IMPROVED DESIGN CONTROL DOCUMENTATION

FOR

CRYSTAL RIVER UNIT 3

DESIGN BASIS

FOR

POST-ACCIDENT MONITORING INSTRUMENTATION

The following contains design basis information pertaining to the Plant as of September 28, 1990 (Date of Record).

Gerald B. Moore — 10/4/90

J C Uhrnek — 10/4/90

P. M. Rubio — 10/9/90



These signatures apply to pages 1 through 91, Revision 1.

## REVISION HISTORY

| Revision/Date | Description |
|---|---|
| 0 / 9/5/86 | Initial issue. |
| 1 / 9/28/90 | This revision is the result of modifications and changes made through Refuel 7. It revises all RG 1.97 variables to bring them into compliance with the RG 1.97, Rev. 3 Compliance Table to agree with previous commitments to the NRC contained in FPC letters 3F0388-18, dated 3/21/88; 3F0189-11, dated 1/25/89; 3F1289-12, dated 12/15/89; 3F0190-06, dated 1/10/90; 3F0890-01, dated 8/2/90. It incorporates DBDTC #101 along with minor comments made during the review cycle. This revision also deletes DBDTC No. 66 and 83, as they were incorporated into DBDTC #101. |

DESIGN BASIS INDEX
FOR
POST-ACCIDENT MONITORING INSTRUMENTATION

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## SUMMARY SYSTEM DESCRIPTION

The post-accident monitoring instrumentation is comprised of instrumentation and displays to assess plant and environs conditions during and following an accident. Certain displays were added and/or upgraded in accordance with NUREG-0737 as TMI Lessons Learned Recommendations. Subsequently USNRC Regulatory Guide (RG) 1.97 of post-accident monitors was greatly expanded when supplement 1 to NUREG 0737 - "Requirements for Emergency Response Capability (Generic Letter 82-33)" was issued (12/17/82). The Crystal River Unit 3 degree of compliance is contained in the CR3 RG 1.97 Position Report submitted to the NRC August 21, 1984 on the basis of the events for which CR3 was licensed and a revised report was submitted to the NRC March 21, 1988. Note, that this section of the Design Basis Document, (Section 5-11) replaces the Compliance Table previously submitted to the NRC. Rev. 1 will be submitted to the NRC no later than December of 1990, and will reflect our RG 1.97 position including Refuel 7 modifications.

Variables are grouped into five types depending on the importance of information as defined by RG 1.97, Rev. 3 and in addition each variable is assigned to one of three categories as a function of the safety importance of the measurement as follows:

Type A - Those variables that provide primary information* needed to permit the control room operator to take the specified manually controlled actions for which no automatic control is provided and that are required for safety systems to accomplish their safety function for design basis accident events. They are plant specific and were selected on the basis of the CR3 Emergency Operating Procedures.

Type B - Those variables that provide information to indicate wnether plant safety functions are being accomplished, defined as reactivity control, core cooling, primary coolant integrity, and containment integrity.

Type C - Those variables that indicate the potential for being breached or the actual breach of barriers to fission product release, including fuel cladding, primary coolant pressure boundary, and containment.

Type D - Those variables that provide information to indicate operation of individual safety systems and other systems important to safety.

Type E - Those variables that provide information for use in determining the magnitude of release of radioactive materials and for use in assessing such releases.

* Primary information is information that is essential for the direct accomplishment of the specified safety functions; it does not include those variables that are associated with contingency actions that may also be identified in written procedures.

Category 1 - These measurements are key variables with the most stringent requirements.

Category 2 - These variables have less stringent requirements and generally apply to the instruments designated for indicating system operating status.

Category 3 - Is intended to provide requirements to ensure that high quality off-the-shelf instruments are used for backup and diagnostic instrumentation.

Areas of qualification including range, environmental qualification, seismic qualification, quality assurance, redundancy, power source, display, schedule, position, source and reason are listed and explained below.

A. RANGE

The ranges listed in the Compliance Table are the actual measurement range of the variable at CR3. If the range varies from that stated in the Regulatory Guide justification is supplied for the existing range. 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.

B. ENVIRONMENTAL QUALIFICATION

A response of "Yes" on the Compliance Table indicates that the currently installed equipment meets the requirements of IE Bulletin 79-01B and 10CFR50.49. 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.

Other responses are self-explanatory.

C. SEISMIC QUALIFICATION

A response of "Yes" on the Compliance Table indicates that the entire instrument string is seismically qualified in accordance with Regulatory Guide 1.100. Other responses are self-explanatory.

D. QUALITY ASSURANCE

A response of "Yes" 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. All other responses are self-explanatory.

E. REDUNDANCY

A response of "Yes" 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. All other responses are self-explanatory.

F. POWER SOURCE

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

G. DISPLAY

Under this heading on the Compliance Table is how the variable is indicated and/or recorded in the Control Room (CR), EFIC Room, etc.

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

H. SCHEDULE

This area indicates when the upgrades (if required) will be complete.

I. POSITION

This area explains whether the variable complies, is not required, or explains when it will comply.

J. SOURCE

This area indicates the source documents, which can be found on page 91, for each of the variables.

K. REASON

In this area 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.

## DESIGN BASIS FOR POST-ACCIDENT MONITORING INSTRUMENTATION

**PARAMETER:**

VARIABLE: NEUTRON FLUX
TAG NO.: NI-14-NI1, NI-15-NI1, NI-15-NIR
REF DWG: 205-042, NI-01

Type and Category - A, B, 1

Range - $10^{-8}$ to 100%, (SR, IR, PR)

Environmental Qualification - Yes

Seismic Qualification - Yes

Quality Assurance - Yes

Redundancy - Yes - 2 channels - PR 2 channels - SR 2 channels - IR

Power Source - 1E

Display - Indicated and Recorded in CR
On Demand in EOF & TSC

RG 1.97 Position - Complies

**SOURCE:**

0, 5, 6, 7, 18, 21

**REASON:**

Neutron flux is the measure of reactor power required to monitor reactivity control of the ICS and RPS.

**PARAMETER:**

VARIABLE: CONTROL ROD POSITION
TAG NO.: DR-70-KI, DR-71-KI, DR-72-KI, DR-73-KI
REF DWG: 210-074

Type and Category - B, 3

Range - 0 - 100%, Full-in/Full-out Lights, Average Group Position

Environmental Qualification - N/A

Seismic Qualification - N/A

Quality Assurance - N/A

Redundancy - N/A - 2 Channels

Power Source - Reg Inst. Bus VBDP-1 & VBDP-2

Display - Indicated in CR
Average Group Position On Demand in TSC & EOF

RG 1.97 Position - Complies

**SOURCE:**

0, 5

**REASON:**

Control rod position provides backup information that reactivity control has been accomplished by the ICS and RPS.

**PARAMETER:**

VARIABLE: RCS SOLUBLE BORON CONTENT
TAG NO.: CA-56-CE
REF DWG: 302-700

Type and Category - B,3

Range - 0 - 6000 ppm

Environmental Qualification - N/A

Seismic Qualification - N/A

Quality Assurance - N/A

Redundancy - N/A

Power Source - 1E/DG

Display - Lab Only

RG 1.97 Position - Complies

**SOURCE:**

0, 5, 10, 11, 12,

**REASON:**

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.

**PARAMETER:**

VARIABLE: RCS HOT LEG WATER TEMPERATURE
TAG NO.: RC-4A-TI4-1, RC-4B-TIR1
REF DWG: 205-047, RC-04, RC-10, RC-12A, RC-13A

Type and Category - A, B, 1

Range - 120 - 920°F

Environmental Qualification - Yes

Seismic Qualification - Yes

Quality Assurance - Yes

Redundancy - Yes - 2 Channels

Power Source - 1E/DG

Display - Indicated and Recorded in CR
On Demand in TSC & EOF

RG 1.97 Position - Complies

**SOURCE:**

0, 5, 10, 11, 13, 19

**REASON:**

RCS Hot Leg Water Temperature is a key variable required to monitor the core cooling safety function, to verify natural circulation along with core exit temperatures, and to verify primary to secondary loop coupling along with steam generator pressure.

RCS Hot Leg Temperature not required below 280°F. Plant in cold shutdown below 200°F. RCS Cold Leg Temperature range extends down to 50°F.

**PARAMETER:**

VARIABLE: RCS COLD LEG WATER TEMPERATURE
TAG NO.: RC-5A-TI3, RC-5B-TI4
REF DWG: 205-047, RC-04

Type and Category - B, 3

Range - 50°F - 650°F (Ind)

Environmental Qualification - N/A

Seismic Qualification - N/A

Quality Assurance - N/A

Redundancy - N/A - 2 Channels

Power Source - 1E/DG

Display - Indicated in CR
On Demand in TSC & EOF

RG 1.97 Position - Complies

**SOURCE:**

0, 5, 10, 11

**REASON:**

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 RTDs 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. RCS Cold Leg Water Temperature is a backup to RCS Hot Leg and Core Exit Temperatures.

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 CR3 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.

**PARAMETER:**

VARIABLE: RCS PRESSURE
TAG NO.: RC-158-PI2, RC-158-PIR, RC-159-PI2
REF DWG: 205-047, RC-02

Type and Category - A, B, C, 1

Range - 0 - 3000 psig

Environmental Qualification - Yes

Seismic Qualification - Yes

Quality Assurance - Yes

Redundancy - Yes - 2 Channels

Power Source - 1E/DG

Display - Indicated and Recorded in CR
On Demand in TSC & EOF

RG 1.97 Position - Complies

**SOURCE:**

0, 5, 12, 13, 19,

**REASON:**

RCS pressure is a key variable required to monitor reactor shutdown in event of a reactor coolant upset and to monitor reactor coolant integrity and core cooling capability.

**PARAMETER:**

VARIABLE: REACTOR COOLANT INVENTORY
TAG NO.: RC-163A-LR1, RC-163B-LR1, RC-164A-LR1, RC-164B-LR1, RC-169-XR[1]
REF DWG: 205-047, RC-12, RC-12A, RC-13, RC-13A

Type and Category - B, 1 - RV. LVL and Hot Leg LVL
B, 2 - Void Fraction[2]
B, 3 - RCS Cold Leg Temperature Feeding Void Fraction[3]

Range - Bottom of Hot Leg to Top of Hot Leg
Bottom of Hot Leg to Top of Vessel

Environmental Qualification - Yes

Seismic Qualification - Yes (Category 1 Variable Only)

Quality Assurance - Yes

Redundancy - Yes - 2 Channels

Power Source - 1E (Category 1 Variable Only)

Display - Indicated and Recorded in CR

RG 1.97 Position - Complies

**SOURCE:**

O, 5, 31

**REASON:**

RCS hot leg level is required to monitor, along with RC pump monitors, that no voids exist in the reactor coolant system.

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1 This tag number is associated with but isolated from the coolant inventory variable and is, therefore, identified as a Category 2 variable.

2 When the pumps are running, the void fraction indicators provide inventory level trend measurement.

3 RCS Cold Leg temperature is an input to void fraction

**PARAMETER:**

VARIABLE: DEGREES OF SUBCOOLING
TAG NO.: RC-4-TI4, RC-4-TI5
REF DWG: 205-047, RC-04, RC-10 and D8034033, Sh. 2

Type and Category - B, 2 - RCS Hot Leg Water Temperature & RCS Pressure
B, 3 - RCS Cold Leg Water Temperature & Incore Monitors

Range - ± 658°F

Environmental Qualification - Yes (Category 2 Variable Only)

Seismic Qualification - N/A

Quality Assurance - Yes (Category 2 Variable Only)

Redundancy - N/A - 1 Channel per loop

Power Source - UPS/DG

Display - Indicated in CR

RG 1.97 Position - Complies

**SOURCE:**

O, 5

**REASON:**

Two subcooling margin monitors are located on the PSA section of the main control board. These instruments continuously display saturation temperature for each loop. In addition to displaying saturation temperature, each instrument can display RC pressure and core exit temperature on demand. Two separate groups of 6 CETs each have been selected to provide representative temperatures from each core quadrant and the control region. The temperature displayed on demand is the highest of the six CETs in each group and displays over a range of 0°F to 1,023°F, well above saturation temperatures.

**PARAMETER:**

VARIABLE: CONTAINMENT SUMP WATER LEVEL (SUMP)
TAG NO.: WD-301-LI, WD-302-LI, WD-301-LR, WD-302-LR
REF DWG: 205 060, WD-01

Type and Category - B, C, 2

Range - 0 - 10 ft.

Environmental Qualification - Yes

Seismic Qualification - N/A

Quality Assurance - Yes

Redundancy - N/A - 2 Channels

Power Source - UPS/DG with 1E Standby

Display - Indicated in CR
On Demand in EOF and TSC
REC in EFIC Room

RG 1.97 Position - Complies

**SOURCE:**

0, 5, 22

**REASON:**

Containment sump level is an important method of leak detection inside containment, including the reactor coolant system.

Location of indicators and recorder satisfies NUREG-0737, Item II.F.1.5.

**PARAMETER:**

VARIABLE: CONTAINMENT SUMP WATER LEVEL (FLOOD)
TAG NO.: WD-303-LI, WD-304-LI, WD-303-LR, WD-304-LR
REF DWG: 205-060, WD-03

Type and Category - A, B, C, 1

Range - 0 - 10 ft. (Above Sump)

Environmental Qualification - Yes

Seismic Qualification - Yes

Quality Assurance - Yes

Redundancy - Yes - 2 Channels

Power Source - 1E

Display - Indicated in CR
Recorded in EFIC Room
On Demand in EOF & TSC

RG 1.97 Position - Complies

**SOURCE:**

0, 4, 5, 22

**REASON:**

Containment level is an important method of detection and inventory of a major fluid loss, including a LOCA.

Location of indicators and recorder satisfies NUREG-0737, Item II.F.1.5.

**PARAMETER:**

VARIABLE: CONTAINMENT ISOLATION VALVES POSITION (MANUAL)
TAG NO.: N/A
REF DWG: N/A

Type and Category - B, 1

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

RG 1.97 Position - N/A

**SOURCE:**

0, 5, 10, 11, 23

**REASON:**

Containment isolation valve position is required to ensure containment integrity in event of a LOCA.

Locked closed manual valves do not require position indication.

**PARAMETER:**

VARIABLE: CONTAINMENT ISOLATION VALVES POSITION (AUTOMATIC)
TAG NO.: SEE ES LIGHT MATRIX
REF DWG: 201-162

Type and Category - B, 1

Range - Open/Closed Lights (via Light Matrix)

Environmental Qualification - Yes

Seismic Qualification - Yes

Quality Assurance - Yes

Redundancy - Redundant indication per valve not intended by RG 1.97, since CR3 has redundant isolation barriers for all fluid penetrations.

Power Source - 1E

Display - Indicated in CR

RG 1.97 Position - Complies

**SOURCE:**

0, 5, 10, 11, 13, 19

**REASON:**

Containment isolation valve position is required to ensure containment integrity in event of a LOCA.

**PARAMETER:**

VARIABLE: CORE EXIT TEMPERATURE (BACKUP)
TAG NO.: RC-171-TR, RC-172-TR, RC-173-TR
REF DWG: 205-047, RC-07, RC-08, RC-09

Type and Category - A, 1

Range - 0° - 2500°F

Environmental Qualification - Yes

Seismic Qualification - Yes

Quality Assurance - Yes

Redundancy - Yes

Power Source - UPS/DG

Display - 16 CETs Recorded in CR

RG 1.97 Position - Complies

**SOURCE:**

0, 5, 31

**REASON:**

Core exit temperatures along with RCS Hot Leg Temperature to verify natural circulation of reactor coolant, and to detect potential breach of fuel cladding.

Ref: The NRC's evaluation of CR3 is response to NUREG-0737, Item II.F.2, Docket No. 50-302, dated 9/6/83.

Core Exit Temperature measurement displays include a primary and backup display arrangement.

The primary display consists of 52 Core Exit Thermocouples (CETs) recorded on demand in the Control Room over a range of 0-2500°F. (Twelve (12) are also recorded on demand in the TSC and EOF over a range of 0-2000°F.)

The backup display consists of 16 temperature measurements from 16 CETs - 4 from each core quadrant. The system is part of the ICC detection system and is Class 1E. Each of the 16 Core Exit Temperature measurements is continuously recorded in the CR on three separate recorders over a range of 0-2500°F.

Primary and backup displays are electrically independent, energized from independent power sources, and physically separated, up to and including the isolators. The primary display is not Class 1E but is energized from a battery backed, high-reliability uninterruptable power supply, which is backed up by the diesel generator.

**PARAMETER:**

VARIABLE: CORE EXIT TEMPERATURE (PRIMARY)
TAG NO.: IM-1H, 2L, 3F, 3M, 4E, 5D, 5H, 5K, 5O, 6G, 6P, 7B, 7E, 7M, 7R, 8B, 8F, 8H, 8N, 9C, 9G, 9M, 9N, 10D, 10R, 11E, 11K, 11L, 12F, 12K, 12O, 13C, 13H, 13F, 14D, 14M,-TE

REF DWG: N/A

Type and Category - B, C, 3

Range - 0° - 2500°F

Environmental Qualification - N/A

Seismic Qualification - N/A

Quality Assurance - N/A

Redundancy - N/A

Power Source - UPS/DG

Display - 52 CETs Indicated in CR
16 Recorded On Demand in CR
12 On Demand in TSC & EOF

RG 1.97 Position - Complies

**SOURCE:**

0, 5, 31

**REASON:**

Core exit temperatures along with RCS Hot Leg Temperature to verify natural circulation of reactor coolant, and to detect potential breach of fuel cladding.

Ref: The NRC's evaluation of CR3 is response to NUREG-0737, Item II.F.2, Docket No. 50-302, dated 9/6/83.

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Primary and backup displays are electrically independent, energized from independent power sources, and physically separated, up to and including the isolators. The primary display is not Class 1E but is energized from a battery backed, high-reliability uninterruptible power supply, which is backed up by the diesel generator.

PARAMETER:

VARIABLE: RCS RADIOACTIVITY CONCENTRATION
TAG NO.: N/A
REF DWG: N/A

Type and Category - C, 3

Range - $10^{-2}$ to $10^{-3}$ ci/gm

Environmental Qualification - N/A

Seismic Qualification - N/A

Quality Assurance - N/A

Redundancy - N/A

Power Source - 1E

Display - Indicated and Recorded in LAB

RG 1.97 Position - Complies

**SOURCE:**

0, 5, 10, 11, 12

**REASON:**

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.E.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.

**PARAMETER:**

VARIABLE: CONTAINMENT HYDROGEN CONCENTRATION
TAG NO.: WS-10-CR, WS-11-CR
REF DWG: 205-062, WS-01, WS-02

Type and Category - C, 1

Range - 0 - 10%

Environmental Qualification - Yes

Seismic Qualification - Yes

Quality Assurance - Yes

Redundancy - Yes - 2 Channels

Power Source - 1E

Display - Indicated and Recorded in EFIC Room

RG 1.97 Position - Complies

**SOURCE:**

0, 5, 22

**REASON:**

Containment hydrogen monitoring is a key variable used to detect a potential breach of containment resulting from fuel failure.

Location of indicators and records satisfies NUREG-0737, Item II.F.1.6.

**PARAMETER:**

VARIABLE: CONTAINMENT PRESSURE
TAG NO.: BS-16-PI, BS-17-PI, BS-90-PI, BS-91-PI, BS-90-PR, BS-91-PR
REF DWG: 205-009, BS-01 and BS-02

Type and Category - B, C, 1

Range - -10 - 70 psig (BS-16, 17-PI)
0 - 200 psig (BS-90, 91-PI)

Environmental Qualification - Yes

Seismic Qualification - Yes

Quality Assurance - Yes

Redundancy - Yes - 2 Channels

Power Source - 1E

Display - Indicated in CR
Recorded in EFIC Room
On Demand in TSC & EOF

RG 1.97 Position - Complies

**SOURCE:**

0, 5, 22

**REASON:**

Containment pressure is a key measurement used for detection of a LOCA, verification of ESFAS mitigation, or detection of a potential breach of containment.

Recorder location meets NUREG-0737, Item II.F.1.4.

**PARAMETER:**

VARIABLE: DECAY HEAT FLOW (LPI FLOW)
TAG NO.: DH-01-FI3-1, DH-01-FI4-1
REF DWG: 205-021, DH-01, DH-02

Type and Category - D, 2

Range - 0 - 5,000 gpm (Design = 3000 gpm)

Environmental Qualification - Yes

Seismic Qualification - N/A

Quality Assurance - Yes

Redundancy - N/A - 2 Channels

Power Source - UPS/DG with 1E Standby

Display - Indicated in CR
On Demand in TSC & EOF

RG 1.97 Position - Complies

**SOURCE:**

0, 5

**REASON:**

DH flow measurement monitors LPI safety injection in event of a LOCA, or residual heat removal (RHR) during reactor shutdown.

**PARAMETER:**

VARIABLE: DHHE OUTLET TEMPERATURE
TAG NO.: DH-2-TI1, DH-2-TI2
REF DWG: 205-021, DH-04 and DH-05

Type and Category - D, 2

Range - 0 - 300°F

Environmental Qualification - Yes

Seismic Qualification - N/A

Quality Assurance - Yes

Redundancy - N/A - 2 Channels

Power Source - UPS with 1E Standby

Display - Indicated in CR

RG 1.97 Position - Complies

**SOURCE:**

0, 5, 10, 11, 13, 20

**REASON:**

DHHE outlet temperature is used to monitor operation of the LPI system after a LOCA.

RTD is mounted in LPI piping.

Range covers all anticipated requirements. Design temperature of the Decay Heat System and Heat Exchanger for CR3 is 300°F.

**PARAMETER:**

VARIABLE: CORE FLOOD TANK LEVEL
TAG NO.: CF-2-LI1, CF-2-LI2, CF-2-LI3, CF-2-LI4
REF DWG: D8034038

Type and Category - D, 2

Range - 13" from bottom to 14 ft.

Environmental Qualification - Yes

Seismic Qualification - N/A

Quality Assurance - Yes

Redundancy - N/A - 2 Channels

Power Source - UPS/DG

Display - Indicated in CR

RG 1.97 Position - Complies

**SOURCE:**

0, 5, 10, 11, 16

**REASON:**

CF tank level is required to monitor safety injection in event of a LOCA.

**PARAMETER:**

VARIABLE: CORE FLOOD TANK PRESSURE
TAG NO.: CF-1-PI1, CF-1-PI2, CF-1-PI3, CF-1-PI4
REF DWG: D8034038

Type and Category - D, 3

Range - 0 - 800 psig

Environmental Qualification - N/A

Seismic Qualification - N/A

Quality Assurance - N/A

Redundancy - N/A - 2 Channels

Power Source - UPS/DG

Display - Indicated in CR

RG 1.97 Position - Complies

**SOURCE:**

0, 5, 10, 11, 12

**REASON:**

Core Flood Tank Pressure is a key variable for pre-accident status to assure that this passive safety system is prepared to discharge into the RCS in the event of a LOCA. 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.

**PARAMETER:**

VARIABLE: CORE FLOOD TANK ISOLATION VALVE POSITION
TAG NO.: CFV-5, CFV-6
REF DWG: 302-702

Type and Category - D, 2

Range - Closed/Open Lights

Environmental Qualification - Yes

Seismic Qualification - N/A

Quality Assurance - Yes

Redundancy - N/A - 2 Channels

Power Source - UPS/DG

Display - Indicated in CR

RG 1.97 Position - Complies

**SOURCE:**

0, 3, 5, 13, 20

**REASON:**

CF Tank Isolation Valve position is required to monitor that valve operational status is correct.

**PARAMETER:**

VARIABLE: BORIC ACID CHARGING FLOW
TAG NO.: N/A
REF DWG: N/A

Type and 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

RG 1.97 Position - Complies

**SOURCE:**

0, 5, 10, 11, 12

**REASON:**

To Monitor Operation of RCS Injection Systems.

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.

**PARAMETER:**

VARIABLE: HPI FLOW (0-500 gpm)
TAG NO.: MU-23-FI1, MU-23-FI2, MU-23-FI3, MU-23-FI4
REF DWG: D8034039

Type and Category - D, 2

Range - 0 - 500 gpm (Design = 300 gpm)

Environmental Qualification - Yes

Seismic Qualification - N/A

Quality Assurance - Yes

Redundancy - N/A - 2 Channels (One Channel is 0-200 gpm and the Redundant Channel is 0-500 gpm)

Power Source - UPS/DG

Display - Indicated in CR
On Demand in TSC & EOF

Schedule - Refuel VIII

RG 1.97 Position - This flow loop will be upgraded to Class 1E, RG 1.97 Type and Category A, D, 1 during Refuel VIII.

**SOURCE:**

0, 5, 8, 9, 15, 17

**REASON:**

HPI flow measurement is a key variable used to monitor operation of the ESFAS system in event of a LOCA.

**PARAMETER:**

VARIABLE: HPI FLOW (0 - 200 gpm)
TAG NO.: MU-23-FI5-1, MU-23-FI6-1, MU-23-FI7-1, MU-23-FI8-1
REF DWG: 205-046, MU-01, MU-02, MU-03 and MU-04

Type and Category - A, D, 1

Range - 0 - 200 gpm

Environmental Qualification - Yes

Seismic Qualification - Yes

Quality Assurance - Yes

Redundancy - Yes - 2 Channels (One channel is 0-200 gpm and the redundant channel is 0-500 gpm.)

Power Source - UPS/DG

Display - Indicated in CR
On Demand in TSC & EOF

RG 1.97 Position - Complies

**SOURCE:**

0, 5, 8, 9, 15, 24, 25, 26

**REASON:**

HPI flow measurement is a key variable used to monitor operation of the ESFAS system in event of a LOCA.

**PARAMETER:**

VARIABLE: BORATED WATER STORAGE TANK LEVEL
TAG NO.: DH-7-LI, DH-37-LI, DH-7-LIR-1
REF DWG: 205-021, DH-06, DH-07

Type and Category - A, D, 1

Range - 0 - 50 ft.

Environmental Qualification - Yes

Seismic Qualification Yes

Quality Assurance - Yes

Redundancy - Yes - 2 Channels

Power Source - 1E/DG

Display - Indicated and Recorded in CR
On Demand in TSC & EOF

RG 1.97 Position - Complies

**SOURCE:**

0, 5, 10, 11, 32

**REASON:**

BWST level indication is a key variable in that this tank is the primary source of injection water for at least 20 minutes following a LOCA.

The variable is indicated on redundant, qualified, indicators, located on a seismically qualified panel board and one of the redundant channels is recorded.

Due to a lack of seismically qualified panel space the recorder is mounted on panel not seismically qualified.

The recorder itself is environmentally qualified and electrically isolated from the rest of the qualified instrument loop.

B&W's Criteria for BWST 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 sufficient time for 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 ne for use during and after an accident. This criterion requires that the BWS: 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. At CR3, the tank level is monitored from 0 to 50 feet. A low alarm is provided at 4 feet and switchover is required at 2.5 feet. Thus, the operator is provided with adequate level indication at all times.

**PARAMETER:**

VARIABLE: REACTOR COOLANT PUMP STATUS
TAG NO.: RECALL PT NO. 129, 130, 131, 132
REF DWG: N/A

Type and Category - D, 3

Range - 0 - 150% LOAD

Environmental Qualification - N/A

Seismic Qualification - N/A

Quality Assurance - N/A

Redundancy - N/A - 1 per pump

Power Source - OP

Display - Indicated Limits in CR
0-150% Indicated in CR
Indicated Total Amps in Switchgear
On Demand in TSC & EOF

RG 1.97 Position - Complies

**SOURCE:**

O, 5

**REASON:**

RC pump motor amps and indicating lights are required to monitor operation of the primary coolant system pumps.

**PARAMETER:**

VARIABLE: RC SYSTEM SAFETY RELIEF VALVE FLOW/POSITION
TAG NO.: RC-160-MI1, RC-160-MI2, RC-160-MI3
REF DWG: 205-047, RC-

Type and Category - D, 2

Range - Acoustic System

Environmental Qualification - Yes

Seismic Qualification - N/A

Quality Assurance - Yes

Redundancy - N/A (Sensor Back-up Only)

Power Source - UPS/DG

Display - Indicated in CR
On Demand in TSC & EOF

RG 1.97 Position - Complies

**SOURCE:**

0, 5

**REASON:**

RC System safety valve flow is a key variable to monitor valve operation and loss of primary coolant.

Accelerators are seismically mounted.

**PARAMETER:**

VARIABLE: PRESSURIZER LEVEL
TAG NO.: RC-1-LIR-1, RC-1-LIR-3
REF DWG: 205-047, RC-01, RC-05, RC-06

Type and Category - D, 1

Range - 0 - 320 Inches.

Environmental Qualification - Yes

Seismic Qualification - Yes

Quality Assurance - Yes

Redundancy - Yes - 2 Channels

Power Source - 1E/DG

Display - Indicated and Recorded in CR
On Demand in TSC & EOF

RG 1.97 Position - Complies

**SOURCE:**

0, 1, 2, 5, 10, 11, 12

**REASON:**

Pressurizer level is a key variable required to ensure proper operation of the pressurizer.

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" $H_2O$ 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.

The Accident Analysis chapters of several B&W Owners Group Utility Final Safety Analysis Reports (SAR), as well as Part II, Volume 2 of the B&W Owners Group Abnormal Transient Operating Guidelines (ATOG) were reviewed to obtain pressurizer level responses to anticipated transients and accidents.

For anticipated transients such as decreasing feedwater temperature, excessive main feedwater flow, loss of main feedwater flow, decreasing steam flow, small steam leaks, loss of external load, loss of off-site power, loss of condenser vacuum and small steam generator tube leaks, the existing ranges for the pressurizer level are sufficient such that indicated level should remain on-scale.

For severe transients (accidents) such as steam line break, steam generator tube rupture and many small break LOCA's, the pressurizer will void. Following ESFAS actuation of the HPI system, actions can be taken as necessary to stabilize the plant. Those actions are based on subcooling margin and RCS pressure, not pressurizer level. For the case of a total loss of feedwater, the pressurizer will go solid unless either main or emergency feedwater is restored to the steam generators within about 15 minutes. Actions taken are dependent on when feedwater is restored, subcooling margin and RCS pressure, not pressurizer level.

In general, for severe transients or accidents, the pressurizer will either void or go solid. A voided pressurizer will cause indicated level to go off-scale low followed by a rapid decrease in RCS pressure to saturation. A solid pressurizer will cause indicated level to go off-scale high accompanied by high RCS pressure, possible large and rapid changes in RCS pressure, PORV and pressurizer safety valve actuation. All of these indications are available in the Control Room.

Based on this information, the existing ranges of pressurizer level indication are sufficient for anticipated transients. For severe transients or accidents, indicated pressurizer level will go off-scale high or low due to the pressurizer going solid or voiding and, as a result, top to bottom instruments would provide no significant additional information. In these cases, subcooling margin, RCS pressure, PORV status and pressurizer safety valve status are monitored to determine actions to be taken.

**PARAMETER:**

VARIABLE: PRESSURIZER HEATER STATUS
TAG NO.: RC-203-JI, RC-204-JI
REF DWG: 210-654

Type and Category - D, 2

Range - 0 - 1000 kw

Environmental Qualification - Yes

Seismic Qualification - N/A

Quality Assurance - Yes

Redundancy - N/A

Power Source - Unit Bus with 1E Standby

Display - Wattmeters in CR

RG 1.97 Position - Complies

**SOURCE:**

0, 1, 2, 4, 5, 10, 11, 14

**REASON:**

Pressurizer heater status is important to determine operating status of the pressurizer. Emergency heaters are loaded manually onto the diesels with observation of load before and after.

**PARAMETER:**

VARIABLE: RC DRAIN TANK LEVEL
TAG NO.: WD-23-LI1
REF DWG: 205-060, WD-04

Type and Category - D, 3

Range - 6" from Bottom - Top

Environmental Qualification - N/A

Seismic Qualification - N/A

Quality Assurance - N/A

Redundancy - N/A

Power Source - UPS/DG

Display - Indicated in CR
On Demand in TSC & EOF

RG 1.97 Position - Complies

**SOURCE:**

O, 5

**REASON:**

RC drain tank level is required to monitor operation of the RCS system relief valves.

**PARAMETER:**

VARIABLE: RC DRAIN TANK TEMPERATURE
TAG NO.: WD-24-TI-1
REF DWG: 205-060, WD-02

Type and Category - D, 3

Range - 0 - 400°F

Environmental Qualification - N/A

Seismic Qualification - N/A

Quality Assurance - N/A

Redundancy - N/A

Power Source - UPS/DG

Display - Indicated in CR
On Demand in TSC & EOF

RG 1.97 Position - Complies

**SOURCE:**

0, 5, 10, 11

**REASON:**

RC drain tank temperature is required to monitor operation of the RCS system relief valves.

Rupture disc (set @ 110 psig) precludes temperature from exceeding 345°F.

RG 1.97 range of 0 - 400°F is acceptable to 50 - 750°F NRC requirement.

**PARAMETER.**

VARIABLE: RC DRAIN TANK PRESSURE
TAG NO.: WD-22-PI1
REF DWG: 205-060, WD-06

Type and Category - D, 3

Range - 0 - 100 psig (Design = 100 psig)

Environmental Qualification - N/A

Seismic Qualification - N/A

Quality Assurance - N/A

Redundancy - N/A

Power Source - UPS/DG

Display - Indicated in CR
On Demand in TSC & EOF

RG 1.97 Position - Complies

**SOURCE:**

O, 5

**REASON:**

RC drain tank pressure is required to monitor operation of the RCS system relief valves.

**PARAMETER:**

VARIABLE: STEAM GENERATOR LEVEL
TAG NO.: SP-17-LI1, SP-17-LIR, SP-18-LI1, SP-21-LI1, SP-21-LIR, SP-22-LI1, SP-25-LI1, SP-25-LIR, SP-26-LI1, SP-29-LI1, SP-29-LIR, SP-30-LI1
REF DWG: 205-074, SP-01 thru SP-04

Type and Category - A, D, 1

Range - 0 - 150 Inches (Startup)
100 - 394 Inches (Operation)

Environmental Qualification - Yes

Seismic Qualification - Yes

Quality Assurance - Yes

Redundancy - Yes - 2 Channels

Power Source - 1E/DG

Display - Indicated and Recorded in CR
On Demand in TSC & EOF

RG 1.97 Position - Complies

**SOURCE:**

0, 5, 19

**REASON:**

Steam generator level is a key variable to monitor secondary plant operation (FW, EF, EFIC).

CR3, 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. CR3 installed the Emergency Feedwater Initiation & Control (EFIC) system, which was completed in Refuel 5, 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.

**PARAMETER:**

VARIABLE: STEAM GENERATOR PRESSURE
TAG NO.: MS-106-PIR, MS-107-PIR, MS-110-PIR, MS-111-PIR
REF DWG: 205-039, MS-01 and MS-02

Type and Category - A, D, 1

Range - 0 - 1200 psig (Ind)

Environmental Qualification - Yes

Seismic Qualification - Yes

Quality Assurance - Yes

Redundancy - Yes - 4 Channels

Power Source - 1E/DG

Display - Indicated and Recorded in C.
On Demand in TSC & EOF

RG 1.97 Position - Complies

**SOURCE:**

0, 5, 10, 11, 19

**REASON:**

Steam generator pressure is a key variable to monitor secondary plant operation.

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 110 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.

The highest safety valve setting is typically 110 psig. The steam relief capacity is 20-25% above the expected steam flow rate. Excess relief capacity is maintained when safety valves are inoperable. The FSAR analysis indicates a maximum steam pressure of about 1100 psig for operating plants. Based on these facts, it is FPCs position that the existing range of 0-1200 psig is sufficient.

**PARAMETER:**

VARIABLE: MAIN STEAM SAFETY RELIEF VALVE POSITION
TAG NO.: MSX-1, MSX-2, MSX-3, MSX-4, MSX-5
REF DWG: 209-039, MS-23

Type and Category - D, 2

Range - Video Display

Environmental Qualification - Yes

Seismic Qualification - N/A

Quality Assurance - Yes

Redundancy - N/A

Power Source - UPS/DG

Display - Video display unit viewing MSSV vent stacks is mounted on the MCB

RG 1.97 Position - Complies

**SOURCE:**

0, 1, 2, 4, 5, 10, 11, 27

**REASON:**

Main steam relief valve position is important to monitor secondary plant releases.

**PARAMETER:**

VARIABLE: MAIN FEEDWATER FLOW
TAG NO.: SP-8A-FI1, SP-8A-FI2, SP-8B-FI2, SP-8A-FIR1, SP-8B-FI1
REF DWG: D8034031, Sh. 1 and 3

Type and Category - D, 3

Range - 0 - 6,000,000 lb/hr (Design = $5.3 \times 10^6$ lbs/hr)

Environmental Qualification - N/A

Seismic Qualification - N/A

Quality Assurance - N/A

Redundancy - N/A - 3 Channels

Power Source - UPS/DG

Display - Indicated and Recorded in CR
On Demand in TSC & EOF

RG 1.97 Position - Complies

**SOURCE:**

O, 5

**REASON:**

Main feedwater flow is important to monitor secondary plant operation during normal operation.

**PARAMETER:**

VARIABLE: EMERGENCY FEEDWATER FLOW
TAG NO.: EF-23-FI1, EF-24-FI1, EF-25-FI1, EF-26-FI1
REF DWG: 205-026, EF-01 and EF-02

Type and Category - D, 1

Range - 0 - 1000 gpm (Design = 740 gpm)

Environmental Qualification - Yes

Seismic Qualification - Yes

Quality Assurance - Yes

Redundancy - Yes - 4 Channels

Power Source - 1E

Display - Indicated and Recorded on demand in CR
On Demand in TSC & EOF

RG 1.97 Position - Complies

**SOURCE:**

O, 5

**REASON:**

Emergency feedwater flow is important to monitor secondary plant operation during a transient.

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

**PARAMETER:**

VARIABLE: EMERGENCY FEEDWATER TANK LEVEL
TAG NO.: EF-98-LI1, EF-99-LI1
REF DWG: 205-026, EF-05

Type and Category - A, D, 1

Range - 0 - 38 FT.

Environmental Qualification - Yes

Seismic Qualification - Yes

Quality Assurance - Yes

Redundancy - Yes - 2 Channels

Power Source - 1E

Display - Indicated and Recorded on Demand in CR
On Demand in TSC & EOF

RG 1.97 Position - Complies

**SOURCE:**

0, 5, 28

**REASON:**

Emergency feedwater tank level is a key variable to ensure water supply for emergency feedwater.

**PARAMETER:**

VARIABLE: CONTAINMENT SPRAY FLOW
TAG NO.: BS-1-FI1, BS-1-FI2
REF DWG: D8034036

Type and Category - D, 2

Range - 0 - 1900 gpm (Design = 1500 gpm)

Environmental Qualification - Yes

Seismic Qualification - N/A

Quality Assurance - Yes

Redundancy - N/A - 2 Channels

Power Source - UPS/DG

Display - Indicated in CR

RG 1.97 Position - Complies

**SOURCE:**

O, 5,

**REASON:**

Containment spray flow is important to monitor operation of the Reactor Building spray system in event of an accident.

**PARAMETER:**

VARIABLE: RB FAN HEAT REMOVAL
TAG NO.: Computer Pt. S348, S376, S387 (SW-47-FT1, SW-51-FT1, SW-55-FT1)
REF DWG: 205-056, SW-01

Type and Category - D, 2

Range - On-Off Indicator Lights
NSCCW Flow

Environmental Qualification - Yes

Seismic Qualification - N/A

Quality Assurance - Yes

Redundancy - N/A

Power Source - VBDP-2

Display - ES Status Lights (Display for DW flow to RBCU is available on demand via plant computer.)

RG 1.97 Position - Complies

**SOURCE:**

0, 5, 13

**REASON:**

RB heat removal is important to monitor Reactor Building cooling in event of an accident.

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 speed of the fan motors by about one-half during accidents where the heavier steam-air mixture might over-load the motors at full speed. The fan cooling units are cooled by cooling water from the Nuclear Services Closed Cycle Cooling System (SW).

For the following reasons, the status of the fan breakers and cooling water flow rates 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 was upgraded to comply with RG 1.97 requirements during Refuel 6.

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.

**PARAMETER:**

VARIABLE: CONTAINMENT ATMOSPHERE TEMPERATURE
TAG NO.: AH-536-TIR, AH-537-TIR, AH-538-TIR, AH-539-TIR
REF DWG: 205-056, AH-01

Type and Category - D, 2

Range - 0 - 400°F

Environmental Qualification - Yes

Seismic Qualification - N/A

Quality Assurance - Yes

Redundancy - N/A - 4 Measurements

Power Source - UPS/DG

Display - Recorded in CR
On Demand in TSC & EOF

RG 1.97 Position - Complies

**SOURCE:**

0, 5, 19

**REASON:**

Containment atmospheric temperature is important to indicate accomplishment of cooling following an accident.

**PARAMETER:**

VARIABLE: CONTAINMENT SUMP WATER TEMPERATURE
TAG NO.: N/A
REF DWG: N/A

Type and 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

RG 1.97 Position - Complies

**SOURCE:**

0, 5, 10, 11

**REASON:**

The NRC RG 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. Containment

atmospheric temperature instrumentation was upgraded during Refuel 6 to meet RG 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 (BS) and the Reactor Building Air Handling System (AH). The Reactor Building containment Fan Heat Removal Cooling Water Flow Instrumentation (SW) was upgraded to provide heat removal indication meeting the requirements of RG 1.97 during Refuel 6 (See position Page 50).

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 RG 1.97 requirements.

b. Equipment Temperature Limits

Protection of DH and BS from Excessive Sump Temperatures: These systems are designed for fluid temperatures in excess of the RG 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.

**PARAMETER:**

VARIABLE: MAKEUP FLOW-IN
TAG NO.: MU-24-FI
REF DWG: 205-041, MU-06

Type and Category - D, 3

Range - 0 - 200 gpm (Design = 115 gpm)

Environmental Qualification - N/A

Seismic Qualification - N/A

Quality Assurance - N/A

Redundancy - N/A

Power Source - UPS/DG

Display - Indicated in CR

RG 1.97 Position - Complies

**SOURCE:**

0, 5, 10, 11

**REASON:**

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) 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 System 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 System. For the reasons provided in the Position Section for the variable, Makeup Tank Level (Page 57), 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.

**PARAMETER:**

VARIABLE: LETDOWN FLOW-OUT
TAG NO.: MU-4-FI
REF DWG: 205-041, MU-05

Type and Category - D, 3

Range - 0 - 160 gpm (Design = 140 gpm)

Environmental Qualification - N/A

Seismic Qualification - N/A

Quality Assurance - N/A

Redundancy - N/A

Power Source - UPS/DG

Display - Indicated in CR
On Demand in TSC & EOF

RG 1.97 Position - Complies

**SOURCE:**

0, 5, 10, 11

**REASON:**

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 System 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 System 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 System. For the reasons provided in the position section for the variable Makeup Tank Level (Page 57), 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 CR3, normal letdown flow rate through the block orifice is 45 gpm with a maximum flow rate of 140 gpm with both letdown coolers in operations. 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.

**PARAMETER:**

VARIABLE: MAKEUP TANK LEVEL
TAG NO.: MU-14-LIR1
REF DWG: 205-041, MU-07;
D8034039, Sh. 2

Type and Category - D, 2

Range - 0 - 120 Inches

Environmental Qualification - Yes - SR portion

Seismic Qualification - Yes - SR portion

Quality Assurance - Yes - SR portion

Redundancy - N/A - 2 Channels

Power Source - UPS

Display - Recorded in CR
On Demand in TSC & EOF

RG 1.97 Position - Complies

**SOURCE:**

0, 5

**REASON:**

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

During normal operation and certain design basis accidents where the MU System is still operable, the Makeup Tank Level is the key variable used to provide indication that the MU System 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 System. 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 System. Flow rate [illegible]ation provided for Makeup Flow and Letdown Flow can be used as confirmatory [illegible]kup information to Makeup Tank Level and Pressurizer Level.

Meets intent of RG 1.97, 2 ½" from bottom to 4" from top of vessel. Parts of safety system are seismic with QA. QA requirements meeting CR3 licensing commitments were applied to safety related portions of this instrument string.

**PARAMETER:**

VARIABLE: COMPONENT COOLING WATER TEMPERATURE TO ESF SYSTEMS
TAG NO.: DC-35-TI, DC-39-TI, RW-12-TI, RW-13-TI
REF DWG: 208-019, DC-02; 205-050, RW-01

Type and Category - D, 2

Range - 0 - 200°F (DC Sys)
0 - 250°F (SW Sys)

Environmental Qualification - N/A

Seismic Qualification - N/A

Quality Assurance - N/A

Redundancy - N/A

Power Source - UPS/DG

Display - Indicated in CR

RG 1.97 Position - Complies

**SOURCE:**

O, 5

**REASON:**

Component cooling temperatures are important to monitor operation of ESF cooling systems.

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

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

**PARAMETER:**

VARIABLE: COMPONENT COOLING WATER FLOW TO ESF SYSTEMS (SYSTEM STATUS)
TAG NO.: DC-5-PI, DC-6-PI, DC-50-LI, DC-54-LI, SW-2-PI, SW-139-LI
REF DWG: 205-019, DC-01; 205-056, SW-02

Type and Category - D, 2

Range - 10 ft. below to 4 ft. above normal WL (SW Sys);
from 11 ft. -3" below to 4 ft. above normal WL (DC Sys);
0 - 200 psig (SW Sys);
0 - 60 psig (DC Sys)

Environmental Qualification - Yes

Seismic Qualification - N/A

Quality Assurance - Yes

Redundancy - N/A

Power Source - VBDP-2

Display - Indicated in CR (SW temperature display is available on demand via plant computer)

RG 1.97 Position - Complies

**SOURCE:**

0, 1, 5, 10, 11, 13

**REASON:**

Component cooling systems status is important to monitor operation of the ESF cooling systems.

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 CR3 licensing commitments were applied to safety related portions of this instrument string.

**PARAMETER:**

VARIABLE: HIGH-LEVEL RADIOACTIVE LIQUID TANK LEVEL
TAG NO.: WD-76-PI, WD-78-LI, WD-81-LI, WD-103-LI, WD-106-LI, WD-161-LI, WD-180-LI
REF DWG: 308-813; 308-817; 308-339

Type and Category - D, 3

Range - 0 - 100%

Environmental Qualification - N/A

Seismic Qualification - N/A

Quality Assurance - N/A

Redundancy - N/A

Power Source - Instrument Air

Display - Local WD Panel

RG 1.97 Position - Complies

**SOURCE:**

0, 5

**REASON:**

Level indication of concentrated waste tanks, concentrated boric acid tanks, and spent resin tank is important to indicate storage volume.

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.

**PARAMETER:**

VARIABLE: RADIOACTIVE GAS HOLD-UP TANK PRESSURE
TAG NO.: WD-16-PI, WD-17-PI, WD-18-PI
REF DWG: 308-806

Type and Category - D, 3

Range - 0 - 150 psig (Design = 150 psig)

Environmental Qualification - N/A

Seismic Qualification - N/A

Quality Assurance - N/A

Redundancy - N/A

Power Source - Instrument Air

Display - Local WD Panel

RG 1.97 Position - Complies

**SOURCE:**

0, 5, 10, 11,

**REASON:**

Waste gas holdup tank pressure is important to indicate storage capacity.

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 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.

**PARAMETER:**

VARIABLE: EMERGENCY VENTILATION DAMPER POSITION INDICATION
TAG NO.: AH-382-KS1A, AH-383-KS1A, AH-384-KS1B, AH-746-ZS, AH-747-ZS, AH-748-ZS, AH-910-KS1B
REF DWG: 308-847

Type and Category - D, 2

Range - On - Off Fan Lights; OP-CL Lights

Environmental Qualification - Yes

Seismic Qualification - N/A

Quality Assurance - Yes

Redundancy - N/A

Power Source - UPS/DG

Display - Indicated Lights in CR

RG 1.97 Position - Complies

**SOURCE:**

0, 5, 10, 11, 13, 29

**REASON:**

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.

**PARAMETER:**

VARIABLE: STATUS OF STANDBY POWER
TAG NO.: EGDG -3A/3B VM & AM ON SSF
INVERTER 3A/3B POWER AVAILABLE LIGHTS
4KV BUS 3A/3B VM ON SSF
480V BUS 3A/3B VM OF SSF
125V/250V 3A/3B POWER AVAILABLE LIGHTS

REF DWG: N/A

Type and Category - D, 2

Range - CR3 -

| | DG | INVERTER | 4160V | 480V | 250/125VDC |
|---|---|---|---|---|---|
| | 3A, 3B | 3A to 3D | 3A, 3B | 3A, 3B | 3A, 3B Power |
| | Volts Amps | Pwr Available Ind. Lts - R/G | Volts | Volts | Available Ind. Lts - R/G |

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 in CR

RG 1.97 Position - Complies

**SOURCE:**

O, 5

**REASON:**

Electrical meters for DGs, inverters and vital buses are important to monitor electrical system status.

**PARAMETER:**

VARIABLE: CONTAINMENT AREA RADIATION - HIGH RANGE
TAG NO.: RM-G29-RIR, RM-G30-RI, RM-G29-RI
REF DWG: 205-049, RM-10

Type and Category - C, E, 1

Range - 1 to $10^8$ R/hr

Environmental Qualification - Yes

Seismic Qualification - Yes

Quality Assurance - Yes

Redundancy - Yes - 2 Channels

Power Source - 1E

Display - Indicated and Recorded in CR
On Demand in TSC & EOF

RG 1.97 Position - Complies

**SOURCE:**

0, 4, 5

**REASON:**

Containment high range radiation monitors are important to detect and assess significant releases, and for emergency planning.

**PARAMETER:**

VARIABLE: RADIATION EXPOSURE RATE INSIDE BUILDING OR AREAS WHERE ACCESS IS REQUIRED TO SERVICE EQUIPMENT IMPORTANT TO SAFETY
TAG NO.: RM-G4-RIR, RM-G9-RIR, RM-G10-RIR
REF DWG: 205-049, RM-02, RM-03, RM-04

Type and Category - E, 3

Range - 0.01 to 10 R/hr

Environmental Qualification - N/A

Seismic Qualification - N/A

Quality Assurance - N/A

Redundancy - N/A

Power Source - 1E

Display - Indicated and Recorded on MCB

RG 1.97 Position - Complies

**SOURCE:**

0, 5, 10, 11

**REASON:**

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

NRC RG 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.

RG 1.97 describes areas of concern as those where access is required to service safety related equipment. 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 provide 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 RG 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 CR3 is $10^3$ R/hr. We do not anticipate even under emergency conditions, sending personnel into radiation fields of this magnitude.

**PARAMETER:**

VARIABLE: CONTAINMENT OR PURGE EFFLUENT, NOBLE GAS
TAG NO.: AH-717-FIR, RM-A1-RIR-1, RM-A1-RIR-2, RM-A1-RIR-3
REF DWG: 205-005, AH-04; 205-049, RM-06 and RM-06A

Type and Category - C, E, 2

Range - $2 \times 10^{-6}$ to $4.5 \times 10^{7}$ $\mu$ ci/cc Xe133; 0 -65,000 cfm (Design = 50,000 CFM)

Environmental Qualification - Yes

Seismic Qualification - N/A

Quality Assurance - No - (Radiation monitoring equipment was originally purchased without Quality Assurance documentation. Future purchases will specify QA requirements.)

Redundancy - N/A

Power Source - UPS/DG

Display - Indicated and Recorded in CR

RG 1.97 Position - Complies

**SOURCE:**

0, 5

**REASON:**

Noble gas concentration and vent flow rate is required to detect a breach of containment and significant releases.

**PARAMETER:**

VARIABLE: REACTOR SHIELD BUILDING ANNULUS
TAG NO.: N/A
REF DWG: N/A

Type and 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

RG 1 97 Position - Not in CR3 design.

**SOURCE:**

O, 5

**REASGN:**

N/A in CR3 design

**PARAMETER:**

VARIABLE: AUXILIARY BUILDING NOBLE GAS
TAG NO.: AH-32-FIR, RM-A2-RIR-1, RM-A2-RIR-2 RM-A2-RIR-3
REF DWG: 205-005, [illegible]; 205-049, RM-07A

Type and Category - C, 1

Range - $2 \times 10^{-6}$ to $4.5 \times 10^{1}$ $\mu$ ci/cc Xe133; 0-200,000 cfm (Design = 156,680 cfm)

Environmental Qualification - Yes

Seismic Qualification - N/A

Quality Assurance - No - (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.)

Redundancy - N/A

Power Source - UPS/DG

Display - Indicated and Recorded in CR
Concentration also displayed on demand in the TSC and EOF common plant vent, Category E2, from Auxiliary Building.

RG 1.97 Position - Complies

**SOURCE:**

0, 5

**REASON:**

Noble gas concentration and vent flow rate is required to detect a breach of containment and significant releases.

**PARAMETER:**

VARIABLE: CONDENSER AIR REMOVAL SYSTEM EXHAUST
TAG NO.: RM-A12-RIR-1
REF DWG: 205-049, RM-05

Type and Category - C, E, 2

Range - $2 \times 10^{-6}$ to $10^{-2}$ $\mu$ ci/cc Kr85

Environmental Qualification - Yes

Seismic Qualification - N/A

Quality Assurance - No - (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.)

Redundancy - N/A

Power Source - 1E

Display - Indicated and Recorded in CR
On Demand in TSC & EOF

RG 1.97 Position - Complies

**SOURCE:**

0, 5, 10, 11,

**REASON:**

Noble gas monitor in condenser air removal system exhaust is the key variable for detection of a breach of the primary to secondary loop boundary. The Auxiliary Building RM and flow meter are important to detect significant releases.

The condenser air removal system exhausts through the Auxiliary Building (See Page 70) in which the flow is monitored. The range of the monitor in the Auxiliary Building is $2 \times 10^{-6}$ to $4.5 \times 10^{7}$ $\mu$ ci/cc Xe133.

The range was corrected to confirm to the requirements of NUREG-0737, Item II.F.1.1.

**PARAMETER:**

VARIABLE: VENT FROM SG SAFETY VALVES OR ADVs
TAG NO.: RM-G25-RI, RM-G28-RI
REF DWG: 205-049, RM-08

Type and Category - 5, 2

Range - $8.7 \times 10^{-3}$ to $2.5 \times 10^{7}$ $\mu$ ci/cc Xe133

Environmental Qualification - Yes

Seismic Qualification - N/A

Quality Assurance - Yes

Redundancy - N/A - 1 each ADV

Power Source - 1E

Display - Indicated in CR
Recorded On Demand

RG 1.97 Position - Complies

**SOURCE:**

0, 1, 2, 5, 10, 11, 30

**REASON:**

The four 24" main steam headers contain a total of 16 relief valves and 2 atmospheric dump valves. Each atmospheric dump valve discharge is monitored for radiation by monitors with readouts in the Control Room. The system was calibrated in terms of $\mu$ ci/cc Xe133 in order to comply with NUREG-0737. Radioactive releases are manually calculated.

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, they meet the environmental qualifications for the normal environment.

**PARAMETER:**

VARIABLE: ALL PLANT RELEASE POINT - PARTICULATES AND HALOGENS
TAG NO.: See Page 68 and 70
REF DWG: N/A

Type and Category - E, 3

Range - $2 \times 10^{-6}$ to $4.5\ 10^{7}$ $\mu$ ci/cc Xe133 (RB); 0-65,000 cfm (RB)
(Design = 50,000 cfm)
$2 \times 10^{-6}$ to $4.5\ 10^{7}$ $\mu$ ci/cc Xe133 (AB); 0-200,000 cfm (AB)
(Design = 156,680 cfm)

Environmental Qualification - N/A

Seismic Qualification - N/A

Quality Assurance - N/A

Redundancy - N/A

Power Source - UPS/DG

Display - Indicated and Recorded in CR

RG 1.97 Position - Complies

**SOURCE:**

0, 5

**REASON:**

To provide information regarding release of radioactive halogens and particulates.

**PARAMETER:**

VARIABLE: AIRBORNE RADIO HALOGENS AND PARTICULATES
TAG NO.: N/A
REF DWG: N/A

Type and Category - E, 3

Range - $10^{-9}$ to $10^{-3}$ $\mu$ ci/cc

Environmental Qualification - N/A

Seismic Qualification - N/A

Quality Assurance - N/A

Redundancy - N/A

Power Source - Vital Bus

Display - LAB ONLY

Other - Portable sampling and onsite analysis.

RG 1.97 Position - Complies

**SOURCE:**

O, 5

**REASON:**

To estimate release rates of radioactive materials during an accident.

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, we have multi-channel gamma-ray spectrometer systems to provide the capability of onsite analysis.

**PARAMETER:**

VARIABLE: PLANT AND ENVIRONS RADIATION
TAG NO.: N/A
REF DWG: N/A

Type and Category - E, 3

Range - $10^{-3}$ to $10^{3}$ R/hr

Environmental Qualification - N/A

Seismic Qualification - N/A

Quality Assurance - N/A

Redundancy - N/A

Power Source - Batteries

Display - Portable

RG 1.97 Position - Complies

**SOURCE:**

0, 5, 10, 11

**REASON:**

To monitor radiation in plant and environs where range of normal monitor impractical for accident levels.

Personnel not permitted in areas exceeding $10^{3}$ R/hr.

Range of portable monitors is acceptable deviation to NRC required range of $10^{-3}$ to $10^{3}$ R/hr.

**PARAMETER:**

VARIABLE: PLANT AND ENVIRONS RADIOACTIVITY
TAG NO.: N/A
REF DWG: N/A

Type and Category - E, 3

Range - Multi-channel Gamma-Ray Spectrometer

Environmental Qualification - N/A

Seismic Qualification - N/A

Quality Assurance - N/A

Redundancy - N/A

Power Source - Batteries

Display - 2 Channel portable gamma ray spectrometers are available (Eberline SAM-2). Also a mobile multi-channel analyzer/computer contracted with Dept. of Health and Rehabilitation.

RG 1.97 Position - Complies

**SOURCE:**

O, 5

**REASON:**

To monitor airborne radioactivity in the plant and environs where range of normal monitor is impractical for accident levels.

**PARAMETER:**

VARIABLE: WIND DIRECTION
TAG NO.: MM-13-MI, MM-18-SR, MM-14-MI, MM-19-SR
REF DWG: 205-070, MM-01 and MM-02

Type and Category - E, 3

Range - 0 - 360°

Environmental Qualification - N/A

Seismic Qualification - N/A

Quality Assurance - N/A

Redundancy - N/A

Power Source - UPS/DG

Display - Indicated and Recorded in CR

RG 1.97 Position - Complies

**SOURCE:**

0, 5

**REASON:**

To assess impact of atmospheric releases.

**PARAMETER:**

VARIABLE: WIND SPEED
TAG NO.: MM-11-SI, MM-18-SR, MM-12-SI, MM-19-SR
REF DWG: 205-070, MM-01 and MM-02

Type and Category - E, 3

Range - 0 - 50 M/sec

Environmental Qualification - N/A

Seismic Qualification - N/A

Quality Assurance - N/A

Redundancy - N/A

Power Source - UPS/DG

Display - Indicated and Recorded in CR

RG 1.97 Position - Complies

**SOURCE:**

0, 5

**REASON:**

To assess impact of atmospheric releases.

**PARAMETER:**

VARIABLE: ESTIMATION OF ATMOSPHERIC STABILITY
TAG NO.: MM-15-TI, MM-16-TI, MM-17-TI, MM-20-TR, MM-21-TR
REF DWG: 205-070, MM-04

Type and Category - E, 3

Range - -5° to +10°F

Environmental Qualification - N/A

Seismic Qualification - N/A

Quality Assurance - N/A

Redundancy - N/A

Power Source - UPS/DG

Display - Indicated and Recorded in CR

RG 1.97 Position - Complies

**SOURCE:**

0, 5, 10, 11

**REASON:**

To assess impact of atmospheric releases.

In accordance with Regulatory Guide 1.23, Table 1, the measurement of temperature difference for estimating atmospheric stability requires a range from -1.9°C to +4.0°C for the 100 meter height. The height distance between temperature measuring points at CR3 is 142 ft. At this distance the RG 1.23 equivalent range of required temperature to estimate stability in degrees fahrenheit is -1.48°F to 3.12°F range, it is totally sufficient for providing an estimate of atmospheric stability.

**PARAMETER:**

VARIABLE: PRIMARY COOLANT AND SUMP - GROSS ACTIVITY (GRAB SAMPLE)
TAG NO.: CA-54-CE
REF DWG: 302-700

Type and Category - E, 3

Range - 1 $\mu$ ci/ml to 10 ci/ml

Environmental Qualification - N/A

Seismic Qualification - N/A

Quality Assurance - N/A

Redundancy - N/A

Power Source - N/A

Display - Local Panel

RG 1.97 Position - Complies

**SOURCE:**

0, 5, 10, 11

**REASON:**

To assess magnitude of radioactive releases.

**PARAMETER:**

VARIABLE: PRIMARY COOLANT AND SUMP - GAMMA SPECTRUM (GRAB SAMPLE)
TAG NO.: CA-54-CE
REF DWG: 302-700

Type and Category - C, E, 3

Range - Isotopic Analysis

Environmental Qualification - N/A

Seismic Qualification - N/A

Quality Assurance - N/A

Redundancy - N/A

Power Source - N/A

Display - Local Panel

RG 1.97 Position - Complies

**SOURCE:**

0, 5

**REASON:**

To verify mitigation of RC system high radiation from breach of fuel cladding, and to assess magnitude of radioactive releases.

**PARAMETER:**

VARIABLE: PRIMARY COOLANT AND SUMP - BORON CONTENT (GRAM SAMPLE)
TAG NO.: CA-56-CE
REF DWG: 302-700

Type and Category - E, 3

Range - 0 - 6,000 ppm

Environmental Qualification - N/A

Seismic Qualification - N/A

Quality Assurance - N/A

Redundancy - N/A

Power Source - N/A

Display - Local Panel

RG 1.97 Position - Complies

**SOURCE:**

0, 5

**REASON:**

To assess magnitude of radioactive releases.

**PARAMETER:**

VARIABLE: PRIMARY COOLANT AND SUMP - CHLORIDE CONTENT (GRAB SAMPLE)
TAG NO.: CA-57-CE
REF DWG: 302-700

Type and Category - E, 3

Range - 0 - 20 ppm

Environmental Qualification - N/A

Seismic Qualification - N/A

Quality Assurance - N/A

Redundancy - N/A

Power Source - N/A

Display - Local Panel

RG 1.97 Position - Complies

**SOURCE:**

0, 5

**REASON:**

To assess the magnitude of radioactive releases.

**PARAMETER:**

VARIABLE: PRIMARY COOLANT AND SUMP - DISSOLVED $H_2$ OR TOTAL GAS (GRAB SAMPLE)
TAG NO.: CA-55-CE
REF DWG: 302-700

Type and Category - E, 3

Range - 0 - 2,000 cc (STP) /KG

Environmental Qualification - N/A

Seismic Qualification - N/A

Quality Assurance - N/A

Redundancy - N/A

Power Source - N/A

Display - Local Panel

RG 1.97 Position - Complies

**SOURCE:**

O, 5

**REASON:**

To assess the magnitude of radioactive releases.

**PARAMETER:**

VARIABLE: PRIMARY COOLANT AND SUMP - DISSOLVED OXYGEN
TAG NO.: N/A
REF DWG: N/A

Type and Category - E, 3

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

RG 1.97 Position - Not Mandatory

**SOURCE:**

O, 5

**REASON:**

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.

**PARAMETER:**

VARIABLE: PRIMARY COOLANT AND SUMP - pH (GRAB SAMPLE)
TAG NO.: CA-56-CE
REF DWG: 302-700

Type and Category - E, 3

Range - 1 - 13

Environmental Qualification - N/A

Seismic Qualification - N/A

Quality Assurance - N/A

Redundancy - N/A

Power Source - N/A

Display - Local Panel

RG 1.97 Position - Complies

**SOURCE:**

O, 5

**REASON:**

To assess the magnitude of radioactive releases.

**PARAMETER:**

VARIABLE: CONTAINMENT AIR - HYDROGEN CONTENT (GRAB SAMPLE)
TAG NO.: WS-10-CR, WS-11-CR
REF DWG: 205-062, WS-01, WS-02

Type and Category - E, 3

Range - 0 - 10%

Environmental Qualification - N/A

Seismic Qualification - N/A

Quality Assurance - N/A

Redundancy - N/A

Power Source - N/A

Display - Local Panel

RG 1.97 Position - Complies

**SOURCE:**

0, 5

**REASON:**

To assess the magnitude of radioactive releases.

**PARAMETER:**

VARIABLE: CONTAINMENT AIR - OXYGEN CONTENT
TAG NO.: N/A
REF DWG: N/A

Type and Category - E, 3

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

RG 1.97 Position - Oxygen content is not required.

**SOURCE:**

O, 5

**REASON:**

The NRC RG 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 not necessary because existing instrumentation provide more direct indication and are better qualified to perform the function of the required variable.

**PARAMETER:**

VARIABLE: CONTAINMENT AIR - GAMMA SPECTRUM
TAG NO.: WS-13-CE
REF DWG: 302-694

Type and Category - E, 3

Range - Isotopic Analysis

Environmental Qualification - N/A

Seismic Qualification - N/A

Quality Assurance - N/A

Redundancy - N/A

Power Source - N/A

Display - Local Panel

RG 1.97 Position - Complies

**SOURCE:**

0, 5

**REASON:**

To assess the magnitude of radioactive releases.

## SOURCE DOCUMENT

0. FPC letter #3F0884-07; 08/21/84
1. FPC letter #3F1185-17; 11/15/85
2. FPC letter #3F0386-11; 03/27/86
3. FPC letter #3F0687-09; 06/12/87
4. FPC letter #3F0188-03; 01/06/88
5. FPC letter #3F0388-18; 03/21/88
6. FPC letter #3F0688-06; 06/08/88
7. FPC letter #3F0988-06; 09/09/88
8. FPC letter #3F1089-26; 10/31/89
9. FPC letter #3F0190-06; 01/10/90
10. NRC letter #3N1085-12; 10/24/85
11. NRC letter #3N0687-12; 06/16/87
12. BWOG RG 1.97 Task Force
13. MAR 82-05-03
14. MAR 82-05-03-17
15. MAR 82-05-03-20
16. MAR 82-05-03-21
17. MAR 82-05-03-24 (Refuel 8)
18. MAR 83-11-14-01
19. MAR 84-08-10
20. MAR 84-08-10-02
21. MAR 84-08-10-04
22. SER 50-302; 01/13/84
23. SRP-6.2.4 - 6F, SRP-6.2.4 - 6J, NUREG-0737
24. FPC letter #3F1289-12; 12/15/89
25. MAR 80-11-17-03
26. MAR 89-10-23-01A
27. MAR 82-05-03-16
28. MAR 82-09-19-02
29. MAR 84-08-10-07
30. MAR 85-10-16-02
31. SER 50-302; 9/6/83
32. EQ 89-2613