

**Florida
Power**
CORPORATION

August 21, 1984
3F0884-07

Director of Nuclear Reactor Regulation
Attention: Mr. George W. Rivenbark, Acting Chief
Operating Reactors Branch #4
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Crystal River Unit 3
Docket No. 50-302
Operating License No. DPR-72
NUREG-0737, Supplement I
Regulatory Guide 1.97

Dear Sir:

In accordance with the NRC order dated February 21, 1984 confirming Florida Power Corporation's (FPC's) commitment to Supplement I of NUREG-0737, "Requirements For Emergency Response Capability", FPC is submitting the report required by Item 3 of the implementation schedule describing how the Regulatory Guide 1.97 (RG 1.97), "Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following An Accident" Rev. 3, dated May 1983. Requirements have been or will be met. Deviations from or alternatives to RG 1.97 have supporting justification.

The details of this report have been compiled in accordance with Section 6.2 of Supplement I of NUREG-0737 and are based on the events for which Crystal River Unit 3 was licensed. The responses contained in this report represent FPC's evaluation and interpretation of RG 1.97 variables as they apply to our existing current design basis criteria. Assistance for the justifications for some variables was provided by participation in the "B&W Owners Group RG 1.97 Task Force" and from outside consultants.

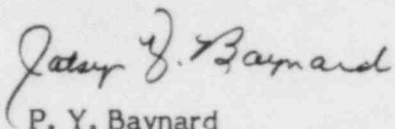
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This comprehensive report includes schedules and proposed modifications. The estimated cost for the implementation of these proposed modifications is in excess of \$5 million dollars. These modifications are scheduled to be completed by December 31, 1987. We will advise you of any significant schedule delays as they occur for implementation of the modifications as identified in this report. An update of this schedule will be included in the annual April schedule updates for the NUREG-0737, Supplement 1 items.

Sincerely,

A handwritten signature in cursive script, reading "P. Y. Baynard".

P. Y. Baynard
Assistant to Vice President
Nuclear Operations

EMG/ddl

Attachments

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97 POSITION DOCUMENT

I. INTRODUCTION

Supplement 1 to NUREG-0737, Requirements for Emergency Response Capability (Generic Letter No. 82-33), dated December 17, 1982 required Florida Power Corporation (FPC) to submit a report describing how it meets the requirements of Regulatory Guide 1.97 (Rev. 2) including supporting technical justification or alternatives for any proposed deviations.

As stated in the cover letter to, and sections 6.1.B and 6.2 of Supplement 1 to NUREG 0737, FPC is using the referenced document as guidance. This allows FPC the flexibility to tailor the guidance given to the specific requirements of Crystal River 3 and to take exception to some of the requirements as long as deviations are shown and supporting justification or alternatives are provided.

This document provides the requested information and is organized to be consistent with Table 3 (PWR Variables) of R.G. 1.97, (Rev. 3). Revision 3 of the Regulatory Guide was used as opposed to Revision 2 to more accurately reflect the current NRC guidance on post-accident monitoring.

II. FORMAT

Each page of the Compliance Table is devoted to a single R.G. 1.97 variable and a comparison of its present status at CR3 to the guidance given in R.G. 1.97, Rev. 3.

On the Compliance Table, where certain requirements are not applicable to a particular variable due to its assigned category and therefore those requirements are not met, a response of "No, not required" will be found for that requirement. If CR3 meets the requirement, regardless of whether or not it's required by its assigned category, a response of "Yes, Complies" will be found.

For each variable, the following heading and contained information will be found on the Compliance Table.

A. VARIABLE

This is the name of the variable as found in R.G. 1.97. If a different nomenclature is utilized at CR-3, it will be contained in parenthesis.

B. TYPE AND CATEGORY

The variables identified are divided into 5 types in accordance with Regulatory Guide 1.97. The definition of each type is as follows:

1. Type A - Those variables which provide the primary information required to permit the control room operators to take specific manual actions for which no automatic control is provided, and that are required for a safety system to accomplish its safety function for design basis accident scenarios. Type A variables are not specified in Regulatory Guide 1.97. They are plant specific and must be selected based on a review of Emergency Operating Procedures to identify information essential for the direct accomplishment of specified safety functions. As a result of a review of the CR3 Emergency Operating Procedures, the following variables were identified as Type A:

RCS Hot Leg Temperature
RCS Pressure
Borated Water Storage Tank Level
Steam Generator Level
Steam Generator Pressure

2. Type B - These variables provide information to indicate whether plant safety functions are being accomplished. Plant safety functions are defined as: reactivity control, core cooling, maintaining reactor coolant system integrity, and maintaining containment integrity.
3. Type C - These variables provide information to indicate the potential for breach or the actual breach of barriers to fission product release. The barriers are defined as: fuel cladding, primary coolant pressure boundary, and containment.
4. Type D - These variables provide information to indicate the operation of individual safety systems and other important systems. These variables help the operator make appropriate decisions in using the individual systems in mitigating the consequences of an accident.
5. Type E - These variables provide information for use in determining the magnitude of the release of radioactive materials and for use in assessing the consequences of such releases.

The variable type listed on the Compliance Table is in accordance with Table 3 of Regulatory Guide 1.97.

In accordance with Regulatory Guide 1.97 each variable is assigned to one of three separate categories that provide a graded approach to the requirements depending on the safety importance of the measurement of a specific variable.

Category 1 provides the most stringent requirements and is intended for key variables. Category 2 provides less stringent requirements and generally applies to instrumentation designated for indicating system operating status.

Category 3 is intended to provide requirements that will ensure that high-quality off-the-shelf instrumentation is obtained and applies to backup and diagnostic instrumentation. It is also used where the state of the art will not support requirements for higher qualified instrumentation.

The category listed for each variable in the Compliance Table is the category assigned by FPC. Generally, this is the same category as listed in Regulatory Guide 1.97. If however FPC has determined that a particular variable is not a key variable or other less stringent requirements better apply, then a note is added referencing to the FPC position, where justification is supplied for the category change.

C. RANGE

The ranges listed in the Compliance Table are the actual measurement range of the variable at CR3 and the range recommended by the Regulatory Guide. If the range varies from that stated in the Regulatory Guide, a note is added referencing to FPC's position where justification is supplied for the existing range. In those cases where the existing range varies from the Regulatory Guide and FPC intends to upgrade to the regulatory guidance, a note is added stating that the range will comply. In some instances, the Regulatory Guide states the range in terms of a percentage of the design. In these cases, the design basis is listed next to the range in parenthesis.

D. ENVIRONMENTAL QUALIFICATION

A response of "Yes, Complies" on the Compliance Table indicates that the currently installed equipment meets the requirements of IE Bulletin 79-01B and 10 CFR 50.49. This determination was based on either having actual environmental qualification documentation available or documentation on similar equipment available.

For Category 2 variables, FPC considers existing installed instrumentation located in a mild environment to be adequate for Regulatory Guide 1.97 Category 2 variables. FPC also considers portions of the Non-nuclear Instrumentation (NNI) adequate for Category 2 variables and has the following position:

For strings which include hardware located in a harsh environment, portions in the harsh environment (sensors, cabling, terminations) should be qualified for the accident temperature, pressure, humidity, radiation and chemical environment. Hardware located in a mild environment (cabling, terminations, processing modules, power supplies, indicators and recorders) is adequate as currently installed.

The basis for this position is as follows:

The Category 2 qualification requirements of Regulatory Guide 1.97, Rev. 3, include no specific provision for seismic qualification. We interpret this to mean that environmental qualification only is required. Since 10CFR50.49 does not require environmental qualification for equipment located in a mild environment, only those components listed in a harsh environment need be qualified.

The currently installed NNI equipment was not supplied as safety related equipment but is comparable in quality and reliability to existing safety related equipment. In fact, some of the NNI electronic modules are identical to those qualified and supplied for these safety related systems. Operating experience with the NNI indicates that this instrumentation can reasonably be expected to be operable for accident monitoring.

Category 2 instrumentation is not required to be seismically qualified, redundant, physically and electrically separated nor powered from a 1E source. The existing NNI hardware located in a mild environment is consistent with the Category 2 criteria and no substantial improvement in reliability or safety would be expected if this equipment were replaced with new, qualified hardware.

For those instruments which are not now installed or for which proper documentation does not currently exist but is required for compliance, either documentation will be generated or the equipment will be replaced. This is indicated on the Compliance Table by a response of "No, Will Comply".

Other responses are self explanatory.

E. SEISMIC QUALIFICATION

A response of "Yes, Complies" on the Compliance Table indicates that the entire instrument string is seismically qualified in accordance with Regulatory Guide 1.100. For equipment which is not presently installed or where only a portion of the instrument string is seismically qualified and must be upgraded, a response of "No, Will Comply" will appear on the Compliance Table. Other responses are self-explanatory.

F. QUALITY ASSURANCE

A response of "Yes, Complies" on the Compliance Table indicates that Quality assurance requirements meeting CR3's licensing commitments as documented in the FSAR Section 1.6 were applied to at least the safety-related portions of the instrument string. In instances where new equipment is being installed or existing equipment upgraded to the above requirement, a response of "No, Will Comply" will appear. All other responses are self-explanatory.

G. REDUNDANCY

A response of "Yes, Complies" indicates that redundant channels are available up to and including any isolation device and that the channels are both electrically independent and physically separate from each other, in accordance with IEEE Standard 279-1971, and meet single failure criteria.

A response of "No", indicates that even though more than one channel may be available as shown, they do not meet the above requirements.

"Will Comply" indicates that the existing channels will be upgraded to comply with the above requirements, or new equipment will be installed to those requirements.

H. POWER SOURCE

The power source for the instrument string listed on the Compliance Table is in compliance with the Regulatory Guide requirements unless otherwise noted.

I. DISPLAY

Under this heading on the Compliance Table is how the variable is indicated and/or recorded in the Control Room (CR). This is in compliance with the regulatory guidance unless otherwise indicated that it "Will Comply".

If the variable is available on demand in the Technical Support Center (TSC) or the Emergency Operating Facility (EOF) it will be so stated.

J. SCHEDULE

This area of the Compliance Table indicates when the upgrades (if required) will be complete. Refuel V is scheduled to be complete by August 1985 and Refuel VI in 1987.

K. POSITION

In this area of the Compliance Table will be Florida Power Corporation's position on a particular variable which will include any justifications which are required along with any comments or clarifying remarks which may be needed.

If the justification presented is justification developed by the Babcock & Wilcox Owners Group (BWOG) Regulatory Guide 1.97 Task Force, it will be so stated.

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CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE: Neutron Flux

TYPE & CATEGORY: B 1

RANGE:	CR-3	Source	Int	Power
		10 ⁻⁸ to 10 ⁻²	10 ⁻⁴ to 10	1 to 125%
	NRC	10 ⁻⁶ to 100%		

ENVIRONMENTAL
QUALIFICATION: Power range only, will comply

SEISMIC
QUALIFICATION: No, will comply

QUALITY ASSURANCE: Yes, complies

REDUNDANCY: No, will comply
2 channels

POWER SOURCE: 1E, complies

DISPLAY: Indicated and recorded in CR, will comply
On demand in TSC & EOF

SCHEDULE: Upgrades complete by end of Refuel VI, see position.

POSITION:

Power range detectors environmentally qualified per B&W Report 10003. Further qualification not required per Section A12, Suppl. No. 2 of Bulletin 79-01B.

System 1E from detectors up to and including NI&P cabinets. Wiring to control panel, and control panel ICS section not seismically qualified with QA.

QA Requirements meeting CR-3 licensing commitments were applied to safety related portions of this instrument string.

By the end of Refuel V, one channel of a Gamma-Metric system will be installed for Remote Shutdown. By the end of Refuel VI a second channel will be installed, with both channels indicated in the control room and meeting all the requirements of Reg. Guide 1.97.

CRYSTAL RIVER 3
REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	Control Rod Position
TYPE & CATEGORY:	B 3
RANGE:	CR-3 0-100%, Full-in/Full-out, Avg group Lights Position
	NRC Full-in or not Full-in
ENVIRONMENTAL QUALIFICATION:	No, not required
SEISMIC QUALIFICATION:	No, not required
QUALITY ASSURANCE:	No, not required
REDUNDANCY:	No, not required 2 channels
POWER SOURCE:	UPS
DISPLAY:	Indicated in CR Avg group position, on demand in TSC & EOF
SCHEDULE:	Installed
POSITION:	Complies

CRYSTAL RIVER 3
REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	RCS Soluble Boron Content	
TYPE & CATEGORY:	B 3	
RANGE:	CR-3	0-6000 ppm
	NRC	0-6000 ppm
ENVIRONMENTAL QUALIFICATION:	No, not required	
SEISMIC QUALIFICATION:	No, not required	
QUALITY ASSURANCE:	No, not required	
REDUNDANCY:	No, not required	
POWER SOURCE:	1E/DG	
DISPLAY:	In laboratory only, need not comply	
SCHEDULE:	Installed	
POSITION:	Complies	

The following position is a justification developed by the BWOG Reg. Guide 1.97 Task Force.

The manual sampling and laboratory analysis is sufficient to meet the intent of Regulatory Guide 1.97, Rev. 03. This is based on the fact that the loss of negative reactivity due to xenon decay is sufficiently slow that the control room operator need not know instantaneously or continuously what the boron concentration is in the RCS. Also, Section II.B.3 of NUREG-0737 requires that capability exists to sample and analyze the reactor coolant in a post-accident environment.

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE: RCS Hot Leg Water Temperature

TYPE & CATEGORY: A,B 1

RANGE: CR-3 120° to 920°F, see Position
NRC 50° to 700°F

ENVIRONMENTAL
QUALIFICATION: No, will comply

SEISMIC
QUALIFICATION: No, will comply

QUALITY ASSURANCE: No, will comply

REDUNDANCY: No, will comply
2 channels

POWER SOURCE: 1E/DG

DISPLAY: Indicated and recorded in CR
On demand in TSC & EOF

SCHEDULE: Upgrades will be completed by end of Refuel VI

POSITION:

RCS Hot Leg Water Temperature is a key variable for monitoring the core cooling safety function. It is used with RCS pressure to monitor the status of the RCS with respect to saturation and subcooled margin limits. It is used with Core Exit Temperature to verify natural circulation and to identify loss of natural circulation. It can also be used with Steam Generator Pressure to verify coupling between the RCS and the Secondary System.

The RCS hot leg temperature range does not envelope the lower end of the Reg. Guide 1.97 recommended range, however the existing range is acceptable based on the following:

1. At temperatures less than 280°F, the plant will be in the Decay Heat Removal mode and this temperature is not required.
2. Cold Shutdown is defined in the Technical Specification as less than 200°F.
3. RCS cold leg temperature range will indicate down to 50°F.

RTD's will be replaced if necessary to meet EQ requirements. Cable used in containment is qualified pending resolution of some outstanding questions.

Only RTD's and indicators are safety related, seismically mounted, and redundant.

Instrument string will be upgraded to meet requirements.

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	RCS Cold Leg Water Temperature	
TYPE & CATEGORY:	B 3, see Position	
RANGE:	CR-3	50° to 650°F, see Position
	NRC	50° to 700°F
ENVIRONMENTAL QUALIFICATION:	No, need not comply	
SEISMIC QUALIFICATION:	No, need not comply	
QUALITY ASSURANCE:	No, need not comply	
REDUNDANCY:	No, need not comply 2 channels	
POWER SOURCE:	1E/DG	
DISPLAY:	Indicated and recorded in CR On demand in TSC & EOF	
SCHEDULE:	Installed	
POSITION:		

The following position is a justification developed by the BWOG Reg. Guide 1.97 Task Force.

Reg. Guide 1.97 lists cold leg water temperature as a Category 1 (key) variable and core exit temperature as a Category 3 (backup) variable for the core cooling function. Cold leg temperature indication may not in all cases provide valid information on the status of core cooling. Since it is located in the RCS loops and not the reactor vessel, there must be either forced or natural circulation flow through the steam generators for indications to be representative of actual core conditions. Also, due to the proximity of the cold leg RTD's to the HPI nozzles, HPI flow may significantly affect the cold leg temperature indication particularly in the absence of forced RCS flow. Incore temperature monitors provide a more direct indication of core cooling independent of whether or not there exists coolant flow through the loops.

The key variables for monitoring the core cooling plant safety function are RCS Hot Leg Water Temperature, Core Exit Temperature, and Steam Generator Pressure (see Discussion section for RCS Hot Leg Water Temperature). RCS Cold Leg Water Temperature is a backup temperature monitor to the RCS Hot Leg Water Temperature and Core Exit Temperature.

For these reasons, core exit temperature and RCS Hot Leg are the key variables for monitoring core cooling and are qualified to Category 1 requirements while RCS cold leg temperature serves as a backup variable and is qualified to Category 3 requirements accordingly.

The CR-3 range of 50 to 650°F is based on providing the capability of the RCS Cold Leg Water Temperature instrumentation to measure a value greater than the saturation temperature for the steam generators, which is approximately 500°F (based on 1050 psig design pressure). 650°F for the high end of the range provides 15% excess measurement capability and is approximately 110% of the design temperature of 600°F. The low end of the range, 50°F, allows for measurement of the variable during conditions where the DHRS or LPI system is not in use or available and the steam generators are removing decay heat.

CRYSTAL RIVER 3
REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	RCS Pressure	
TYPE & CATEGORY:	A,B,C 1	
RANGE:	CR-3	0-2500 psig, will comply
	NRC	0-3000 psig
ENVIRONMENTAL QUALIFICATION:	No, will comply	
SEISMIC QUALIFICATION:	No, will comply	
QUALITY ASSURANCE:	No, will comply	
REDUNDANCY:	Yes, complies 2 channels	
POWER SOURCE:	1E/DG	
DISPLAY:	Indicated and recorded in CR On demand in EOF & TSC	
SCHEDULE:	Equipment Qualification upgrades complete by end of Refuel V, other upgrades complete by end of Refuel VI.	
POSITION:		

Portion of the instrument loop from the ES test cabinet to the control board were not installed to Class 1E requirements. These portions will be upgraded.

RCS pressure transmitters being replaced during Refuel V. New transmitters meet RG 1.89 requirements (1E and environmental qualification).

CRYSTAL RIVER 3
REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE: Coolant Inventory (Reactor Vessel Level)

TYPE & CATEGORY: B 1

RANGE: CR-3 Bottom of hot leg to top of hot leg
Bottom of hot leg to top of vessel
NRC Bottom of hot leg to top of vessel

ENVIRONMENTAL
QUALIFICATION: No, will comply

SEISMIC
QUALIFICATION: No, will comply

QUALITY ASSURANCE: No, will comply

REDUNDANCY: No, will comply
2 channels

POWER SOURCE: No, will comply

DISPLAY: No, will comply

SCHEDULE: To be completed by end of Refuel V

POSITION:

Ref: The NRC's evaluation of CR-3's response to NUREG-0737, Item II.F.2, Docket No. 50-302, dated 9/6/83.

Reactor vessel and hot leg level, including reactor coolant pump monitors to detect voids in coolant is being implemented to satisfy NUREG-0737, Item II.F.2.

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE: Degrees of Subcooling

TYPE & CATEGORY: B 2

RANGE: CR-3 + 658°F
NRC 200°F subcool to 35°F superheat

ENVIRONMENTAL
QUALIFICATION: Yes, temperature transmitter being evaluated to 79-01B

SEISMIC
QUALIFICATION: No, not required

QUALITY ASSURANCE: Yes, complies

REDUNDANCY: No, not required
2 channels

POWER SOURCE: UPS/DG

DISPLAY: Indicated in CR

SCHEDULE: Installed

POSITION: Complies

1E power supply, but wiring not safety related from vital bus.

QA requirements meeting CR-3 licensing commitments were applied to the safety-related portions of this instrument string.

CRYSTAL RIVER 3
REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	Containment Sump Water Level (Narrow Range)	
TYPE & CATEGORY:	B,C 2	
RANGE:	CR-3 NRC	0-10 ft. Sump
ENVIRONMENTAL QUALIFICATION:	Yes, complies	
SEISMIC QUALIFICATION:	Yes, complies	
QUALITY ASSURANCE:	Yes, complies	
REDUNDANCY:	Yes, complies 2 channels	
POWER SOURCE:	UPS/DG with 1E standby	
DISPLAY:	Indicated and recorded in EFIC room On demand in TSC & EOF	
SCHEDULE:	Installed	
POSITION:	Complies	

Ref: Safety Evaluation Report, Docket No. 50-302 dated January 13, 1984

Due to lack of space in the Control Room, the indicators and recorder are located in the Emergency Feedwater Initiation and Control (EFIC) Room. The NRC in the above referenced SER found that this location adequately satisfies the requirements of NUREG-0737, Item II.F.1.5.

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	Containment Sump Water Level (Flood Level)	
TYPE & CATEGORY:	B,C 1	
RANGE:	CR-3 NRC	0-10 ft. above sump Plant specific.
ENVIRONMENTAL QUALIFICATION:	Yes, complies	
SEISMIC QUALIFICATION:	Yes, complies	
QUALITY ASSURANCE:	Yes, complies	
REDUNDANCY:	Yes, complies 2 channels	
POWER SOURCE:	1E	
DISPLAY:	Indicated and recorded in EFIC room On demand in EOF & TSC	
SCHEDULE:	Installed	
POSITION:	Complies	

Ref: Safety Evaluation Report, Docket No. 50-302 dated January 13, 1984

Due to lack of space in the Control Room, the indicators and recorder are located in the Emergency Feedwater Initiation and Control (EFIC) Room. The NRC in the above referenced SER found that this location adequately satisfies the requirements of NUREG-0737, Item II.F.1.5.

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	Containment Isolation Valve Position (Manual Valves)
TYPE & CATEGORY:	B 1
RANGE:	No indication, need not comply
ENVIRONMENTAL QUALIFICATION:	N/A
SEISMIC QUALIFICATION:	N/A
QUALITY ASSURANCE:	N/A
REDUNDANCY:	N/A
POWER SOURCE:	N/A
DISPLAY:	N/A
SCHEDULE:	N/A

POSITION:

Locked/closed valves or blind flanges may be used in lieu of automatic valves. Ref. SRP-6.2.4-6F and NUREG-0737 Pg. 3-91.

Automatic valves are only mentioned for position indication. Ref. SRP-6.2.4-6J. Therefore, indication not required for locked/closed manual valves.

CRYSTAL RIVER 3
REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE: Containment Isolation Valve Position
(Automatic Valves)

TYPE & CATEGORY: B 1

RANGE: CR-3 Open-closed lights
NRC Closed-not closed

ENVIRONMENTAL
QUALIFICATION: No, will comply

SEISMIC
QUALIFICATION: No, will comply

QUALITY ASSURANCE: No, will comply

REDUNDANCY: No, need not comply, see position

POWER SOURCE: No, will comply

DISPLAY: Indicated in CR, see Position

SCHEDULE: Upgrades will be completed by end of Refuel VI

POSITION:

Redundancy is not necessary on a per valve basis since redundant barriers are provided for all fluid penetrations.

Areas of noncompliance will be upgraded to comply.

Position indication is provided in the Control Room via a light matrix. This method should be acceptable for monitoring valve positions rather than recording.

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE: Core Exit Temperature

TYPE & CATEGORY: B,C 1

RANGE: CR-3 0-900°F, will comply
NRC 200° to 2300°F

ENVIRONMENTAL
QUALIFICATION: No, will comply

SEISMIC
QUALIFICATION: No, will comply

QUALITY ASSURANCE: No, will comply

REDUNDANCY: No, need not comply, see position

POWER SOURCE: UPS/DG

DISPLAY: Indicated and recorded on demand in CR
On demand in TSC & EOF

SCHEDULE: See position.

POSITION:

Ref: The NRC's evaluation of CR-3 is response to NUREG-0737, Item II.F.2, Docket No. 50-302, dated 9/6/83.

The Core Exit Thermocouples (CETs) are self-powered devices and are considered a single channel. CETs connected to both safety and nonsafety systems will be isolated prior to the connection with nonsafety systems.

There have been no problems with the existing in-core probe assemblies. One-half of them have been replaced during the 1983 refueling outage with similar units. During the next refueling outage, all of the existing in-containment cable for the in-core probe assemblies will be replaced with qualified cable. Also, during future outages, the in-core probe assemblies will be replaced with qualified units.

The primary and backup display channels will be electrically independent, energized from independent power sources, and physically separated in accordance with Regulatory Guide 1.75 up to and including the isolators. The primary display and computers are not Class 1E, but are energized from a battery backed high-reliability uninterruptible power supply.

The backup display (16 CETs, 4 per Quadrant) and its power sources will be Class 1E.

Peck (Comp) DN104-2

CETs connected only to the plant computer will not be isolated, since they are unpowered.

This variable is being upgraded in accordance with NUREG-0737, Item II.F.2.

CRYSTAL RIVER 3
REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	RCS Radioactivity Concentration	
TYPE & CATEGORY:	C 3, see position	
RANGE:	CR-3 NRC	10 ⁻² to 10 ⁻³ ci/gm 1/2 tech spec limit to 100 times tech spec limit
ENVIRONMENTAL QUALIFICATION:	Need not comply, see position	
SEISMIC QUALIFICATION:	Need not comply, see position	
QUALITY ASSURANCE:	Need not comply, see position	
REDUNDANCY:	Need not comply, see position	
POWER SOURCE:	1E	
DISPLAY:	Indicated and recorded in lab only	
SCHEDULE:	Installed	
POSITION:		

The following position is a justification developed by the BWOG Reg. Guide 1.97 Task Force.

Currently, no instrumentation exists to adequately measure this variable on line. Existing instrumentation, letdown line radiation monitors, can be used to provide indication of fuel failure during normal operation. However, since the letdown line is isolated during serious accidents requiring containment isolation, it will not be available for long term measurement. Section II.B.3 of NUREG-0737 requires that capability exist at each plant to sample the RCS to assess the magnitude of fuel failures during post-accident conditions. As such, this measurement should be the primary determinant of fuel failure during normal operation and post-accident. The letdown line radiation monitor should be used as the initiator for sampling during normal operation because state-of-the-art equipment is unavailable and the primary means of monitoring this variable must therefore be by sampling and analysis. It is recommended that it be downgraded to Category 3.

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	Containment Hydrogen Concentration	
TYPE & CATEGORY:	C 1	
RANGE:	CR-3	0-10%
	NRC	0-10%
ENVIRONMENTAL QUALIFICATION:	Yes, complies	
SEISMIC QUALIFICATION:	Yes, complies	
QUALITY ASSURANCE:	Yes, complies	
REDUNDANCY:	Yes, complies 2 channels	
POWER SOURCE:	1E	
DISPLAY:	Indicated and recorded in EFIC room	
SCHEDULE:	Installed	
POSITION:	Complies	

Ref: Safety Evaluation Report, Docket No. 50-302 dated January 13, 1984

Due to lack of space in the Control Room, the Containment Hydrogen Monitoring System (CHMS) indicators and recorder are located in the Emergency Feedwater Initiation and Control (EFIC) Room. The NRC in the above referenced SER found that this location adequately satisfies the requirements of NUREG-0737, Item II.F.1.6.

CRYSTAL RIVER 3
REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	Containment Pressure
TYPE & CATEGORY:	B,C 1
RANGE:	CR-3 0-280 PSIA (Design = 55 PSIG) NRC 10 psia to 3 times design
ENVIRONMENTAL QUALIFICATION:	Yes, complies
SEISMIC QUALIFICATION:	Yes, complies
QUALITY ASSURANCE:	Yes, complies
REDUNDANCY:	Yes, complies 2 channels
POWER SOURCE:	1E
DISPLAY:	Indicated CR and recorded in EFIC room On demand in TSC & EOF
SCHEDULE:	Qualified transmitters with 1E power to be installed by end of Refuel V
POSITION:	Complies

Ref: Safety Evaluation Report, Docket No. 50-302 dated January 13, 1984

Due to lack of space in the Control Room, the recorder is located in the Emergency Feedwater Initiation and Control (EFIC) Room. The NRC in the above referenced SER found that this location adequately satisfies the requirements of NUREG-0737, Item II.F.1.4.

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	RHR System Flow (Decay Heat)
TYPE & CATEGORY:	D 2
RANGE:	CR-3 0-5000 GPM (Design = 3000 GPM) NRC 0 to 110% Design
ENVIRONMENTAL QUALIFICATION:	Yes, complies
SEISMIC QUALIFICATION:	No, not required
QUALITY ASSURANCE:	Yes, complies
REDUNDANCY:	No, not required 2 channels
POWER SOURCE:	UPS/DG with 1E standby
DISPLAY:	Indicated in CR On demand in TSC & EOF
SCHEDULE:	Installed
POSITION:	Complies

QA requirements meeting CR-3 licensing commitments were applied to safety related portions of this instrument string.

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE: RHR Heat Exchanger Outlet Temperature
(Decay Heat)

TYPE & CATEGORY: D 2

RANGE: CR-3 0-300°F
NRC 40° to 350°F

ENVIRONMENTAL
QUALIFICATION: No, will comply

SEISMIC
QUALIFICATION: No, not required

QUALITY ASSURANCE: Yes, complies

REDUNDANCY: No, not required
2 channels

POWER SOURCE: UPS with 1E standby

DISPLAY: Indicated in CR

SCHEDULE: Upgrades will be complete by end of Refuel VI

POSITION:

Equipment environmental qualification will be upgraded to meet requirements.

Transmitter with mounting is seismic since pressure boundary to safety system.

QA requirements meeting CR-3 licensing commitments were applied to safety related portions of this instrument string.

Design temperature of the Decay Heat system and heat exchanger for CR-3 is 300°F.

CRYSTAL RIVER 3
REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	Accumulator Tank Level (Core Flood Tank)
TYPE & CATEGORY:	D 2
RANGE:	CR-3 0-14 ft. above datum NRC 10 to 90% Vol.
ENVIRONMENTAL QUALIFICATION:	Yes, complies
SEISMIC QUALIFICATION:	No, not required
QUALITY ASSURANCE:	Yes, complies
REDUNDANCY:	No, not required 2 channels
POWER SOURCE:	UPS/DG
DISPLAY:	Indicated in CR
SCHEDULE:	Installed
POSITION:	Complies

Range covers 100% of required liquid level. Volume not covered is for N₂ blanket. Meets intent of RG 1.97.

QA requirements meeting CR-3 licensing commitments were applied to safety related portions of this instrument string.

CRYSTAL RIVER 3
REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	Accumulator Tank Pressure (Core Flood Tank)	
TYPE & CATEGORY:	D 3, see position	
RANGE:	CR-3	0-800 PSIG
	NRC	0-750 PSIG
ENVIRONMENTAL QUALIFICATION:	No, need not comply	
SEISMIC QUALIFICATION:	No, not required	
QUALITY ASSURANCE:	Yes, complies	
REDUNDANCY:	No, not required 2 channels	
POWER SOURCE:	UPS/DG	
DISPLAY:	Indicated in CR	
SCHEDULE:	Installed	
POSITION:	Complies	

The following position is a justification developed by the BWOG Reg. Guide 1.97 Task Force.

QA requirements meeting CR-3 licensing commitments were applied to safety related portions of this instrument string.

Core Flood Tank Pressure is a key variable for pre-accident status to assure that this passive safety system is prepared to serve its function. This pressure indication provides no essential information for operator action during or following an accident. The key variable necessary to determine whether the Core Flood Tanks have fulfilled their safety function is Core Flood Tank Level. Therefore, Core Flood Tank Pressure is a backup type variable and has been classified as a Category 3 instrument accordingly.

CRYSTAL RIVER 3
REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	Accumulator Isolation Valve Position (Core Flood Tank)
TYPE & CATEGORY:	D 2
RANGE:	CR-3 Closed-open limits NRC Closed or oper.
ENVIRONMENTAL QUALIFICATION:	No, will comply
SEISMIC QUALIFICATION:	Yes, complies
QUALITY ASSURANCE:	Yes, complies
REDUNDANCY:	No, not required 2 channels
POWER SOURCE:	UPS/DG
DISPLAY:	Indicated in CR
SCHEDULE:	Upgrades will be complete by the end of Refuel VI
POSITION:	

QA requirements meeting CR-3 licensing commitments were applied to safety related portions of this instrument string.

Instrument cable is presently not environmentally qualified.

Areas of noncompliance will be upgraded to comply.

CRYSTAL RIVER 3
REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	Boric Acid Charging Flow
TYPE & CATEGORY:	D 2
RANGE:	N/A
ENVIRONMENTAL QUALIFICATION:	N/A
SEISMIC QUALIFICATION:	N/A
QUALITY ASSURANCE:	N/A
REDUNDANCY:	N/A
POWER SOURCE:	N/A
DISPLAY:	N/A
SCHEDULE:	N/A
POSITION:	

The following position is a justification developed by the BWOG Reg. Guide 1.97 Task Force.

The B&W - designed NSSS does not include a charging system as part of the Emergency Core Cooling System (ECCS). Flow paths from the ECCS to the RCS include high pressure injection (HPI) and low pressure injection (LPI) with the BWST or the RB Sump as the suction source, and the Core Flood Tank injection. HPI and LPI flow rates are monitored, and BWST, RB sump, and Core Flood Tank levels are monitored by RG 1.97 variables. Therefore, Boric Acid Charging Flow does not need to be monitored as a Type D variable to monitor the operation of the ECCS.

CRYSTAL RIVER 3
REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	Flow in HPI System
TYPE & CATEGORY:	D 2
RANGE:	CR-3 0-500 GPM (Design = 300 GPM) NRC 0 to 110% Design
ENVIRONMENTAL QUALIFICATION:	Yes, complies
SEISMIC QUALIFICATION:	Yes, complies
QUALITY ASSURANCE:	Yes, complies
REDUNDANCY:	No, not required 2 channels
POWER SOURCE:	UPS/DG
DISPLAY:	Indicated in CR On demand in TSC & EOF
SCHEDULE:	Installed
POSITION:	Complies

QA requirements meeting CR-3 licensing commitments were applied to safety related portions of this instrument string.

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE: Flow in LPI System

TYPE & CATEGORY: D 2

RANGE: N/A

ENVIRONMENTAL
QUALIFICATION: N/A

SEISMIC
QUALIFICATION: N/A

QUALITY ASSURANCE: N/A

REDUNDANCY: N/A

POWER SOURCE: N/A

DISPLAY: N/A

SCHEDULE: N/A

POSITION:

Same instrument as RHR system flow, see page 16.

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	Refueling Water Storage Tank Level (Borated Water Storage Tank)	
TYPE & CATEGORY:	A,D 1	
RANGE:	CR-3 NRC	0-600 inches Top to bottom
ENVIRONMENTAL QUALIFICATION:	Yes, complies	
SEISMIC QUALIFICATION:	Yes, complies	
QUALITY ASSURANCE:	Yes, complies	
REDUNDANCY:	Yes, complies 2 channels	
POWER SOURCE:	1E/DG	
DISPLAY:	Indicated and recorded on demand in CR, will comply On demand in TSC & EOF	
SCHEDULE:	Upgrades will be completed by end of Refuel VI	
POSITION:		

QA requirements meeting CR-3 licensing commitments were applied to safety related portions of this instrument string.

The recorder will be upgraded to comply.

The following position is a justification developed by the BWOg Reg. Guide 1.97 Task Force.

B&W's Criteria for BWST (36-3364-02) sets three criteria which must be met by the BWST. The first criterion is related to fuel handling and transfer operations and is not applicable for accident events. The second criterion requires that sufficient volume be contained in the BWST to provide 20 minutes of injection operation prior to switchover to an alternate source. This is a criterion which must be satisfied during normal plant operation to ensure availability of the BWST during an accident. This volume is less than that required to meet the first criterion. The third criterion is the important one for use during and after an accident. This criterion requires that the BWST level be such that adequate NPSH for all ECCS pumps be available.

To meet the desired intent of the regulatory guide that accident monitoring instrumentation also be used, to the extent practicable, during normal operations, the existing BWST level instrumentation has sufficiently wide range to monitor the level required in the BWST by the first criterion. At Crystal River 3, the tank level is monitored from 0 to 50 feet for the first criterion. A low alarm is provided a 4 feet and switchover is required at 2.5 feet. Thus, the operator is provided with adequate level indication at all times.

CRYSTAL RIVER 3
REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	Reactor Coolant Pump Status
TYPE & CATEGORY:	D 3
RANGE:	CR-3 0-125% load NRC Motor current
ENVIRONMENTAL QUALIFICATION:	No, not required
SEISMIC QUALIFICATION:	No, not required
QUALITY ASSURANCE:	No, not required
REDUNDANCY:	No, not required 1 per pump
POWER SOURCE:	OP, complies
DISPLAY:	Pump running lights in CR 0-125% load indicted for each pump in CR Indicator for total circuit amps in CR Recorder for total circuit amps in CR On demand in TSC & EOF
POSITION:	Complies

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE: Primary System Safety Relief Valve Position or Flow
Through or Pressure in Relief Lines

TYPE & CATEGORY: D 2

RANGE: CR-3 Acoustic system
NRC Closed - not closed

ENVIRONMENTAL
QUALIFICATION: Yes, complies

SEISMIC
QUALIFICATION: No, not required

QUALITY ASSURANCE: Yes, complies

REDUNDANCY: No, not required
2 channels

POWER SOURCE: UPS/DG

DISPLAY: Indicated in CR
On demand in TSC & EOF

SCHEDULE: Installed

POSITION: Complies

Accelerometers are seismically mounted.

CRYSTAL RIVER 3
REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	Pressurizer Level
TYPE & CATEGORY:	D 1
RANGE:	CR-3 0-320 inches, see position NRC Top to bottom
ENVIRONMENTAL QUALIFICATION:	No, will comply
SEISMIC QUALIFICATION:	No, will comply
QUALITY ASSURANCE:	No, will comply
REDUNDACY:	No, will comply 2 channels
POWER SOURCE:	1E/DG
DISPLAY:	Indicated and recorded in CR On demand in TSC & EOF
SCHEDULE:	New transmitter will be installed by end of Refuel V. Other upgrades to be complete by end of Refuel VI.
POSITION:	

The following position is a justification developed by the BWOG Reg. Guide 1.97 Task Force.

The pressurizer level was sized based on the following. The water volume is chosen such that the reactor coolant system can experience a reactor trip from full power without uncovering the level sensors in the lower shell and to maintain system pressure above the HPI system actuation setpoint. The steam volume is chosen such that the reactor coolant system can experience a turbine trip without covering the level sensors in the upper shell. The range of 0-320" H₂O was based on this criteria and setpoints for automatic or manual actions are based on this range.

The pressurizer is approximately 512 inches tall. The 0 inch reference for the pressurizer level instrument range is 43 inches above the lower datum line (approx. 96 inches from the bottom), 16 inches below the upper set of heaters, and approximately at the level of the second set of heaters. The upper pressurizer level top (320 inches above the 0 inch reference) is 43 inches below the upper datum (approx. 92 inches from the top), and approximately 37 inches from the spray head.

CRYSTAL RIVER 3
REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	Pressurizer Heater Status
TYPE & CATEGORY:	D 2
RANGE:	CR-3 On-off lights, see Position NRC Electric Current
ENVIRONMENTAL QUALIFICATION:	No, will comply
SEISMIC QUALIFICATION:	No, will comply
QUALITY ASSURANCE:	No, will comply
REDUNDANCY:	No, will comply
POWER SOURCE:	No, will comply
DISPLAY:	On-off heater lights in CR, will comply SCR failure alarm in CR Group overcurrent alarms in CR Breaker open alarms in CR
SCHEDULE:	Upgrades will be complete by end of Refuel VI
POSITION:	

The following position is a justification developed by the BWOG Reg. Guide 1.97 Task Force.

Pressurizer heater control utilizes several banks of heaters which are controlled in an on-off mode and one bank of heaters which is modulated to produce a proportional output that increases as pressure decreases from setpoint. Since the control of these two pressurizer heater banks is either "on" or "off" and not by modulating the current to them, an on-off indication of the heater status is appropriate. RCS pressure can be monitored to determine the effectiveness of the heaters to maintain system pressure.

CRYSTAL RIVER 3
REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	Quench Tank Level (Reactor Coolant Drain Tank)
TYPE & CATEGORY:	D 3
RANGE:	CR-3 6 inches from bottom to top NRC Top to bottom
ENVIRONMENTAL QUALIFICATION:	No, not required
SEISMIC QUALIFICATION:	No, not required
QUALITY ASSURANCE:	No, not required
REDUNDANCY:	No, not required
POWER SOURCE:	UPS/DG
DISPLAY:	Indicated in CR On demand in TSC & EOF
SCHEDULE:	Installed
POSITION:	Complies

CRYSTAL RIVER 3
REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE: Quench Tank Temperature
(Reactor Coolant Drain Tank)

TYPE & CATEGORY: D 3

RANGE: CR-3 0 to 150°F, will comply with Position
NRC 50° to 750°F

ENVIRONMENTAL
QUALIFICATION: No, not required

SEISMIC
QUALIFICATION: No, not required

QUALITY ASSURANCE: No, not required

REDUNDANCY: No, not required

POWER SOURCE: UPS/DG

DISPLAY: On local radwaste panel only, will comply
On demand in TSC & EOF

SCHEDULE: Upgrades will be complete by end of Refuel VI

POSITION:

The following position is a justification developed by the BWOG Reg. Guide 1.97 Task Force.

The Quench Tank, known as the Reactor Coolant Drain Tank (RCDT) is equipped with a rupture disc which blows at 110 psig (saturation temperature = 345°F). Will change range to 0 to 400°F.

Indication will be added to the Control Room.

CRYSTAL RIVER 3
REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	Quench Tank Pressure (Reactor Coolant Drain Tank)	
TYPE & CATEGORY:	D 3	
RANGE:	CR-3 NRC	0-100 PSIG (Design = 100 PSIG) 0 to design
ENVIRONMENTAL QUALIFICATION:	No, not required	
SEISMIC QUALIFICATION:	No, not required	
QUALITY ASSURANCE:	No, not required	
REDUNDANCY:	No, not required	
POWER SOURCE:	UPS/DG	
DISPLAY:	Indicated in CR On demand in TSC & EOF	
SCHEDULE:	Installed	
POSITION:	Complies	

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE: Steam Generator Level

TYPE & CATEGORY: A,D 1

RANGE: CR-3 0 to 150 and 100 to 394 inches, see Position
NRC Tube sheet to separators

ENVIRONMENTAL
QUALIFICATION: No, will comply

SEISMIC
QUALIFICATION: Yes, complies

QUALITY ASSURANCE: Yes, complies

REDUNDANCY: Yes, complies
4 channels

POWER SOURCE: 1E/DG

DISPLAY: Indicated and recorded in CR
On demand in TSC & EOF

SCHEDULE: Upgrades will be complete by end of Refuel V

POSITION:

CR-3, having a B&W NSSS, utilizes Once Through Steam Generators (OTSG) which produce superheated steam and therefore are not equipped with moisture separators in the steam generator. CR-3 is in the process of installing the Emergency Feedwater Initiation & Control (EFIC) systems, which will be completed by the end of Refuel V. This system provides Class 1E, redundant, level indication in the CR. The lower range (start-up) measures 0 to 150 inches and the upper range (operating) measures 100 to 394 inches.

The lower level sensing tap (0 inches) is approximately 6 inches above the lower tube sheet and the upper level sensing tap (394 inches) is at approximately the level of the aspirating ports.

Areas of noncompliance will be upgraded to comply.

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE: Steam Generator Pressure

TYPE & CATEGORY: A,D 1

RANGE: CR-3 0-1200 PSIG, see Position
NRC Atmosphere to 20% > Lowest Safety Vlv
Setting (1260 PSIG)

ENVIRONMENTAL
QUALIFICATION: No, will comply

SEISMIC
QUALIFICATION: Yes, complies

QUALITY ASSURANCE: Yes, complies

REDUNDANCY: Yes, complies
4 channels

POWER SOURCE: 1E/DG

DISPLAY: Indicated in CR
On demand in TSC & EOF

SCHEDULE: Upgrades will be complete by end of Refuel V

POSITION:

The steam generator pressure range of 0-1200 psig is acceptable because the safety valve setpoints range from a low of 1050 psig + 10 psig to 1100 psig + 10 psig, which are close to 20% above the low setpoint recommendation. The high safety valve setpoint is about 100 psig below the high end of the instrument scale.

Therefore, based on the facts that the highest safety valve setting is typically 1100 psig, the steam relief capacity is 20-25% above the expected steam flow rate and that excess relief capacity is maintained when safety valves are inoperable, and the FSAR analysis indicates a maximum steam pressure of about 1100 psig for operating plants, it is recommended that the existing range of 0-1200 psig is sufficient.

Other areas of noncompliance will be upgraded to comply.

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	Main Steam Safety Relief Valve Position	
TYPE & CATEGORY:	D 2	
RANGE:	CR-3 NRC	Not measured, see position Closed - not closed
ENVIRONMENTAL QUALIFICATION:	N/A	
SEISMIC QUALIFICATION:	N/A	
QUALITY ASSURANCE:	N/A	
REDUNDANCY:	N/A	
POWER SOURCE:	N/A	
DISPLAY:	N/A	
SCHEDULE:	N/A	

POSITION:

R.G. 1.97 identifies two uses for MSSRV/ADV position indications. The first is to provide information to monitor the operation of the secondary system. This is expected, by the NRC, to help the operator make appropriate decisions in using available systems to mitigate consequences of an accident.

An additional use is for establishing the magnitude of release of radioactive material from the secondary coolant system during accident conditions.

In order to justify not implementing the R.G. 1.97 requirement for main steam safety/relief valve (MSSRV/ADV) position monitoring, it is necessary to either demonstrate that the information supplied by such instrumentation is not necessary for the stated functions, or that the information can be obtained from other available instrumentation.

The following provides an assessment of the benefits of a MSSRV position monitoring system relative to current practice; and evaluates the acceptability of not installing such a system. Issues which are addressed are:

1. Aid to operator in preventing overcooling sufficient to lead to pressurized thermal shock.

2. Assessment of radioactive material releases through the MSSRV/ADV's during anticipated transients.
3. Regulatory Guide 1.97 requirements for MSSRV (including ADV's) position indication.

For this evaluation, current practice for operating without this instrumentation under both anticipated transients and accident conditions at CR-3 were reviewed. Conclusions are based upon judgements of the adequacy of current practices to meet NRC requirements for system monitoring and release assessments, and the benefits of additional instrumentation weighed against its monetary costs.

EVALUATION OF CURRENT CR-3 PRACTICE

Anticipated Transients

The anticipated transients which result in MSSRV/ADV operation are usually those which result in decreases in heat removal by the secondary system. Examples are loss of load, turbine trip, and loss of condenser vacuum. During any full power turbine trip, a portion of the MSSRV/ADV's will open since the turbine bypass valves are only designed for 15% for full steam flow.

Spurious MSSRV/ADV action is also possible. In the event of spurious MSSRV/ADV lifting or failure of valves to reseat, excessive secondary system heat removal may result.

Plant operating history illustrates that a fully stuck open MSSRV is unlikely. Excessive discharge flow is attributed to shifting of spring set points, leaking seats or inadequate blowdown margin. In all cases, a lowering of steam header pressure results in proper reseating, sometimes manual popping is required to generate the extra forces to eliminate leaks.

One manufacturer of relief valves with similar design features to the Consolidated series 3700 MSSRV's indicates that stuck valve flows of up to 25% capacity can be expected during the first blowdown stage. Consolidated acknowledged that this maximum simmer feature applies to their design.

Required Operator Action and Supporting Instrumentation

Current emergency operating procedures require the operator to:

- (1) Verify reactivity control;
- (2) Maintain or achieve adequate subcooling;
- (3) Verify proper steam generator levels and feedwater flow;
- (4) Verify or establish natural circulation, if RCP's are not operating;
- (5) Verify RC temperature > 500°F, or respond with actions designed to prevent pressurized thermal shock;

- (6) Confirm that a steam generator tube rupture has not occurred;
- (7) Assess radioactive inventory control.

None of these verifications, or associated operator responses, require specific measurements of steam flow or MSSRV/ADV position indication. However, it is of value to know the path of heat transferred from the secondary system to a heat sink, for purposes of terminating the over-cooling transient.

Excessive secondary system cooling can result in excessive reactor coolant system cooldown, with theoretical technical specification violation. The excessive cooldown is monitored on the primary system. Unexpected heat transfer from the secondary system is observed, first, by losses in secondary system pressure.

Diagnosis of MSSRV/ADV Failure to Reseat

Current practice for diagnosing the existing of an MSSRV/ADV which has failed to reseat is by its distinct impact on secondary pressure (see Attachment 1). Other transients can result in similar reductions in secondary system pressure, however, a stuck MSSRV/ADV is the most likely cause, and is checked first. Currently, a turbine plant operator is dispatched to visually check and identify stuck relief valves. This does serve as a limited distraction from other duties.

History of Secondary System and Operator Response and Pressurized Thermal Shock Considerations

A qualitative review of turbine/reactor trip events for the 1981 to 1984 time frame was conducted to note the frequency and characteristics of stuck MSSRV/ADV events. A number of events have occurred over this period. The attachment shows a sample event where the action of the MSSRV/ADV and the operator is fairly distinct. The stuck valve did not, by itself, cause a significant secondary system pressure reduction. The valve may have been partially open. The majority of the pressure drop is associated with the operator action to establish a firm reseating by lowering the turbine bypass setpoint. In all of the observed events, reseating has been achieved with secondary system pressures above 880 psig. Reactor coolant temperatures have not been reduced below 500°F during these events.

These events of limited valve sticking do not appear to be precursors to an event resulting in a valve sticking down to a low pressure. Extended stuck MSSRV/ADV events are, of course, readily recognizable by direct visual observation of the valve exhaust.

Nevertheless, the importance of a stuck MSSRV/ADV event, where the valve does not reseat at all, was reviewed based upon the B&W Owners Group Probabilistic Evaluation of Pressurized Thermal Shock-Phase 1 report (PTS-P1), and transient assessments provided in the B&W Abnormal Transient Operating Guidelines (ATOG).

The analysis provided in the ATOG discussion of small steam leaks uses the event of all turbine bypass valves failing open. This would be equivalent to an event of two stuck MSSRV's, one on each steam generator. This event results in SLBIS actuation within about 5 minutes of reactor trip, isolating all feedwater to both steam generators. For a stuck MSSRV event, the cooldown would continue somewhat longer until the steam generators dry out, since the "break" is not isolated. It is important to note that the SLBIS actuation occurs at 600 psig, far below that which has been required to reseal MSSRV's in the past. In the case of a single, stuck fully open MSSRV, the depressurization would be less severe due to heat transfer from the unaffected loop and the fact that the heat rejection capacity of a single valve is more comparable to reactor coolant pump and decay heat input. In either case, the RCS temperature would not be expected to go below 500°F.

Another analysis from the ATOG shows the primary and secondary system response to a still more severe small steam line break of 0.5 ft², which is equivalent to 4.5 fully open MSSRV's. Again, the proper functioning of the SLBIS terminates the transient prior to excessive cooldown of the RCS.

Conclusion

A MSSRV/ADV position indication system is not necessary for proper response to stuck relief valve events, or to prevent overcooling from these events.

The present procedure for checking for discharging valves after a trip should continue and be adequately documented.

Assessment of Radioactivity Releases Through MSSRV/ADV's During Transients

A very small amount of radioactivity is released through the MSSRV/ADV's during transients that result in secondary system undercooling. The amount is dependent on the level of radioactivity in the secondary system and the amount of steam released to the atmosphere. It is important to note that radioactive noncondensable gases in the secondary system are normally released with the off-gas from the condenser vacuum pumps, on a continuous basis. The only impact on releases caused by the release through the MSSRV/ADV's is a minor reduction in the time delay and a somewhat reduced decontamination factor (DF) for volatile fission products. Since these releases are of such a short duration, the contribution to overall site releases from MSSRV/ADV openings have always been minimal.

Because MSSRV/ADV position indication is not now available at CR-3, the amount of steam released through the MSSRV/ADV's when they are open, is conservatively estimated based upon secondary system conditions. Full power steam flow is assumed for the duration of time that steam pressure is above any valve set point and also for the estimated duration of any MSSRV/ADV sticking open. This may result in an order

of magnitude or more over-estimate of steam release. The duration of valve sticking is estimated based upon secondary system pressure response and discussion with operators who observed the event.

Conclusion

Because the estimated releases are still minimal, the refinement provided by actual position indication has essentially no value. Having actual valve position data is not likely to simplify the estimation procedure. Some benefit may result from eliminating the need for a turbine plant operator to go and visually determine whether a stuck relief valve is the cause of loss of secondary pressure. Such an operator would still probably be requested to confirm visually that the valve had reseated.

Accidents (and Transients using Accident Assumptions)

The accidents discussed in the FSAR Chapter 14 which are relevant to assessing the benefits of a MSSRV/ADV position indication system are:

- a. Loss-of-Load (14.1.2.8.3)
- b. Complete Loss of All Unit AC Power (14.1.2.8.4)
- c. Steam Generator Tube Failure (14.2.2.2)
- d. Maximum Hypothetical Accident (14.2.2.7)

Monitoring of Secondary System Operation During Accidents

As described above, the CR-3 appropriate response to transients and accidents does not require knowledge of the position of the MSSRV/ADV's. For certain design basis accidents, the visual confirmation of MSSRV/ADV status may not be possible, however, as time and priorities permit, the operator can still respond to indications of secondary system pressure as appropriate.

Assessment of Radioactivity Releases Through MSSRV/ADV's During Accidents and Transients Evaluated with Accident Assumptions

The loss of load and loss of AC power accidents assume reactor coolant activity associated with 1% defective fuel and the secondary systems activity associated with a 1 gpm primary to secondary tube leak. These values are also the Technical Specification operating limits and are conservative relative to what is typically observed. Accident atmospheric dispersion factors are used.

The steam generator tube rupture accident assumes a 435 gpm initial primary to secondary leak, with the majority of the activity released through the condenser vacuum pump exhaust. The typical results of these analyses are from 4 to 90 mRem to the thyroid, and 4 mRem or less to the whole body.

Steam released during a. and b. accidents is identified as about 200,000 lb. It is likely that the steam release calculated by the conservative method of assuming full steam flow for the duration of

relief to atmosphere could be 10 or more times this value. The calculated dose rates would still be small relative to any emergency action criteria. In addition, the above offsite dose rates will usually be less because of the actual meteorological conditions at the time of the event and because the typical defective fuel fraction and steam generator tube leakage is well below the Technical Specification limits.

During a steam generator tube rupture, a similar over-estimation of offsite dose rates could result. It is important to note that the benefit of MSSRV/ADV position indication in eliminating the overestimations is by allowing the number of valves open and their capacity to be used in determining steam released. A significant amount of the present over-estimation could be avoided by providing, in the estimating procedure, actual integrated steam flow as a function of time after trip, which could be used to estimate steam released.

Non-mechanistic accidents such as the Maximum Hypothetical Accident (MHA) provides the principal basis on which the NRC has promulgated the R.G. 1.97 requirement for MSSRV/ADV position indication.

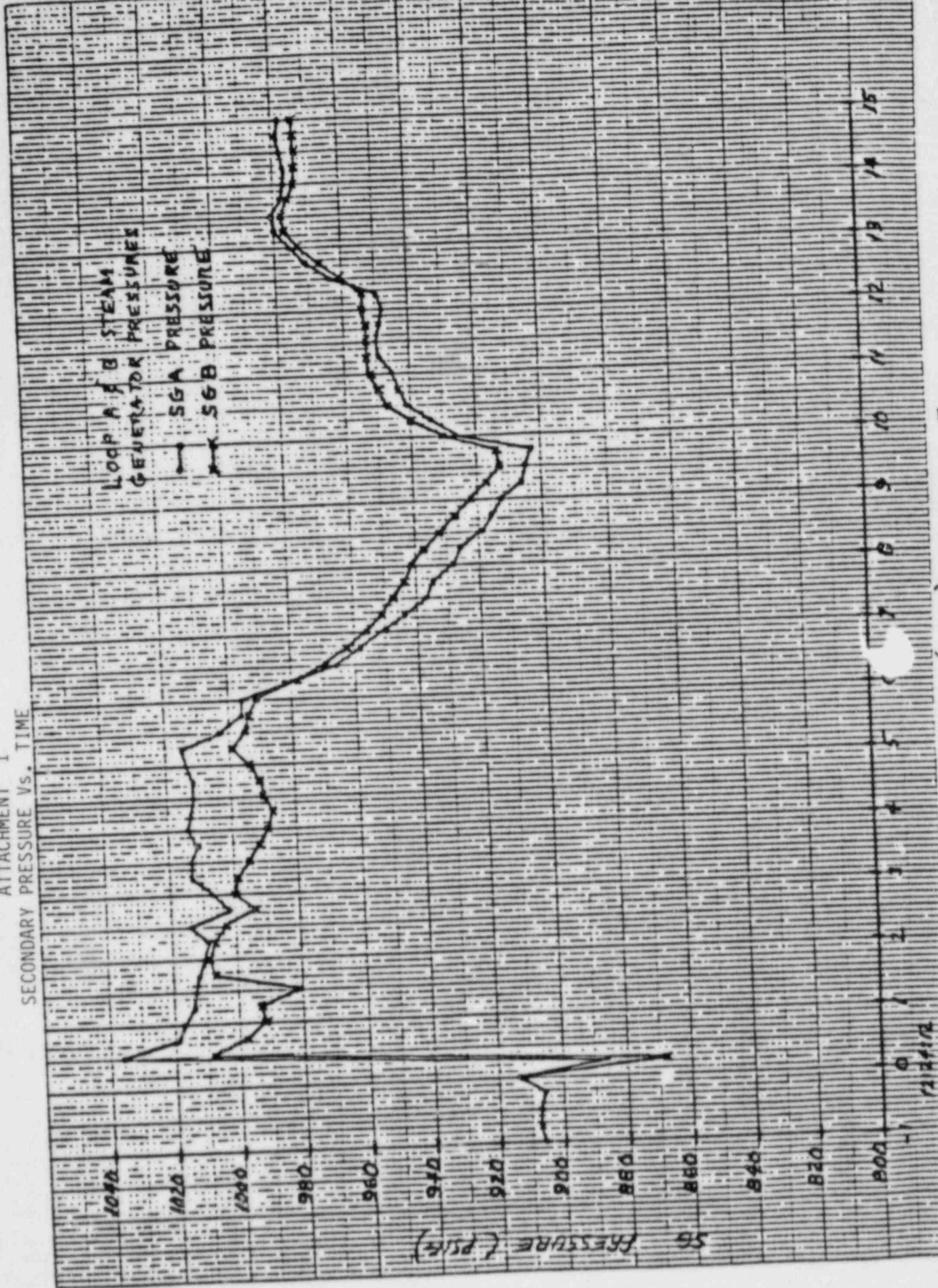
The MHA as described in the FSAR assumes release of a substantial fraction of the core fission products to the containment. It is possible that this activity could also be in the reactor coolant, circulating through the steam generators. The ratio of resulting RCS activity to that associated with the 1% defective fuel design basis is from 200 to 500,000, depending on the isotope of interest. The potential doses resulting from one gpm primary to secondary leak can become very significant and whatever contributes to an accurate estimate of the release would be considered of some value.

Attachment 2 provided an estimate of offsite exposure potential which was used to gauge the relative importance of accurate estimates for releases through steam venting. While this analysis is very conservative, it indicates that over-estimation on the order described above could result in unnecessary offsite emergency efforts.

Conclusions

Over-estimation of releases during an MHA is significant. A more realistic model for steam released for use in procedure EM-304 Rev. 8 is warranted. Losses after initial full load rejection should be based on reactor coolant loads and decay heat effects. If turbine bypass valves are functioning, losses from a simmering/leaking MSSRV can be assumed 25% capacity maximum. Further consideration can be given to steam header pressure during simmering. Steam flow is proportional to the absolute steam header pressure. Steam at 975 PSIG would discharge 15% less capacity than at the MSSRV accumulated design pressure of 1144 PSIG.

ATTACHMENT 1
SECONDARY PRESSURE VS. TIME





ANALYSIS/CALCULATION

Crystal River Unit 3

Sheet 1 of 1

REMARK No.

MAR 81-11-15-00

Date

6 JULY 1984

Project: MAIN STEAM SAFETY RELIEF VALVE MONITORING SYSTEM

CALCULATION OF OFFSITE DOSE FOR EXPOSURE TO A SEMI-INFINITE CLOUD OF NOBLE GASES DUE TO SECONDARY SYSTEM VENTING

REACTOR COOLANT ACTIVITY BASED UPON MAXIMUM HYPOTHETICAL ACCIDENT FUEL RELEASES
ONE GALLON PER MINUTE PRIMARY TO SECONDARY LEAK ASSUMED* WITH INSTANTANEOUS RELEASE
(FIRST HOUR RELEASE)

		LEAKAGE (g./sec)=		X/Q= 0.00276	
		63.1			
ISOTOPE	CNCTRTN MC/CI	HALF-LIFE SEC.	K1 (DOCP) Tol: 1.5.1	RELEASE MC	DOSE mRem
Kr-83m	2.25E+24	6.70E+03	0.00	4.29E+25	0.2
Kr-85m	6.50E+24	1.50E+24	1172.02	1.37E+12	90.4
Kr-85	1.66E+23	3.42E+05	16.12	3.82E+25	0.2
Kr-87	1.21E+25	4.56E+23	5922.02	2.12E+12	702.7
Kr-88	1.86E+25	1.01E+04	14722.02	3.74E+12	3121.7
Xe-131m	1.71E+23	1.02E+05	91.50	3.86E+25	0.2
Xe-133m	5.60E+23	1.95E+05	251.02	2.17E+25	3.1
Xe-133	4.03E+25	4.55E+25	294.02	9.13E+12	151.4
Xe-135	1.05E+25	9.36E+25	3122.02	8.32E+25	145.5
Xe-135	8.07E+24	3.31E+04	1812.02	1.77E+12	182.2
				Total=	4351.3

* This requires full reactor coolant pressure and retention of all noble gas fission products in the RCS, a beyond design basis assumption.

Reactor coolant system liquid volume of 11,381 cu. ft. taken from FSAR Tables 4-3, 4-4, 4-5, 4-6 and 4-7. Max fuel releases from FSAR Table 14-56.

Consideration given to decay over the first hour by the following:

$$\text{Release}(\mu\text{Ci}) = \text{CNCTRTN} \left(\frac{\mu\text{Ci}}{\text{min}} \right) * 63.1 \frac{1}{\text{min}} * \left[1 - e^{-\frac{2495}{240}} \right] \frac{1}{0.693 \cdot 5}$$

Whole body dose calculated by the following:

$$\text{Dose (mRem)} = \frac{K_1 \left(\frac{\mu\text{Ci}}{\text{min}} \right) * X/Q \left(\frac{\text{min}}{\text{ft}^3} \right) * \text{Release} \left(\frac{\mu\text{Ci}}{\text{min}} \right)}{3.156 * 10^7 \frac{\text{sec}}{\text{yr}}}$$

Design Engineer

Date

Verification Engineer

Date

Supervisor, Nuclear Engineering

Date

Paul T. Reubert 7/6/84

T. Heubert 7/11/84

R. Nalany 7/12/84

CRYSTAL RIVER 3
REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	Main Feedwater Flow	
TYPE & CATEGORY:	D 3	
RANGE:	CR-3 NRC	0-6 x 10 ⁶ lbs/hr. (Design = 5.3 x 10 ⁶ lbs/hr) 0 to 110% design
ENVIRONMENTAL QUALIFICATION:	No, not required	
SEISMIC QUALIFICATION:	No, not required	
QUALITY ASSURANCE:	No, not required	
REDUNDANCY:	No, not required 3 channels	
POWER SOURCE:	UPS/DG	
DISPLAY:	Indicated and recorded in CR On demand in TSC & EOF	
SCHEDULE:	Installed	
POSITION:	Complies	

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE: Auxiliary Feedwater Flow

TYPE & CATEGORY: D 2

RANGE: CR-3 0-500,000 lbs/hr. (Design = 370,000 lbs/hr)
NRC 0 to 110% design

ENVIRONMENTAL
QUALIFICATION: No, will comply

SEISMIC
QUALIFICATION: Yes, complies

QUALITY ASSURANCE: Yes, complies

REDUNDANCY: Yes, complies
4 channels

POWER SOURCE: 1E

DISPLAY: Indicated and recorded on demand in CR
On demand in TSC & EOF

SCHEDULE: Upgrades will be complete by end of Refuel V

POSITION:

A redundant 4 channel system, with all safety parts seismically qualified, and transmitters environmentally qualified, will be installed in conjunction with the EFIC modifications.

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE: Condensate Storage Tank Water Level
(Emergency Feedwater Tank) - see Position

TYPE & CATEGORY: D 1

RANGE: CR-3 0-35 ft.
NRC Plant Specific

ENVIRONMENTAL
QUALIFICATION: No, will comply

SEISMIC
QUALIFICATION: No, will comply

QUALITY ASSURANCE: No, will comply

REDUNDANCY: No, will comply

POWER SOURCE: 1E

DISPLAY: Indicated in CR

SCHEDULE: Upgrades will be complete by end of Refuel VI

POSITION:

A new tank called the Emergency Feedwater Tank will be installed to comply with these requirements.

CRYSTAL RIVER 3
REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	Containment Spray Flow	
TYPE & CATEGORY:	D 2	
RANGE:	CR-3 NRC	0-1800 GPM (Design = 1500 GPM) 0 to 110% Design
ENVIRONMENTAL QUALIFICATION:	No, will comply	
SEISMIC QUALIFICATION:	Yes, complies	
QUALITY ASSURANCE:	Yes, complies	
REDUNDANCY:	Yes, complies 2 channels	
POWER SOURCE:	UPS/DG	
DISPLAY:	Indicated in CR	
SCHEDULE:	Upgrades will be complete by end of Refuel V	
POSITION:		

Areas of nonconformance will be upgraded to comply.

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE: Heat Removal by the Containment Fan
Heat Removal System

TYPE & CATEGORY: D 2

RANGE: Not measured, will comply, see position

ENVIRONMENTAL
QUALIFICATION: No, will comply

SEISMIC
QUALIFICATION: No, not required

QUALITY ASSURANCE: No, will comply

REDUNDANCY: No, not required

POWER SOURCE: No, will comply

DISPLAY: No, will comply

SCHEDULE: Upgrades will be complete by end of Refuel VI

POSITION:

The following position is a justification developed by the BWOG Reg. Guide 1.97 Task Force.

The plant has a design air flow rate from the Reactor Building fans during normal and accident or emergency conditions. The design flow rates are achieved by reducing the normal running speeds of the fan motors by about one-half during accidents where the heavier steam-air mixture might overload the motors at full speed. The fan cooling units are cooled by cooling water from the Nuclear Services Closed Cycle Cooling System (NSCCS).

For the following reasons, the status of the fan breakers and cooling water flow rate are the measured variables. The primary indication that the Reactor Building is being cooled is the Reactor Building temperature. A first indication that the Reactor Building fans are performing their function is an indication of the status of the fan breakers to ensure that the fans are on and the delivery of cooling water flow to the cooling units. The flow variable will be upgraded to comply.

As backup information to ensure coupling between the fan and motor, each fan is equipped with vibration detectors which annunciate in the control room. Calibrated percent load meters for the motors are also located in the control room.

CRYSTAL RIVER 3
REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	Containment Atmosphere Temperature	
TYPE & CATEGORY:	D 2	
RANGE:	CR-3 NRC	0-200°F, will comply 40°F to 400°F
ENVIRONMENTAL QUALIFICATION:	No, will comply	
SEISMIC QUALIFICATION:	No, not required	
QUALITY ASSURANCE:	No, will comply	
REDUNDANCY:	No, not required 4 channels	
POWER SOURCE:	UPS/DG	
DISPLAY:	Local indicator, recorded on demand in CR On demand in TSC & EOF	
SCHEDULE:	Upgrades will be complete by end of Refuel VI	
POSITION:		

Areas of noncompliance will be upgraded to comply.

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	Containment Sump Water Temperature	
TYPE & CATEGORY:	D 2	
RANGE:	CR-3 NRC	Not measured, see position. 50 to 250°F
ENVIRONMENTAL QUALIFICATION:	N/A	
SEISMIC QUALIFICATION:	N/A	
QUALITY ASSURANCE:	N/A	
REDUNDANCY:	N/A	
POWER SOURCE:	N/A	
DISPLAY:	N/A	
SCHEDULE:	N/A	

POSITION:

The NRC R.G. 1.97 requires containment sump water temperature indication as a Type D variable for the purpose of monitoring the operation of containment cooling systems. No additional justification is provided.

It is expected that this information would be used following high energy line breaks in containment. While containment sump temperature trends may be indicative of high energy fluid leakages and containment cooling, it would be difficult to conceive of any correlation from monitored values to any useful measure of success.

Containment sump temperatures impact containment cooling only when the Reactor Building spray system is in operation with suction being taken from the sump. This would be expected to be used only after depletion of available supplies from the BWST.

a. Containment Cooling System Monitoring

Containment atmospheric temperature instrumentation provides the most direct indication of containment cooling system success. The existing system is expected to be upgraded to meet R.G. 1.97 requirements.

The next most valuable indication of containment cooling is provided by instrumentation which monitors the operation of systems with a containment cooling function. This function is provided by the Reactor Building Spray System (RBSS) and the Reactor Building Emergency Cooling System (RBECS). The RBECS instrumentation will be upgraded to provide heat removal indication meeting the requirements of R.G. 1.97.

Containment atmospheric temperature is recorded in the control room. The Reactor Building air handling fan motor breaker positions, indicating lights and percent full load ammeter indicators representative of air flow loading are monitored on the control board. Fan cooling water flow leakage is also monitored and alarmed.

Containment sump water temperature provides only a crude indication of containment cooling system success. Because of this and the availability of the instrumentation described above, sump water temperature instrumentation is not necessary for containment cooling system monitoring. Nevertheless, containment sump temperature can be determined when the LPI is in the recirculation mode, using temperature indicators meeting all other R.G. 1.97 requirements.

b. Equipment Temperature Limits

Protection of DHR/LPI and RBSS from Excessive Sump Temperatures: These systems are designed for fluid temperatures in excess of the R.G. 1.97 required range for sump water temperature instrumentation (Ref. FSAR Table 6-3). No operator action is required in response to sump water temperature. Actual options available with excessive sump water temperatures would be limited to the reactor coolant system and containment cooldown prior to transferring to the recirculation mode of containment spray. This transfer is not required for over an hour after a LOCA, in which time the sump temperature is below 205°F.

c. NPSH Requirements

The minimum available NPSH for the Decay Heat Removal pumps is conservatively calculated with sufficient safety margin such that indication of sump temperature is not required in order to insure adequate NPSH and no automatic or manual actions are initiated based on this temperature.

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	Make-up Flow - In
TYPE & CATEGORY:	D 3, see Position
RANGE:	CR-3 0-200 GPM (Design = 115 GPM) NRC 0 to 110% Design
ENVIRONMENTAL QUALIFICATION:	No, not required
SEISMIC QUALIFICATION:	No, not required
QUALITY ASSURANCE:	No, not required
REDUNDANCY:	No, not required
POWER SOURCE:	UPS/DG
DISPLAY:	Indicated in CR
SCHEDULE:	Installed
POSITION:	

The following position is a justification developed by the BWOG Reg. Guide 1.97 Task Force.

During design basis events such as LOCAs, the Makeup and Purification System (MU&PS) is isolated. Makeup flow is a backup variable to the makeup line isolation valve position. During normal operation and certain design basis events such as small break LOCA, the MU&PS is used to supply borated makeup water into the RCS to balance letdown flow out of the RCS. It also adds makeup water in order to maintain pressurizer level at its setpoint. Thus, makeup flow is an important variable for monitoring the operation of the MU&PS. For the reasons provided in the Position section for the variable, Makeup Tank level (page 43), it is suggested that this variable can be a backup to Makeup Tank Level. As a backup Type D variable, it is appropriate that Makeup Flow be classified Category 3.

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE: Letdown Flow - Out

TYPE & CATEGORY: D 3, see position.

RANGE: CR-3 0-160 GPM (Design = 140 GPM)
NRC 0 to 110% Design

ENVIRONMENTAL
QUALIFICATION: No, not required

SEISMIC
QUALIFICATION: No, not required

QUALITY ASSURANCE: No, not required

REDUNDANCY: No, not required

POWER SOURCE: UPS/DG

DISPLAY: Indicated in CR
On demand in TSC & EOF

SCHEDULE: Installed

POSITION:

The following position is a justification developed by the BWOG Reg. Guide 1.97 Task Force.

During design basis events such as LOCAs, the MU&PS is isolated. Letdown flow is a backup variable to the letdown isolation valve position. During normal operation and certain design basis events such as small break LOCAs, the MU&PS is used to supply borated makeup water into the RCS to balance letdown flow out of the RCS. Thus, letdown flow is an important variable for monitoring the operation of the MU&PS. For the reasons provided in the Position section for the variable Makeup Tank level (page 43), it is suggested that this variable can be a backup to Makeup Tank level. As a backup Type D variable, it is appropriate that letdown flow be classified Category 3.

For Crystal River 3, normal letdown flow rate through the block orifice is 45 gpm with a maximum flow rate of 140 gpm with both letdown coolers in operation. Having this maximum flow rate of 140 gpm the range of letdown flow indicator is 0 to 160 gpm which adequately meets the regulatory guide recommendation of 0 to 110% design flow.

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	Volume Control Tank Level (Makeup Tank)
TYPE & CATEGORY:	D 2
RANGE:	CR-3 0-120 inches, meets intent, see position NRC Top to bottom
ENVIRONMENTAL QUALIFICATION:	Yes, complies
SEISMIC QUALIFICATION:	Yes, complies
QUALITY ASSURANCE:	Yes, complies
REDUNDANCY:	No, not required 2 channels
POWER SOURCE:	UPS
DISPLAY:	Recorded in CR On demand in TSC & EOF
SCHEDULE:	Installed
POSITION:	

The following position is a justification developed by the BWOOG Reg. Guide 1.97 Task Force.

During normal operation and certain design basis accidents where the MU&PS is still operable, the Makeup Tank Level is the key variable used to provide indication that the MU&PS is operating properly. Makeup Tank Level information provides the first indication that a suction source for the Makeup pumps is available. Since the Makeup Tank is a surge volume for the RCS, Makeup Tank Level and Pressurizer Level indications can be used to qualitatively assess Makeup Flow into the RCS and Letdown Flow from the RCS.

Quantitative indication of Makeup Flow and Letdown Flow can be provided by flow instrumentation for these variables. However, in most instances, it is more important to know that Makeup and/or Letdown is established (qualitative) and not necessarily what those flow rates are (quantitative) in order to determine the operation of the MU&PS. Since Pressurizer Level instrumentation is Category 1 and the suggested Makeup Tank Level instrumentation be Category 2, then high quality instrumentation is available to

provide information on the status and operation of the MU&PS. Flow rate indication provided for Makeup Flow and Letdown Flow can be used as confirmatory, backup information to Makeup Tank Level and Pressurizer Level.

Meets intent of RG 1.97, 2-1/2" from bottom to 4" from top of vessel. Parts of safety system are seismic with QA. QA requirements meeting CR-3 licensing commitments were applied to safety related portions of this instrument string.

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	Component Cooling Water Temperature to ESF Systems	
TYPE & CATEGORY:	D 2	
RANGE:	CR-3 NRC	0-200°F and 40-250°F, see Position 40° to 200°F
ENVIRONMENTAL QUALIFICATION:	No, not required (mild environment)	
SEISMIC QUALIFICATION:	No, not required	
QUALITY ASSURANCE:	No, see Position	
REDUNDANCY:	No, not required	
POWER SOURCE:	UPS/DG	
DISPLAY:	Indicated in CR	
SCHEDULE:	Installed	
POSITION:	Complies	

The 0-200°F range is for the Decay Heat Closed Cycle Cooling Systems (DC) and the 40 to 250°F range is for the Nuclear Services Closed Cycle Cooling Systems.

This equipment was originally purchased without Quality Assurance documentation. Future equipment will be purchased with the requirement to specify the applicable Quality Assurance practices.

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE: Component Cooling Water Flow to ESF Systems
(Level) see Position

TYPE & CATEGORY: D 2

RANGE: CR-3 (See Position)
Surge Tank Levels: SW - 2" above BL to 2' above
Normal WL
DC - 7" above BL to 1' above
Normal WL
System Pressures: SW - 0-200 PSIG
DC - 0-60 PSIG
NRC 0 to 110% Design Flow

ENVIRONMENTAL
QUALIFICATION: No, will comply

SEISMIC
QUALIFICATION: No, not required

QUALITY ASSURANCE: Yes, complies

REDUNDANCY: No, not required

POWER SOURCE: None, will comply

DISPLAY: Local indication only, will comply with position

SCHEDULE: Upgrades will be complete by the end of Refuel VI

POSITION:

There are presently no flow indications on the main control board for Decay Heat Closed Cycle Cooling (DC) and Nuclear Services Closed Cycle Cooling (SW) systems. Local flow indication for these systems is available. Indicated flow measurements in the control room are not deemed necessary because the DC and SW systems surge tank levels provide better information to the operator. The wide range of design flows to various ESF components would not necessarily be representative of overall system performance. Service water header pressures and remote actuated valve positions are available to the operator and along with the surge tanks levels, which provide a better overall indication of system status.

QA requirements meeting CR-3 licensing commitments were applied to safety related portions of this instrument string.

Area of non-compliance will be upgraded to comply with position.

Peck (Comp) DN104-2

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE: High-Level Radioactive Liquid Tank Level

TYPE & CATEGORY: D 3

RANGE: CR-3 0 to 100%
NRC Top to bottom

ENVIRONMENTAL
QUALIFICATION: No, not required

SEISMIC
QUALIFICATION: No, not required

QUALITY ASSURANCE: No, not required

REDUNDANCY: No, not required

POWER SOURCE: Instrument Air

DISPLAY: Indication at local panel only, see Position

SCHEDULE: Upgrades will be complete by the end of Refuel VI

POSITION:

Tanks covered by this variable are:

Concentrated Waste Tanks (2)
Concentrated Boric Acid Tanks (2)
Spent Resin Holdup Tank

The level indication for the concentrated waste tanks, concentrated boric acid tanks and the spent resin hold-up tank are indicated on the radioactive waste disposal control panel located in the Auxiliary Building. High level alarms at this panel will cause a common alarm to actuate on the main control board. The controls for the liquid waste disposal system are all located at the local panel; therefore indication on the main control board would not enhance operator control from the control room.

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE: Radioactive Gas Hold-up Tank Pressure
(Waste Decay Tanks)

TYPE & CATEGORY: D 3

RANGE: CR-3 0-150 PSIG (Design = 150 PSIG), see position
NRC 0 to 150% Design

ENVIRONMENTAL
QUALIFICATION: No, not required

SEISMIC
QUALIFICATION: No, not required

QUALITY ASSURANCE: No, not required

REDUNDANCY: No, not required

POWER SOURCE: Instrument air

DISPLAY: Indication at local panel only, see Position

SCHEDULE: Upgrades will be complete by the end of Refuel VI

POSITION:

The control and indications for the waste disposal system are located on the radioactive waste disposal panel in the Auxiliary Building. Indication of radioactive gas hold-up tank pressure is not a necessary control room variable for the post accident monitoring. In the event of an accident which results in significant failed fuel or significant radioactive gas release, the manual transfer of radioactive gases to the radioactive gas hold-up tanks would not be attempted since the Reactor Building would be utilized as the hold-up tank. There are no automatic transfer operations involving the radioactive gas hold-up tanks. Therefore, the monitoring in the control room of the radioactive gas hold-up tanks during post accident conditions is not necessary since these tanks are not utilized for accident mitigation.

The radioactive gas hold-up tanks are equipped with relief valves which are set at 125 psig. The range of the pressure indication is 120% above the relief valve setting.

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE: Emergency Ventilation Damper Position Indication
(See Position)

TYPE & CATEGORY: D 2

RANGE: CR-3 See position
NRC Open-Closed Status

ENVIRONMENTAL
QUALIFICATION: No, will comply.

SEISMIC
QUALIFICATION: No, not required.

QUALITY ASSURANCE: No, will comply.

REDUNDANCY: No, not required.
2 channels

POWER SOURCE: UPS/DG

DISPLAY: See position.

SCHEDULE: Upgrades will be complete by the end of Refuel VI.

POSITION:

Dampers covered under this category are those used in ventilation systems for the following:

Emergency Diesel Generator
Control Complex
Decay Heat Pump Area
Spent Fuel Cooling Pump Area

The dampers in these systems are controlled from the fan start circuitry and do not have individual control switches. Redundant systems are provided so that a single failure will not defeat their safety function. Panel lights show when the fan circuitry is operating.

Back-up operational data is provided to operators by high quality commercial grade low flow and high temperature alarms. The control complex dampers also have open position lights.

The above data should be adequate to determine if an HV system is operational. Individual damper position would only be beneficial if isolation were required.

For those dampers in the control complex which are closed on either high radiation or engineered safeguards systems actuation, qualified closed position indication will be added.

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE: Status of Standby Power

TYPE & CATEGORY: D 2

RANGE:	CR-3	Inverter				250/125V DC
	DG	3A to 3D	4160V	480V		3A, 3B
	3A,3B	Not	3A,3B	3A,3B		Not
	Volts;Amps	Measured	Volts	Volts;Amps		Measured
	NRC	Plant Specific				

ENVIRONMENTAL
QUALIFICATION:

Yes - Yes No -

SEISMIC

QUALIFICATION:

No not required.

QUALITY ASSURANCE:

No - No No -

REDUNDANCY:

Redundancy based on dual buses.

POWER SOURCE:

UPS - UPS UPS -

DISPLAY:

Indicated Will Comply Indicated Indicated Will Comply

SCHEDULE:

Upgrades will be completed by end of Refuel VI.

POSITION:

Areas of non-compliance will be upgraded to comply.

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	Containment Area Radiation - High Range	
TYPE & CATEGORY:	C, E	1
RANGE:	CR-3	1 to 10^7 R/Hr
	NRC	1 to 10^7 R/Hr
ENVIRONMENTAL QUALIFICATION:	Yes, complies.	
SEISMIC QUALIFICATION:	Yes, complies.	
QUALITY ASSURANCE:	Yes, complies.	
REDUNDANCY:	Yes, complies. 2 channels	
POWER SOURCE:	1E	
DISPLAY:	Indicated and recorded in CR. On demand in TSC & EOF.	
SCHEDULE:	Installed	
POSITION:	Complies	

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	Radiation Exposure Rate inside buildings or areas where access is required to service equipment important to safety or which are in direct contact with primary containment where penetrations and hatches are located.	
TYPE & CATEGORY:	E	3
RANGE:	CR-3 NRC	.01 to 10R/Hr, complies with position. .1 to 10,000 R/Hr
ENVIRONMENTAL QUALIFICATION:	No, not required.	
SEISMIC QUALIFICATION:	No, not required.	
QUALITY ASSURANCE:	No, not required.	
REDUNDANCY:	No, not required.	
POWER SOURCE:	1E	
DISPLAY:	Indicated and recorded in CR.	
SCHEDULE:	Installed.	
POSITION:	Complies	

The following position is a justification developed by the BWOG Reg. Guide 1.97 Task Force.

NRC R.G. 1.97 Rev. 3 requires area radiation monitors inside buildings or areas where access is required to service equipment important to safety. The NRC identified purposes for this instrumentation are: "Detection of significant releases, release assessments, and long term surveillance." This is a Type E variable with the overall purpose of being monitored as required in determining the magnitude of the release of radioactive materials and continually assessing such releases. The required range for these monitors is 0.1 to 10^4 R/Hr.

R.G. 1.97 describes areas of concern as those where access is required to service equipment important to safety. This implies that this instrumentation may be used for purposes other than those described above, i.e. for health physics purposes.

For purposes of determining the magnitude of releases, the area radiation exposure rate monitors are clearly of very minor importance. Determination

of release magnitude is done by other Type E variables associated with release paths. There is no useable correlation between area exposure rate monitors and amount of release.

Detection of significant releases by area radiation exposure rate monitoring is secondary to that provided by the release path monitoring. Nonetheless, area radiation levels inside the plant are monitored to verify compliance with 10CFR20. These instruments are considerably more sensitive (1000x) than required by R.G. 1.97 and are sufficient for supporting the detection of significant releases.

Determinations of accessibility of equipment for service or long term surveillance is the function of health physics personnel, generally using portable instrumentation. Monitoring of recordings of area radiation exposure rates from the Control Room is not a substitute for this health physics function. However, exposure rate monitoring equipment in areas outside containment have an upper range of 10 R/Hr., which is adequate for initial assessments of accessibility.

These ranges are based on background reading in the areas in which they are located. Should personnel entry be required in areas where these monitors have gone off scale or indicate a high radiation area a health physics escort would accompany personnel into these areas using portable instrumentation to assess radiation levels. The high range for portable instrumentation at CR-3 is 10^3 R/Hr. We do not anticipate, even under emergency conditions, sending personnel into radiation fields of this magnitude. We believe that this meets the intent of Regulatory Guide 1.97.

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE: Containment or Purge Effluent, Noble Gas

TYPE & CATEGORY: E, C, 2

RANGE: CR-3 2×10^{-6} to 10^5 uci/cc, 0 to 65,000 CFM (Design=50,000 CFM)
NRC 10^{-6} to 10^5 uci/cc, 0 to 110% Design

ENVIRONMENTAL
QUALIFICATION: Yes, complies.

SEISMIC
QUALIFICATION: No, not required.

QUALITY ASSURANCE: No, see position.

REDUNDANCY: No, not required.

POWER SOURCE: UPS/DG

DISPLAY: Indicated and Recorded in CR.

SCHEDULE: Installed

POSITION: Complies

The radiation monitoring equipment was originally purchased without Quality Assurance documentation. Future radiation monitoring equipment will be purchased with the requirement to specify the applicable Quality Assurance practices.

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	Reactor Shield Building Annulus
TYPE & CATEGORY:	E 2
RANGE:	N/A
ENVIRONMENTAL QUALIFICATION:	N/A
SEISMIC QUALIFICATION:	N/A
QUALITY ASSURANCE:	N/A
REDUNDANCY:	N/A
POWER SOURCE:	N/A
DISPLAY:	N/A
SCHEDULE:	N/A
POSITION:	Not in CR3 design.

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	Auxiliary Building, Noble Gas	
TYPE & CATEGORY:	C,E	2
RANGE:	CR-3 NRC	10^{-6} to 10^3 uci/cc, 0-200,000 CFM (Design=156,680 CFM) 10^{-6} to 10^3 uci/cc, 0 to 110% Design
ENVIRONMENTAL QUALIFICATION:	Yes, complies	
SEISMIC QUALIFICATION:	No, not required.	
QUALITY ASSURANCE:	No, see position.	
REDUNDANCY:	No, not required.	
POWER SOURCE:	UPS/DG	
DISPLAY:	Indicated and recorded in CR. Concentration available on demand in TSC & EOF.	
SCHEDULE:	Installed.	
POSITION:	Complies.	

The radiation monitoring equipment was originally purchased without Quality Assurance documentation. Future radiation monitoring equipment will be purchased with the requirement to specify the applicable Quality Assurance practices.

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE: Condenser Air Removal System Exhaust

TYPE & CATEGORY: C,E 2

RANGE: CR-3 2×10^{-6} to 10^{-2} uci/cc Kr(85), see Position
NRC 10^{-6} to 10^5 uci/cc, 0 to 110% Design Flow

ENVIRONMENTAL
QUALIFICATION: Yes, complies.

SEISMIC
QUALIFICATION: No, not required.

QUALITY ASSURANCE: No, see position.

REDUNDANCY: No, not required.

POWER SOURCE: 1E

DISPLAY: Indicated and recorded in CR.
On demand in TSC & EOF.

SCHEDULE: Installed

POSITION:

The condenser air removal system exhausts through the Auxiliary Building (see page 54) in which the flow is monitored. The range of the monitor in the Auxiliary Building is 10^{-6} to 10^3 uci/cc

The radiation monitoring equipment was originally purchased without Quality Assurance documentation. Future radiation monitoring equipment will be purchased with the requirement to specify the applicable Quality Assurance practices.

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE: Common Plant Vent

TYPE & CATEGORY: E 2

RANGE: NA

ENVIRONMENTAL
QUALIFICATION: NASEISMIC
QUALIFICATION: NA

QUALITY ASSURANCE: NA

REDUNDANCY: NA

POWER SOURCE: NA

DISPLAY: NA

SCHEDULE: NA

POSITION:

Common plant vent from Auxiliary Building, see page 54.

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE: Vent from Safety Valves or Atmospheric Dump Valves
(Main Steam Line Radiation Monitor) - See position.

TYPE & CATEGORY: E 2

RANGE: CR-3 Not measured, see position.
NRC 10^{-1} to 10^3 uci/cc (and duration of release in
second mass of steam per unit time).

ENVIRONMENTAL
QUALIFICATION: Yes, see position.

SEISMIC
QUALIFICATION: No, not required.

QUALITY ASSURANCE: Yes, see position.

REDUNDANCY: No, not required.
1 each header

POWER SOURCE: 1E/Battery Backed

DISPLAY: Indicated in CR, recorded on demand

SCHEDULE: Installed.

POSITION:

The four 24" main steam headers contain a total of 16 relief valves and 2 atmospheric dump valves. Each header is presently monitored for radiation by on-line monitors with readouts in the Control Room. The system is calibrated in terms of area monitoring, i.e. mR/HR (range = .1 to 10^7 mR/HR). There are plans underway to recalibrate the entire system for various sources and in terms of uci/CC in order to comply with NUREG-0737.

There are no flow monitors to meter the quantity of steam venting to the atmosphere from the relief valves or the manual dump valves and there are no position detectors to provide a status (open/closed) indication of the valves.

Refer to the position on item 33 (page 33) for an evaluation of this position.

This variable is only used during a S.G. tube rupture type accident. The results of this accident do not create a harsh environment, therefore although the sensors are not qualified to a harsh environment, and they are in containment, they still meet the environmental qualifications for the normal environment. Also, these monitors are only needed very early in the event.

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	All Other Identified Release Points
TYPE & CATEGORY:	E 2
RANGE:	N/A
ENVIRONMENTAL QUALIFICATION:	N/A
SEISMIC QUALIFICATION:	N/A
QUALITY ASSURANCE:	N/A
REDUNDANCY:	N/A
POWER SOURCE:	N/A
DISPLAY:	N/A
SCHEDULE:	N/A
POSITION:	

No other release points, see pages 52 and 54.

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE: All Identified Plant Release Points
Particulates and Halogens

TYPE & CATEGORY: E 3

RANGE: CR-3 Reactor Building
10⁻¹¹ to 10⁻⁷ uci/cc, 0-65,000CFM (Design=50,000 CFM)

CR-3 Aux. Building
10⁻¹¹ to 10⁻⁷ uci/cc, 0-200,000CFM (Design=156,680 CFM)

NRC 10⁻³ to 10² uci/cc, 0 to 110% Design

ENVIRONMENTAL
QUALIFICATION: No, not required.

SEISMIC
QUALIFICATION: No, not required.

QUALITY ASSURANCE: No, not required.

REDUNDANCY: No, not required.

POWER SOURCE: UPS/DG

DISPLAY: Indicated and recorded in CR.

SCHEDULE: Installed.

POSITION: Complies

NRC required range of 10⁻³ to 10² uci/cc can be covered by grab sample capability.

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	Airborne Radio Halogens and Particulates	
TYPE & CATEGORY:	E 3	
RANGE:	CR-3	10 ⁻⁹ to 10 ⁻³ uci/cc
	NRC	10 ⁻⁹ to 10 ⁻³ uci/cc
ENVIRONMENTAL QUALIFICATION:	No, not required.	
SEISMIC QUALIFICATION:	No, not required.	
QUALITY ASSURANCE:	No, not required.	
REDUNDANCY:	No, not required.	
POWER SOURCE:	Vital Bus	
DISPLAY:	No, not required in CR.	
SCHEDULE:	Installed.	
POSITION:	Complies	

Various portable air samplers can be used to obtain the sample which is then taken to the Lab for counting. (Such as the Radevco H809 high volume air sampler.)

Also have portable particulate monitors Eberline AMS-2 and AMS-3 on hand. (5) and 13 mini-scalers (Eberline) MS-2. Scaler up to 500K CPM, AMS-2 up to 50K CPM AMS-3 up to 100K CPM.

Once the sample is at the Lab, will have Automated Isotopic & Chemical Measurement System installed with associated hardware and software to provide the capability of onsite analysis.

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE: Plant and Environs Radiation, Portable Instrumentation

TYPE & CATEGORY: E 3

RANGE: CR-3 10⁻³ to 10³ R/Hr, complies with position.
NRC 10⁻³ to 10⁴ R/Hr

ENVIRONMENTAL QUALIFICATION: No, not required.

SEISMIC QUALIFICATION: No, not required.

QUALITY ASSURANCE: No, not required.

REDUNDANCY: No, not required.

POWER SOURCE: Batteries

DISPLAY: No, not required in CR.

SCHEDULE: Installed

POSITION:

Existing portable instrumentation can detect dose rates from 10⁻³ R/Hr to 10³ R/Hr. In the plant we do not anticipate encountering radiation fields greater than those which can be measured by our current equipment except under severe accident conditions. Even under accident conditions we do not anticipate sending individuals into greater than 10³ R/Hr fields. Therefore, we meet the intent of Regulatory Guide 1.97 with our current equipment.

Available instruments: Xetex Model 302A - GM Tube - 0-999 R/Hr
Eberline Teletector - GM Tube - 0-1000 R/Hr
Eberline PIC-6A - Ion Chamber - 1 mr/Hr to 1000 R/Hr
Radector III - Ion Chamber - .1 mr/Hr to 1K R/Hr

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	Plant and Environs Radioactivity
TYPE & CATEGORY:	E 3
RANGE:	CR-3 NRC
	Multi-channel Gamma-Ray Spectrometer Isotopic Analysis.
ENVIRONMENTAL QUALIFICATION:	No, not required.
SEISMIC QUALIFICATION:	No, not required.
QUALITY ASSURANCE:	No, not required.
REDUNDANCY:	No, not required.
POWER SOURCE:	N/A
DISPLAY:	No, not required in CR.
SCHEDULE:	Installed.
POSITION:	Complies. Additionally, 2-two channel gamma ray spectrometers, which are portable, are available (Eberline SAM-2), as is a multi-channel analyzer with computer which is contracted for with the Department of Health and Rehabilitation Services. This unit is on a truck, and mobile.

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	Wind Direction
TYPE & CATEGORY:	E 3
RANGE:	CR-3 0-540° NRC 0-360°
ENVIRONMENTAL QUALIFICATION:	No, not required.
SEISMIC QUALIFICATION:	No, not required.
QUALITY ASSURANCE:	No, not required.
REDUNDANCY:	No, not required.
POWER SOURCE:	UPS/DG
DISPLAY:	Indicated and recorded in CR.
SCHEDULE:	Installed.
POSITION:	Complies.

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	Wind Speed
TYPE & CATEGORY:	E 3
RANGE:	CR-3 0-50 M/Sec. NRC 0-22 M/Sec.
ENVIRONMENTAL QUALIFICATION:	No, not required.
SEISMIC QUALIFICATION:	No, not required.
QUALITY ASSURANCE:	No, not required.
REDUNDANCY:	No, not required.
POWER SOURCE:	UPS/DG
DISPLAY:	Indicated and recorded in CR.
SCHEDULE:	Installed.
POSITION:	Complies.

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE: Estimation of Atmospheric Stability

TYPE & CATEGORY: E 3

RANGE: CR-3 -5°C to +5°C, see Position
NRC -5°C to +10°C

ENVIRONMENTAL
QUALIFICATION: No, not required.

SEISMIC
QUALIFICATION: No, not required.

QUALITY ASSURANCE: No, not required.

REDUNDANCY: No, not required.

POWER SOURCE: UPS/DG

DISPLAY: Indicated and recorded in CR.

SCHEDULE: Installed.

POSITION:

In accordance with Regulatory Guide 1.23, the measurement of temperature difference for estimating atmospheric stability only requires a range from -1.9°C to +4.0°C for the 50 meter interval. Any temperature difference that is outside this range does not impact the stability category.

The range of -1.9 to +4.0°C corresponds to -3.42° to 7.2°F. CR-3's range envelops that range and is sufficient for providing an estimate of atmospheric stability.

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	Primary Coolant and Sump (Grab Sample) - Gross Activity	
TYPE & CATEGORY:	E 3	
RANGE:	CR-3 NRC	10 uci/ml to 10 ci/ml 1 uci/ml to 10 ci/ml
ENVIRONMENTAL QUALIFICATION:	No, not required.	
SEISMIC QUALIFICATION:	No, not required.	
QUALITY ASSURANCE:	No, not required.	
REDUNDANCY:	No, not required.	
POWER SOURCE:	N/A	
DISPLAY:	No, not required in CR.	
SCHEDULE:	Installed.	
POSITION:	Complies.	

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	Primary Coolant and Sump (Grab Sample) - Gamma Spectrum	
TYPE & CATEGORY:	C, E 3	
RANGE:	CR-3 NRC	Isotopic Analysis Isotopic Analysis
ENVIRONMENTAL QUALIFICATION:	No, not required.	
SEISMIC QUALIFICATION:	No, not required.	
QUALITY ASSURANCE:	No, not required.	
REDUNDANCY:	No, not required.	
POWER SOURCE:	N/A	
DISPLAY:	No, not required in CR.	
SCHEDULE:	Installed.	
POSITION:	Complies.	

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	Primary Coolant and Sump (Grab Sample) - Boron Content	
TYPE & CATEGORY:	E 3	
RANGE:	CR-3	0-6000 ppm
	NRC	0-6000 ppm
ENVIRONMENTAL QUALIFICATION:	No, not required.	
SEISMIC QUALIFICATION:	No, not required.	
QUALITY ASSURANCE:	No, not required.	
REDUNDANCY:	No, not required.	
POWER SOURCE:	N/A	
DISPLAY:	No, not required in CR.	
SCHEDULE:	Installed.	
POSITION:	Complies.	

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	Primary Coolant and Sump (Grab Sample) - Chloride Content	
TYPE & CATEGORY:	E 3	
RANGE:	CR-3	0-20 ppm
	NRC	0-20 ppm
ENVIRONMENTAL QUALIFICATION:	No, not required.	
SEISMIC QUALIFICATION:	No, not required.	
QUALITY ASSURANCE:	No, not required.	
REDUNDANCY:	No, not required.	
POWER SOURCE:	N/A	
DISPLAY:	No, not required in CR.	
SCHEDULE:	Installed.	
POSITION:	Complies.	

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	Primary Coolant and Sump (Grab Sample) - Dissolved Hydrogen or Total Gas	
TYPE & CATEGORY:	E 3	
RANGE:	CR-3 NRC	0-2000 CC (STP)/kg 0-2000 CC (STP)/kg
ENVIRONMENTAL QUALIFICATION:	No, not required.	
SEISMIC QUALIFICATION:	No, not required.	
QUALITY ASSURANCE:	No, not required.	
REDUNDANCY:	No, not required.	
POWER SOURCE:	N/A	
DISPLAY:	No, not required in CR.	
SCHEDULE:	Installed.	
POSITION:	Complies.	

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	Primary Coolant and Sump (Grab Sample) - Dissolved Oxygen	
TYPE & CATEGORY:	E 3	
RANGE:	CR-3 NRC	Not measured, see position. 0-20 ppm
ENVIRONMENTAL QUALIFICATION:	N/A	
SEISMIC QUALIFICATION:	N/A	
QUALITY ASSURANCE:	N/A	
REDUNDANCY:	N/A	
POWER SOURCE:	N/A	
DISPLAY:	N/A	
SCHEDULE:	N/A	

POSITION:

Ref: NRC criteria guidelines on NUREG-0737, Item II.B.3, Post Accident Sampling System, dated July 12, 1982

Criterion 4 of the reference stated that the measurement of oxygen is recommended but is not mandatory.

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	Primary Coolant and Sump (Grab Sample) - pH	
TYPE & CATEGORY:	E	3
RANGE:	CR-3	1 to 13
	NRC	1 to 13
ENVIRONMENTAL QUALIFICATION:	No, not required.	
SEISMIC QUALIFICATION:	No, not required.	
QUALITY ASSURANCE:	No, not required.	
REDUNDANCY:	No, not required.	
POWER SOURCE:	N/A	
DISPLAY:	No, not required in CR.	
SCHEDULE:	Installed.	
POSITION:	Complies.	

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	Containment Air (Grab Sample) - Hydrogen Content	
TYPE & CATEGORY:	E 3	
RANGE:	CR-3	0 - 10%
	NRC	0 - 10%
ENVIRONMENTAL QUALIFICATION:	No, not required.	
SEISMIC QUALIFICATION:	No, not required.	
QUALITY ASSURANCE:	No, not required.	
REDUNDANCY:	No, not required.	
POWER SOURCE:	N/A	
DISPLAY:	No, not required in CR.	
SCHEDULE:	Installed.	
POSITION:	Complies.	

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	Containment Air (Grab Sample) - Oxygen Content	
TYPE & CATEGORY:	E	3
RANGE:	CR-3 NRC	Not measured, see position. 0 - 30%
ENVIRONMENTAL QUALIFICATION:	N/A	
SEISMIC QUALIFICATION:	N/A	
QUALITY ASSURANCE:	N/A	
REDUNDANCY:	N/A	
POWER SOURCE:	N/A	
DISPLAY:	N/A	
SCHEDULE:	N/A	
POSITION:		

The NRC R.G. 1.97 required that Containment Oxygen be measured from 0 to 30% by volume. The category of the variable is 3 and the type is E. A Type E variable is one that is "monitored as required for use in determining the magnitude of the release of radioactive materials, and for continuously assessing such releases." For a Type E variable, Category 3 items are considered as backup variables.

In discussions with the NRC, it was determined that the NRC expects the operator to compare the oxygen percentage with the hydrogen percentage to determine if the hydrogen formed is being caused by radiolysis or by metal-water reaction, which would be indicative of core damage.

Percentage of oxygen in the containment atmosphere is classified as a Type E variable. The definition of a Type E variable is that it is to be "monitored as required for use in determining the magnitude of the release of radioactive materials, and for continuously assessing such releases. However, the percentage of oxygen in the containment atmosphere does not provide the necessary information to determine the magnitude of releases of radioactive materials. At best, it provides a very indirect means of arriving at an order of magnitude estimate. There are other systems in place that can be used for this purpose. Some of these would be Containment Area Radiation, Radioactivity Concentration or Radiation Level in the

Primary Coolant, Analysis of the Primary Coolant, Gross Activity and Gamma Spectrum of the Primary Coolant and Containment Sump, and Gamma Spectrum of the Containment atmosphere. All of these systems provide a more direct means of determining the magnitude of the release and in addition most are Category 1 variables which means they are qualified to the same extent as a safety-related system.

The only other purpose of this variable then would be to allow the operator to determine what physical process is occurring that is forming the hydrogen in the Containment. Radiolysis occurs at all times, and is a slow process. It causes oxygen and hydrogen to be formed from water, so the percentages of both would increase providing no other processes were happening.

However, during a LOCA, a large amount of steam would be generated along with various other gases and the percentage of both hydrogen and oxygen would tend to be in a very dynamic state, rendering a reasonable decision based on that information virtually impossible.

A decrease in the percentage of oxygen along with an increase in hydrogen would be indicative of a metal-water reaction which in turn indicates core damage. Again, however, much better qualified instrumentation is available that provides a direct indication of core damage, rather than an indirect indication of core damage. Some of these systems are: Hot and Cold Leg Water temperatures, Core Exit temperature, Coolant inventory, Degrees of Subcooling, and the systems mentioned for determining the magnitude of the release. Additionally, the problems with a dynamic situation in the containment would also hold true in this case.

The requirement for providing the means of measuring Containment Oxygen content is necessary because existing instrumentation provides more direct indication and are better qualified to perform the function of the required variable.

CRYSTAL RIVER 3

REGULATORY GUIDE 1.97
COMPLIANCE TABLE

VARIABLE:	Containment Air (Grab Sample) - Gamma Spectrum	
TYPE & CATEGORY:	E 3	
RANGE:	CR-3 NRC	Isotopic Analysis Isotopic Analysis
ENVIRONMENTAL QUALIFICATION:	No, not required.	
SEISMIC QUALIFICATION:	No, not required.	
QUALITY ASSURANCE:	No, not required.	
REDUNDANCY:	No, not required.	
POWER SOURCE:	N/A	
DISPLAY:	No, not required in CR.	
SCHEDULE:	Installed.	
POSITION:	Complies.	