EFIC is not part of the Reactor Trip System since it does not participate in any function required to trip the reactor. FPC has determined, based on the following, that the EFIC equipment is diverse from the RTS equipment, and that there is no common failure mechanism which can prevent both systems from performing their intended function.

Manufacturing Processes: Although the Bailey 880 equipment and the EFIC equipment are both manufactured specifically for use in 1E Nuclear Systems, they are manufactured by two different companies (Bailey Meter Co. and Vitro Laboratories Division of Automation Industries, Inc.), at two different manufacturing facilities utilizing independent manufacturing procedures.

Principle of Operations: The EFIC system is completely digital in operation while the RTS is an analog system.

System Interfaces: The EFIC system uses primarily Optical Isolation technology for its interfaces while the RTS systems uses relay contacts and operational amplifiers.

Construction Technology: The Bailey Model 880 equipment utilizes discreet component technology while the EFIC equipment utilizes Large Scale Integration technology.

DSS SCR De-gating Relays vs. RTS SCR De-gating Relays

FPC is revising the CRD relay logic for DSS proposed in the Conceptual Design to that described in Attachment 3 to this letter. This change is being made to obtain diversity (AC vs DC) between the RPS and DSS trip relays.

AMSAC vs. RTS Turbine Trip Relays

FPC is revising the Turbine Trip scheme proposed in the Conceptual Design to that described in Attachment 3 to this letter. This change is being made for design simplification.

FPC has determined that adequate diversity will exist between the RTS Turbine Trip Relay, a GE HEA relay, and the relays proposed for AMSAC as shown on Sheets 3 and 5 of 7 of Attachment 5 because the HEA relay is 125 VDC powered while the Bailey Model 820 relay modules being added will be powered from 120 VAC.

II. Electrical Independence

The Safety Evaluation of Topical report "Design Requirements for DSS and AMSAC" (B&W ATWS SER), paragraph 5.2 states the electrical independence requirements as follows:

"Electrical independence is required from the sensor output up to the final actuation device for AMSAC and from the sensor output up to and including the final actuation device for the DSS."

The NRC position as stated in the October 7 and October 20, 1988 teleconferences is that use of EFIC, which is powered from the same inverters and station batteries as the RTS to complete the AMSAC function does not completely satisfy the Electrical Independence requirement of the SER.

The NRC further stated in the October 20, 1988 teleconference that FPC must identify all DSS and AMSAC system components for CR-3 that receive power from sources that are also used to provide power to the existing RTS; and if RTS power supplies are used, information must be provided to demonstrate that faults within the DSS or AMSAC circuits cannot degrade the reliability/integrity of the existing RTS below an acceptable level. Correspondence between the NRC and Baltimore Gas and Electric (BG&E) regarding the acceptability of the power system configuration for ATWS vs. RTS at BG&E's Calvert Cliffs Station (Docket Nos. 50-317 and 50-318) was cited as an example of the information required to demonstrate acceptable reliability/integrity of the RTS.

FPC has completed a review of the EFIC and RTS power systems and has determined that the use of EFIC by AMSAC to initiate Emergency Feedwater will not degrade the reliability/integrity of the existing RTS below an acceptable level. This analysis is included as Attachment 1 to this letter.

A list of DSS and AMSAC equipment which share a common power supply with the RTS as defined by the NRC (same inverters and station batteries) follows:

DSS

1. RC Pressure sensors power supplies, signal conditioning, and 1E-to-Non-1E isolation modules.

   This equipment is currently installed in CR-3 and is all powered from the same vital busses and static transfer switches as the EFIC equipment. Therefore, the same power system analysis for the EFIC equipment provided as Attachment 1 to this letter also applies to the RC pressure signal loop equipment. Furthermore, it is FPC's position that, since these signals loops are 1E to satisfy Reg. Guide 1.97, powering the signal and isolation modules from the non-1E UPS incorporated in the FPC ATWS Conceptual Design would be a reduction in the margin of safety for CR-3. FPC has determined that use of this equipment to provide a wide range RC pressure signal to ATWS cannot degrade the reliability/ integrity of the existing RTS below an acceptable level.

AMSAC

1. Neutron Flux Instrumentation including the Fission Chamber detector, amplifier signal processor, and 1E to non-1E isolation modules.

   This equipment is currently installed in CR-3 and is all powered from the same vital busses and static transfer switches as the EFIC equipment. Therefore, the same power system analysis for the EFIC equipment provided as Attachment 1 to this letter also applies to these Neutron Flux instrumentation channels. FPC has determined that use of this equipment as part of AMSAC cannot degrade the reliability/integrity of the existing RTS below an acceptable level.

Furthermore, it is FPC's position that, since these signals are 1E per Reg. Guide 1.97, powering the signal and isolation modules from the non-1E UPS incorporated in the FPC ATWS Conceptual Design would be a reduction in the margin of safety for Crystal River Unit 3.

<u>EFIC</u>

1. The analysis supporting FPC's determination that use of EFIC to implement the AMSAC function cannot degrade the reliability/integrity of the existing RTS below an acceptable level is included as Attachment 1.

III. <u>Isolation Devices</u>

The Safety Evaluation of Topical Report "Design Requirements for DSS and AMSAC" (B&W ATWS SER) paragraph 6.2 states that "only approved isolators, existing or diverse, may be used for isolating existing sensors and actuation devices for the ATWS systems where appropriate.

Whether diverse or existing isolators are used, the plant-specific submittals must provide analyses ensuring that the isolators are qualified to function under the maximum worst case fault conditions. The analyses should follow the guidelines presented in Appendix A of this SER or be from some other previously approved procedure."

As presented in the FPC ATWS Conceptual Design Document, 1E-to-Non-1E isolators will be used in three areas in the FPC ATWS design. These interfaces are listed on page 4 of the Conceptual Design Document as follows:

1. <u>DSS</u>

   RC Pressure Signals from Remote Shutdown Aux Equipment Cabinets to DSS logic (1E to non-1E)

2. <u>AMSAC</u>

   Neutron Flux signals from Gamma Metrics cabinets to AMSAC logic (1E to non-1E)

3. <u>AMSAC</u>

   Emergency Feedwater initiation signal from AMSAC to EFIC (non-1E to 1E)

All of the isolators listed above are currently installed spares in the CR-3 plant and are located in their respective 1E cabinets.

It is FPC's position that since this equipment was previously installed, reviewed and accepted as the licensing basis for meeting other regulatory requirements such as NUREG 0737, 10CFR50 Appendix R and Reg. Guide 1.97, it should only be subjected to verification that the maximum credible fault voltage applied to its terminals from the interfacing non-1E equipment would not exceed its qualification.

A review of the Conceptual Design by FPC has indicated that the maximum credible fault voltage that could be applied to these isolators due to conductor-to-conductor shorts would be 250 VDC or 480 VAC. The manufacturers' qualifications of these isolators are as follows:

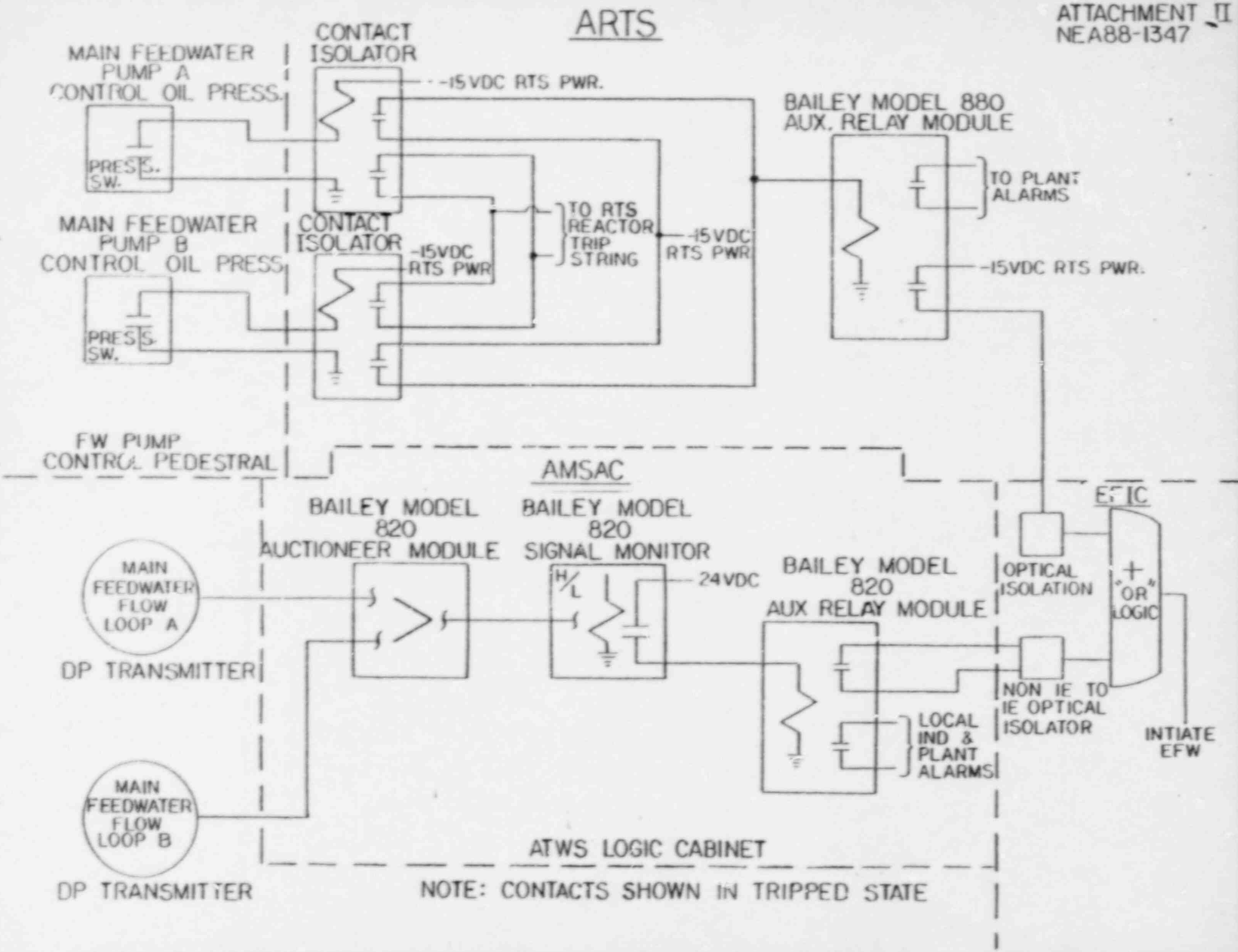
Gamma Metrics (Neutron Flux) - 1000 VDC
Foxboro (RC Pressure) - 600 VDC
Vitro (EFIC) - 750 VDC

Therefore, FPC concludes that these isolators are qualified to function under the maximum worst case fault conditions that will be posed under their proposed use in the 1E-ATWS interface.

The completion of the Detail Design process will incorporate an engineering analysis to finalize the maximum credible fault voltage and ensure that this voltage is bounded by the isolator qualification in all cases.

IV. EFIC/RTS Logic for Emergency Feedwater Initiation

The logic development of the EFIC inputs from the ARTS Main Feedwater Pump trip circuitry and the AMSAC loss of Main Feedwater flow circuitry is shown in a simplified logic diagram (Figure 1 Attachment 2) included with this letter.



NOTE: CONTACTS SHOWN IN TRIPPED STATE

Attachment 3 to 3F1188-11

Changes to ATWS Design Shown in FPC letter dated September 28, 1988

1. The relay logic for DSS located in the CRD cabinets as shown on sheets 9 and 10 of Attachment 4 to the ATWS Conceptual Design document is being changed to use DC relays and will be powered from the ATWS UPS instead of the CRD AC power. This change is being made to obtain additional diversity (AC vs DC) between the DSS and RPS trip relays.

2. The Feedwater Flow transmitters and associated square root extractors will be powered from the ATWS UPS with the square root extractors being located in the ATWS logic cabinet instead of the NNI cabinets. As presented in the Conceptual Design (sheets 1, 2, and 4 of Attachment 5), the flow signal is being obtained from the NNI cabinets downstream of the square root extractor modules which are used to convert delta-pressure to flow. This change will be made to provide additional electrical independence between the AMSAC signal conditioning and the RPS. Presently, the feedwater flow transmitters and signal conditioning are connected to the vital busses which also provide power to the RPS.

3. The Turbine Trip slave relays shown in the Conceptual Design (sheet 6 of 7 in Attachment 5) are being deleted. In their place, contacts from the Bailey 820 Auxiliary Relay Modules 86/AMSAC will be used directly in the turbine trip scheme. Our Conceptual Design had planned to use the Auxiliary Relay Modules to energize the slave relays whose contacts would then trip the turbine. This change is being made for design simplification. As a consequence of the elimination of the slave relays, the Auxiliary Relay Modules 86/AMSAC will be changed from 24 VDC to 118 VAC. The change in power supplies is to maintain the diversity of AC (AMSAC) versus DC (RTS) relays provided in the Conceptual Design.

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NUMBER OF OVERSIZE PAGES FILMED ON APERTURE CARDS 1

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