Attachment 10

Westinghouse Electric Company WNA-DS-01617-WBT-NP, Revision 4, "Post Accident Monitoring System - System Requirements Specification," Dated February, 2011

Westinghouse

Westinghouse Non-Proprietary Class 3

Nuclear Automation
Watts Bar Unit 2 NSSS Completion Program
I&C Projects

Post Accident Monitoring System-
System Requirements Specification

WNA-DS-01617-WBT-NP
Rev. 4

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REVISION HISTORY

RECORD OF CHANGES

Revision	Author	Description	Completed
1	Digish R. Shah	Added brackets to WNA-DS-01617-WBT, Rev. 1, to indicate proprietary information.	July 2010
2	Digish R. Shah	Added brackets to WNA-DS-01617-WBT, Rev. 2, to indicate proprietary information.	November 2010
3	Digish R. Shah	• Deleted Reference 3 • Updated Acronyms • Revised Reference: 13, 14 • Re-referenced reference 9 throughout the document which was incorrectly referenced as reference 8 • Revised Figures: 2.1-2, 2.5-3 • Revised Tables: 2.5-5, 2.6-1, 2.6-4, 3.2-2 • Moved Tables: 3.2-3 to 3.2-4, 4.3-2 to 4.3-3, 4.3-1 to 4.3-2 • Added Table: 3.2-3 • Added Section 2.5.2.1.3 • Renamed Section 2.6.2.2.4 • Revised Section 4 • Revised Requirements: R2.4-1, R2.5.2.1-1, R2.5.3.4.7-2, R2.5.3.4.7-5, R2.5.3.4.7-6, R2.5.3.4.14-1, R2.5.3.5-11, R2.6.2.2.4-1, R2.6.2.2.20-3, R2.6.2.2.21-3, R2.6.3.3-1 through R2.6.3.3-7, R2.9.5-5, R2.9.5-6, R3.1.1-4, R3.2.3-1, R3.2.3-2, R3.2.3-3, R3.2.3-4, R3.2.3-6, R4.1-1, R4.3.3-1, R4.3.3-3 • Added Requirements: R2.5.2.1.3-1, R2.5.2.1.3-2, R2.5.2.1.3-3, R2.5.2.1.3-4, R2.5.3.4.7-8, R2.7-3, R3.1.1-9, R3.2.1-3, R3.2.3-7, R4.3.3-4, R4.3.3-5 • Corrected Typographical Errors: R2.5.2.1-1, R2.5.2.1-3, R2.5.2.1.1-1, R2.5.2.1.2-1, R2.5.2.1.2-4, R2.5.2.1.2-5, R2.5.3.4.1-6, R2.5.3.2-5, R2.5.3.2-20, R2.5.3.2-21, R2.5.3.4.1.2-3, R2.5.3.4.10-4, R2.5.3.4.20-4, R2.5.3.5-4, R2.6.2-2, R2.6.2.2.19-8, R2.6.2.2.21-3, R2.6.3-2, R2.6.3.1-1, R2.9.5-6, R3.2.2-2, R3.2.3-2, R4.2.2-3, R4.2.2-5, R4.3.1-4, R4.3.2-7, Section 1.3	November 2010

Revision	Author	Description	Completed
		• Deleted R2.6.2.2.5-6 (requirement content moved to R2.6.2.2.4-1) • Moved Requirement: R3.2.3-5 to R3.2.1-3 • Reworded FE switch and SLE switch to FE keyswitch and SLE keyswitch throughout the document for consistency • Reworded references to "SHALL" or "MUST" outside of following requirements: R2.3.1-1, R2.5.3.2-20, R2.5.3.2-11, R2.5.3.2-21, R2.5.3.4.3-2 through R2.5.3.4.3-7, R2.5.3.4.4-2 through R2.5.3.4.4-7, R2.5.3.4.4-2 through R2.5.3.4.4-6, R2.5.3.4.10-3, R2.5.3.4.10-4, R2.5.3.4.10-6, R2.5.3.4.13-4, R2.5.3.4.13-9, R2.5.3.4.19-1, R2.6.2.2.7-2, R2.6.2.2.21-3, R2.6.2.4-1, R2.6.3-2, R2.6.3.1-1, R2.6.3.3-1, R2.6.3.3-2, R2.6.3.3-3, R2.6.3.3-4, R2.6.3.3-7, R2.9.4-3, R3.1.7-4, R3.1.7-5, R3.1.7-6, R3.3.3-1, R4.3.2-7, R4.3.2-8, Table 2.6-4, Section 2.9.4, 3.2, 4.3.2	
4	Digish R. Shah	• Revised Reference Revisions: 1, 2, 16, 17 • Updated Reference 13 and added Reference 21 • Corrected all instances of Reference 9 to provide correct wording for referenced document • Corrected grammatical error in R2.5.2.1-1 and subection 2.5.3.2 • Revised Figure: 2.1-1 and 2.1-2 • Revised R2.5.3.4.7-8, R3.1.7-9, subsection 2.5.2, and Section 4 • Revised R2.5.3.4.14-1, R2.5.3.4.14-3, R2.5.3.4.14-4, R2.5.3.4.18-2, R2.6.2.2-6, and Table 2.6-4 to replace RCP status "Start up" and "Coast Down" with "Starting" and "Coasting down" • Revised R2.5.2.1-2, R2.5.2.1-4, R2.5.2.1-5, R2.5.2.1.1-1, R2.5.2.1.2-1, R2.5.2.1.2-4, R2.5.2.1.3-1, R2.5.2.1.3-3, R2.5.2.2-2, R2.6.2.2.20-6, R2.6.2.20-11, R2.6.3-2, R2.6.3.3-1, R2.6.3.3-2, R2.6.3.3-3, R2.6.3.3-5, R2.6.3.3-7, R2.9.5-3, and R4.3.2-7 to state the keyswitch positions as they appear in the system, i.e., "ENABLE" and "OFF" • Added Requirements: R3.2.3-8, R3.2.3-9	See EDMS

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ACRONYMS AND TRADEMARKS

Acronyms used in the document are defined in WNA-PS-00016-GEN, "Standard Acronyms and Definitions" (Reference 14), or included below to ensure unambiguous understanding of their use within this document.

Acronyms	Definition
AC	Advant® Controller
AI	Analog Input
CET	Core Exit Thermocouple
CETMS	Core Exit Thermocouple Monitoring System
Common Q	Common Qualified Platform
d/p	Differential Pressure
DH	Dynamic Head
DI	Digital Input
DP	Differential Pressure Transducer
EUDH	Expected Uncompensated Dynamic Head
FE	Function Enable
FO	Fiber Optic
FPD	Flat Panel Display
FPDS	Flat Panel Display System
HJTC	Heated Junction Thermocouple
I/O	Input/Output
ICC	Inadequate Core Cooling
ICCMS	Inadequate Core Cooling Monitoring System
INDH	Initial Normalized Dynamic Head
MCB	Main Control Board
MCR	Main Control Room
MTP	Maintenance and Test Panel
NDH	Normalized Dynamic Head
NSSS	Nuclear Steam Supply System
OM	Operator's Module
P.L.S.	Precautions, Limitations and Setpoints
PAMS	Post Accident Monitoring System
PDH	Power Compensated Dynamic Head
PPS	Plant Protection System
P_{SAT}	Saturation Pressure
$PWR_{\Delta T}$	Core Thermal Power
RCP	Reactor Coolant Pump
RCS	Reactor Coolant System
RJT	Reference Junction Temperature
RTD	Resistance Temperature Detector
RVL	Reactor Vessel Level
RVLIS	Reactor Vessel Level Instrumentation System

ACRONYMS AND TRADEMARKS (Cont'd)

Acronyms	Definition
RVLMS	Reactor Vessel Level Monitoring System
SLE	Software Load Enable
SMM	Saturation Margin Monitor
T_{SAT}	Saturation Temperature
UDH	Uncompensated Dynamic Head
VF	Pseudo-Void Fraction

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GLOSSARY OF TERMS

Standard terms used in the document are defined in WNA-PS-00016-GEN, "Standard Acronyms and Definitions" (Reference 14), or included below to ensure unambiguous understanding of their use within this document.

Term	Definitions

None.

REFERENCES

Following is a list of references used throughout this document.

1. WCAP-16097-P-A, Appendix 1, Rev. 0, "Common Qualified Platform Topical Report Post Accident Monitoring Systems," Westinghouse Electric Company LLC.

2. 00000-ICE-30156, Rev. 08, "System Requirements Specification for the Common Q Post Accident Monitoring System," Westinghouse Electric Company LLC.

3. Deleted

4. 00000-ICE-30155, Rev. 09, "System Requirements Specification for the Common Q Generic Flat Panel Display," Westinghouse Electric Company LLC.

5. Regulatory Guide 1.97, Rev. 03, "Instrumentation for Light Water Cooled Nuclear Power Plants to Assess Plant Conditions During and Following an Accident," U.S. Nuclear Regulatory Commission, May 1983.

6. Regulatory Guide 1.180, Rev. 1, "Guidelines for Evaluating Electromagnetic and Radio-Frequency Interference in Safety-Related Instrumentation and Control Systems," U.S. Nuclear Regulatory Commission, October 2003.

7. NUREG-0737, "Clarification of TMI Action Plan Requirements," U.S. Nuclear Regulatory Commission, 1980.

8. Deleted

9. IAPWS-95, "The IAPWS Formulation 1995 for the Thermodynamic Properties of Ordinary Water Substance for General and Scientific Use," The International Association for the Properties of Water and Steam, September 1996.

10. EPRI Topical Report TR-102323 R1, Guidelines for Electromechanical Interference Testing in Power Plants, January 1997.

11. Deleted.

12. 956080, Rev. 1, "Cabinet Mounted Electronics – Inadequate Core Cooling Monitor (ICCM – 86)," Westinghouse Electric Company LLC.

13. WBT-D-2649, Rev. 0, "Revised Westinghouse Comments on TVA Specification EDCR52351," Westinghouse Electric Company LLC.

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14. WNA-PS-00016-GEN, Rev. 5, "Standard Acronyms and Definitions," Westinghouse Electric Company LLC.

15. Deleted

16. WNA-CR-00010-WBT, Rev. 2, "Watts Bar Unit 2 User Configurable Setpoints for the Post Accident Monitoring System," Westinghouse Electric Company LLC.

17. WNA-DS-01070-GEN, Rev. 05, "Application Restrictions for Generic Common Q Qualification," Westinghouse Electric Company LLC.

18. IEEE Standard 323, "IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations," Institute for Electrical and Electronics Engineers, Inc., 1983.

19. IEEE Standard 344, "IEEE Recommended Practices for Seismic Qualification of Class IE Equipment for Nuclear Power Generating Stations," Institute for Electrical and Electronics Engineers, Inc., 1975.

20. IEEE Standard 344, "IEEE Recommended Practices for Seismic Qualification of Class IE Equipment for Nuclear Power Generating Stations," Institute for Electrical and Electronics Engineers, Inc., 1987.

21. EDCR 52351, Attachment B, Rev. 0, "WBN Unit 2 Post Accident Core Monitoring System Requirements Specification," Tennessee Valley Authority.

REQUIREMENTS

Design and/or other requirements have been identified in this document. Following is a list of the requirement numbers and the document page on which the requirement is identified.

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R2.5.3.4.15-1 2-34
R2.5.3.4.15-2 2-34
R2.5.3.4.15-3 2-34
R2.5.3.4.15-4 2-34
R2.5.3.4.15-5 2-34
R2.5.3.4.16-1 2-34
R2.5.3.4.16-2 2-34
R2.5.3.4.17-1 2-34
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R2.5.3.4.17-3 2-35
R2.5.3.4.17-4 2-35
R2.5.3.4.17-5 2-36
R.2.5.3.4.17-6 2-36
R2.5.3.4.17-7 2-36
R2.5.3.4.17-8 2-36
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R2.6.1-4 2-40
R2.6.2-1 2-40
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R2.6.2-3 2-40
R2.6.2-4 2-40
R2.6.2-5 2-40
R2.6.2-6 2-40
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R2.6.2.1-1 2-41
R2.6.2.1-2 2-41
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R2.6.2.2-4 2-42
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R2.6.2.2-10 2-43
R2.6.2.2-11 2-43
R2.6.2.2.1-1 2-49
R2.6.2.2.2-1 2-49
R2.6.2.2.3-1 2-49
R2.6.2.2.4-1 2-49
R2.6.2.2.5-1 2-50
R2.6.2.2.5-2 2-50
R2.6.2.2.5-3 2-50
R2.6.2.2.5-4 2-50
R2.6.2.2.5-5 2-50
R2.6.2.2.6-1 2-52
R2.6.2.2.6-2 2-52
R2.6.2.2.6-3 2-52
R2.6.2.2.6-4 2-52
R2.6.2.2.7-1 2-52
R2.6.2.2.7-2 2-52
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R2.6.2.2.10-1 2-53
R2.6.2.2.10-2 2-53
R2.6.2.2.10-3 2-53
R2.6.2.2.10-4 2-53
R2.6.2.2.10-5 2-53
R2.6.2.2.10-6 2-54
R2.6.2.2.10-7 2-54
R2.6.2.2.11-1 2-54
R2.6.2.2.12-1 2-54
R2.6.2.2.13-1 2-54
R2.6.2.2.14-1 2-54
R2.6.2.2.15-1 2-55
R2.6.2.2.16-1 2-55
R2.6.2.2.16-2 2-55

R2.6.2.2.16-3..... 2-55
R2.6.2.2.17-1..... 2-55
R2.6.2.2.17-2..... 2-55
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R2.6.2.2.18-1..... 2-55
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R2.6.2.2.19-1..... 2-55
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R2.6.2.3-1 2-58
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R2.6.3.1-3 2-63
R2.6.3.1-4 2-63
R2.6.3.1-5 2-63
R2.6.3.1-6 2-63
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R2.6.3.1-16 2-64
R2.6.3.2-1 2-64
R2.6.3.3-1 2-65
R2.6.3.3-2 2-65
R2.6.3.3-3 2-65
R2.6.3.3-4 2-65
R2.6.3.3-5 2-65
R2.6.3.3-6 2-65
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R2.7-1 2-65
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SECTION 1
INTRODUCTION

1.1 PURPOSE

This document defines the functional requirements for the Watts Bar Unit 2 Post Accident Monitoring System (PAMS) based on WCAP-16097-P-A, "Common Qualified Platform Topical Report Post Accident Monitoring System (PAMS), Appendix 1" (Reference 1). The Watts Bar Unit 2 PAMS allows setpoint changes and signal bypasses from both the operator's module (OM) and maintenance and test panel (MTP).

The Watts Bar Unit 2 PAMS requirements have been built upon the generic system requirements for the Common Qualified platform (Common Q) Phase 3 PAMS, 00000-ICE-30156, "System Requirements Specification for the Common Q Post Accident Monitoring System" (Reference 2). Those sections of Reference 2 that require modifications are defined in this document. The Watts Bar Unit 2 PAMS will include the Reactor Vessel Level Instrumentation System (RVLIS) as the vessel level monitoring system. The requirements for the RVLIS are defined in this document.

1.2 SYSTEM SCOPE

The system described in this document is intended to monitor accident conditions and inadequate core cooling (ICC) and provide information and data to the plant monitoring computers for use in its control room display.

The Watts Bar Unit 2 PAMS is comprised of two independent and isolated trains. The instruments used to provide the input signals to the Watts Bar Unit 2 PAMS are not included in the scope of this document. The PAMS includes flat panel displays (FPDs) for the OM and MTP. The generic system requirements for the FPD are provided in 00000-ICE-30155, "System Requirements Specification for the Common Q Generic Flat Panel Display" (Reference 4).

The Watts Bar Unit 2 PAMS is based on the Westinghouse Common Q PAMS standard design. The Watts Bar Unit 2 PAMS includes the following subsystems:

- Saturation Margin Monitor (SMM)
- Core Exit Thermocouple Monitoring System (CETMS)
- Reactor Vessel Level Monitoring System (RVLMS)

The PAMS design bases are as follows:

- Provide safety grade processing and display for ICC instrument signals to detect the approach to, existence of, and recovery from ICC conditions per NUREG-0737, "Clarification of TMI Action Plan Requirements" (Reference 7), Section II.F.2, and Regulatory Guide 1.97, "Instrumentation for Light Water Cooled Nuclear Power Plants to Assess Plant Conditions During and Following an Accident" (Reference 5).

- Provide safety grade processing and display of accident monitoring instrument signals per Reference 5.
- Provide a processing and display system that incorporates human factor engineering techniques to enhance the control room design by displaying essential plant parameters in a systematic and efficient manner per Reference 7, Section I.D.1.
- Provide safety grade isolation of Class 1E data to be provided to non-Class 1E monitoring system(s).

The PAMS requirements herein are also based on the following assumptions:

- Although the PAMS is monitored during normal operation, its primary use is for post-accident conditions following reactor trip and in the presence of decay heat only.
- The event proceeds slowly enough that the operator is allowed sufficient time to observe the instrument displays and take appropriate actions.

1.3 SYSTEM OVERVIEW

The PAMS is a Class 1E safety-related alarm and display system. The Watts Bar Unit 2 PAMS consists of two independent trains of equipment (Trains A and B) which acquire and process two trains of inputs. The trains are physically separated and electrically isolated from each other. Each train of the Watts Bar Unit 2 PAMS is comprised of two Advant® Controller 160 (AC160) racks, a primary rack and an extension rack, located in one cabinet. Figure 2.1-2 shows the typical configuration of the PAMS.

For each train, the Primary AC160 rack contains a processor module that processes the Common Q PAMS algorithms and a communication interface module for communicating data on the AF100 bus. The extension rack extends the primary rack backplane to accommodate additional input/output (I/O) modules. The processor module receives all core exit thermocouple (CET), SMM, and reactor vessel level (RVL) signals from the input modules that are located in the primary and extension racks. The processor performs input processing and algorithms, and sends the outputs to its output cards and over the AF100 to the OM, and the MTP. The MTP has an Ethernet port that provides the capability to send data to the plant computer.

The OM will be mounted in the main control room (MCR) and is used to provide various display pages to the operator. The OM uses the Flat Panel Display System (FPDS), which consists of a PC node box, an FPD with touch screen capability, a standard AF100 communication interface for communication to the processor module.

The OM receives the signals to be displayed over the AF100 from the PAMS processor.

The general relationship of the individual systems for Watts Bar Unit 2 PAMS are described below and provided in Figure 1.3-1.

- The RVLMS monitors reactor vessel head differential pressure, lower range differential pressure, and dynamic range differential pressure to measure reactor coolant level in the vessel.

- The CETMS monitors CET temperatures to detect and alarm ICC conditions.
- The SMM uses the representative CET temperature, Reactor Coolant System (RCS) pressure, and the maximum RCS hot leg temperature to calculate saturation margins.

Each train of Watts Bar Unit 2 PAMS provides the combined functions of the ICCMS (i.e., SMM, CETMS, and RVLMS).

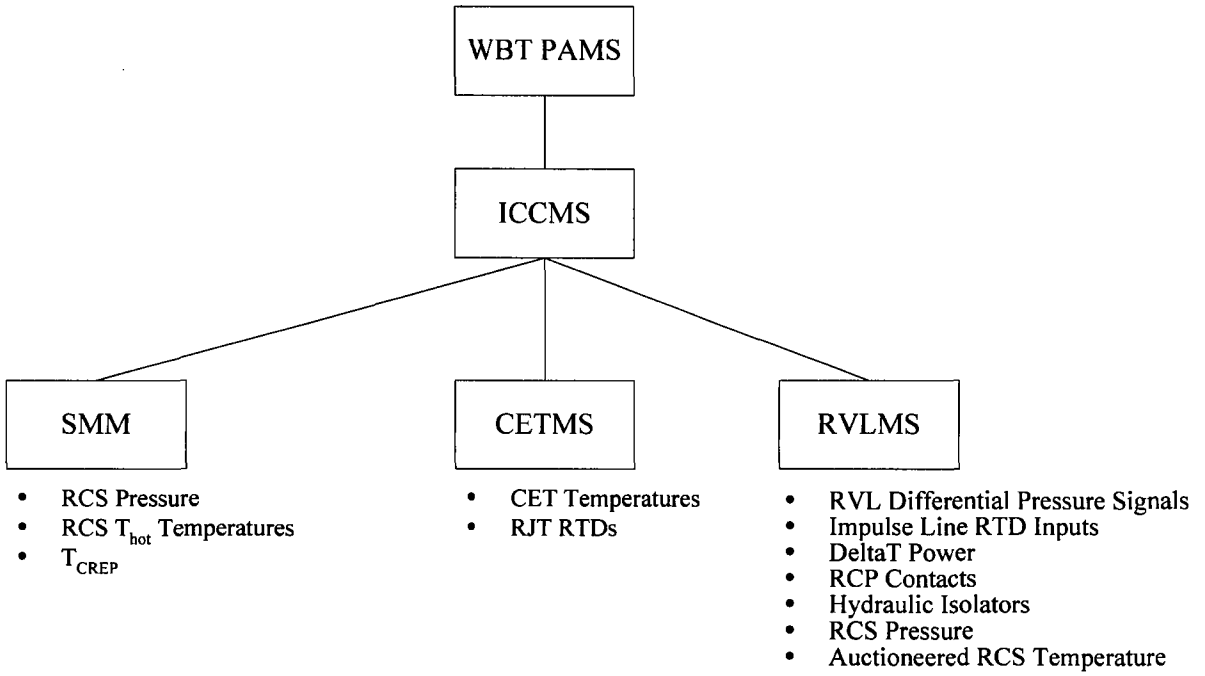

Figure 1.3-1. Relationship of Individual Systems for Watts Bar Unit 2 PAMS

1.3.1 Codes and Standards

The codes and standards to be utilized for the Watts Bar Unit 2 PAMS design are as discussed in the individual sections where they apply.

(Last Page of Section 1)

SECTION 2
GENERAL SYSTEM DESCRIPTION

2.1 SYSTEM CONTEXT

A Watts Bar Unit 2 PAMS block diagram is provided in Figure 2.1-1. The PAMS design is based on Common Q hardware as discussed in this document. A PAMS configuration diagram is shown in Figure 2.1-2. This system requirements specification will contain references to those sections that have the same requirements as Common Q PAMS (Reference 2). Clarifications to those sections that require changes from the Common Q PAMS requirements or have any additional requirements specific to Watts Bar Unit 2 PAMS are fully defined in this document. A detailed discussion of the Watts Bar Unit 2 PAMS interface requirements is provided in Section 4. The requirements for the FPD to be used for the PAMS OM and MTP are provided in Reference 4.

R2.1-1
[A document shall be generated defining the compliance of the Watts Bar Unit 2 PAMS with the requirements of WNA-DS-01070-GEN, "Application Restrictions for Generic Common Q Qualification" (Reference 17).]

2.2 SYSTEM MODES AND STATES

R2.2-1
[The PAMS shall be capable of operation during normal and abnormal environments and plant operating modes.]

Rationale: Requirement to meet RG 1.97 (Reference 5).

2.3 MAJOR SYSTEM CAPABILITIES

2.3.1 Inadequate Core Cooling (ICC) Detection Functions

R2.3.1-1
[The requirements for the ICC functions as defined in Reference 2, Section 2.3.1, shall apply with HJTC functions being replaced with the RVLIS function defined herein.]

Guidance: The Heated junction thermocouple (HJTC) system capabilities are not to be considered for Watts Bar 2 PAMS.

Rationale: The Watts Bar 2 PAMS employs the RVLIS as the reactor water inventory level measuring system instead of the HJTC system.

a,c

Figure 2.1-1. [ ]a,c

a,c

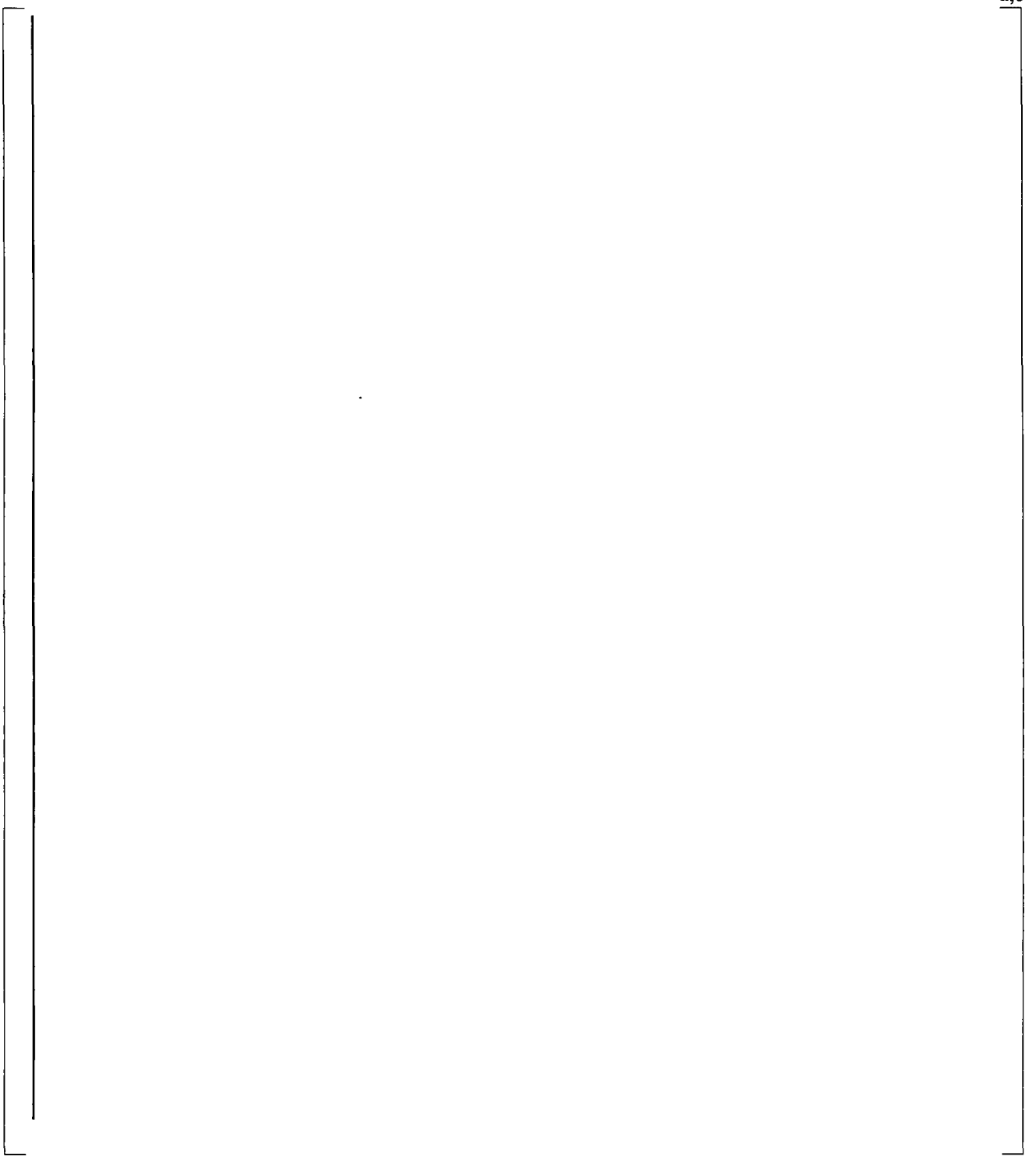

Figure 2.1-2. [ ]a,c

2.3.2 Backup Safety Parameter Display System Functions

The Post Accident Monitoring System displays a minimum set of plant variables from which overall plant safety can be assessed. Only instrumentation of the highest reliability and quality should be used for PAMS.

The PAMS variables may be categorized by the following critical functions:

- RCS Inventory Control
- RCS Pressure Control
- Core Heat Removal
- RCS Heat Removal

The bases used for selecting the parameters to be displayed for each critical function are "emergency procedure guidelines" and Regulatory Guide 1.97 (Reference 5).

The emergency procedure guidelines require certain instrumentation to be used for diagnosing events. These key variables are monitored by the operator to determine what event is taking place, so that he may perform immediate actions and consult the emergency procedures. The guidelines also call for instrumentation to diagnose the accomplishment of plant safety functions. The operator uses these instruments to assess the safe status of the plant, independent of the event or events existing.

Regulatory Guide 1.97 (Reference 5) requires instrumentation to be used to assess plant conditions during and following an accident. Those instruments applicable to the PAMS are those used to determine plant safety status and to indicate the integrity of barriers to radioactive release.

R2.3.2-1
[DELETED]

2.3.3 Test and Maintenance Functions

R2.3.3-1
[The test and maintenance requirements defined in Reference 2, Section 2.3.3, shall apply.]

2.4 PAMS PROGRAM STRUCTURE

R2.4-1 a,c

2.5 MAJOR SYSTEM CONDITIONS

2.5.1 Initialization

R2.5.1-1
[The initialization requirements defined in Reference 2, Section 2.5.1, shall apply.]

2.5.2 Interlocks and Permissives

The MTP is designed with a keyswitch for Function Enable (FE) and a keyswitch for Software Load Enable (SLE). The OM has a FE keyswitch. The keyswitches act as a security measure for inappropriate and/or unauthorized modifications to the system. The FE and SLE keyswitches provide the capabilities as follows:

R2.5.2-1
[DELETED]

2.5.2.1 FE Keyswitch

R2.5.2.1-1 a,c

Guidance: Typically an input signal would not be bypassed unless that input signal has failed. The indication displayed on the OM or MTP when a signal is bypassed is discussed in subsection 2.6.2.4.

R2.5.2.1-2 a,c

R2.5.2.1-3 a,c

R2.5.2.1-4 a,c

R2.5.2.1-5
[The FE keyswitch on the OM and MTP shall be keyed the same.]

Guidance: Keying the FE keyswitches identically will facilitate administrative control to allow only one of the FE keyswitches to be in the "ENABLE" position at a time.

2.5.2.1.1 CET Signal Bypass

R2.5.2.1.1-1 a,c

R2.5.2.1.1-2 a,c

2.5.2.1.2 Process (Analog) Signal Bypass

R2.5.2.1.2-1 a,c

R2.5.2.1.2-2 a,c

R2.5.2.1.2-3 a,c

R2.5.2.1.2-4 a,c

R2.5.2.1.2-5 a,c

2.5.2.1.3 Print Screen Function Access

R2.5.2.1.3-1 a,c

R2.5.2.1.3-2 a,c

R2.5.2.1.3-3 a,c

R2.5.2.1.3-4 a,c

2.5.2.2 Software Load Enable

R2.5.2.-1 a,c

R2.5.2.2-2 a,c

R2.5.2.2-3 a,c

R2.5.2.2-4
[The SLE keyswitch shall be keyed differently from the FE keyswitch.]

2.5.3 Algorithm Implementation

The algorithms to implement the functions for the PAMS are discussed in the following sections.

2.5.3.1 Analog Input Processing

R2.5.3.1-1
[The analog input (AI) processing requirements defined in Reference 2, subsection 2.5.3.1, shall apply.]

R2.5.3.1-2 a,c

R2.5.3.1-3 a,c

R2.5.3.1-4 a,c

2.5.3.2 Saturation Margin Processing

The Common Q PAMS saturation margin function as defined in Reference 2, which includes a calculation of a temperature and pressure saturation margin for RCS and CET temperature and pressure. The Watts Bar 2 PAMS uses this same algorithm. The Watts Bar 2 PAMS implementation uses different process inputs and does not have an upper head saturation margin calculation. This section was copied from Reference 2 with the unused functions removed for clarity purposes only.

R2.5.3.2-1
[The OM and MTP shall display the temperature margin, indicating subcooled or superheated.]

Guidance: This can be accomplished by displaying "SUPERHEATED" or "SUBCOOLED" after the margin value or by subcooled as a positive value and superheated as a negative value.

R2.5.3.2-2
[The OM and MTP shall display the saturation pressure margin, indicating subcooled or superheated.]

Guidance: This can be accomplished by displaying "SUPERHEATED" or "SUBCOOLED" after the margin value or by subcooled as a positive value and superheated as a negative value.

R2.5.3.2-3 a,c

[ ]

Table 2.5-1. [ ]^{a,c}

a,c

R2.5.3.2-4 a,c

[ ]

R2.5.3.2-5 a,c

R2.5.3.2-6 a,c

R2.5.3.2-7 a,c

R2.5.3.2-8

a,c

[ ]

R2.5.3.2-9

a,c

[ ]

R2.5.3.2-10

a,c

[ ]

R2.5.3.2-11

a,c

[ ]

R2.5.3.2-12

a,c

[ ]

R2.5.3.2-13

a,c

[ ]

R2.5.3.2-14

[a,c]

R2.5.3.2-15

[a,c]

Table 2.5-2. [ ]^{a,c}

[a,c

]

R2.5.3.2-16

[a,c]

Table 2.5-3. [ ]^{a,c}

[a,c

]

R2.5.3.2-17

[a,c]

R2.5.3.2-18

[a,c]

R2.5.3.2-19 a,c

R2.5.3.2-20 a,c

R2.5.3.2-21 a,c

2.5.3.3 RVLIS Signal Processing

The following sections provide a description of the RVLIS signal processing requirements. These requirements are based on 956080, "Cabinet Mounted Electronics – Inadequate Core Cooling Monitor (ICCM-86)" Vessel Level Algorithm as defined in Reference 12, Section 6.4.

R2.5.3.3-1 a,c

R2.5.3.3-2 a,c

R2.5.3.3-3 a,c

R2.5.3.3-4 a,c

Table 2.5-4. [ ][a,c]

a,c

R2.5.3.3-5 a,c

R2.5.3.3-6 a,c

R2.5.3.3-7 a,c

R2.5.3.3-8 a,c

R2.5.3.3-9 a,c

R2.5.3.3-10 a,c

R2.5.3.3-11 a,c

R2.5.3.3-12 a,c

R2.5.3.3-13 a,c

R2.5.3.3-14 a,c

R2.5.3.3-15 a,c

R2.5.3.3-16

a,c

[

]

R2.5.3.3-17

a,c

[

]

a,c

[

]

Figure 2.5-1. [ ]^{a,c}

a,c

Figure 2.5-2. [ ][a,c]

2.5.3.4 Reactor Level Determination

a,c

[ ]

a,c

R2.5.3.4-1

[ ]

a,c

R2.5.3.4-2

[ ]

2.5.3.4.1 Calculation of Fluid Densities (Fourth Order Polynomial Curve Fits)

a,c

R2.5.3.4.1-1

[ ]

a,c

[ ]

R2.5.3.4.1-2 a,c [ ]

R2.5.3.4.1-3 a,c [ ]

R2.5.3.4.1-4 a,c [ ]

R2.5.3.4.1-5 a,c [ ]

R2.5.3.4.1-6 a,c [ ]

2.5.3.4.2 Summation of Reference Leg Density Corrections

R2.5.3.4.2-1 a,c

[ ]

R2.5.3.4.2-2 a,c

[ ]

R2.5.3.4.2-3 a,c

[ ]

R2.5.3.4.2-4 a,c

[ ]

R2.5.3.4.2-5 a,c

[ ]

2.5.3.4.3 Vessel Liquid Density Calculation

R2.5.3.4.3-1 a,c

[ ]

R2.5.3.4.3-2 a,c

[ ]

R2.5.3.4.3-3 a,c

[ ]

R2.5.3.4.3-4 a,c

[ ]

R2.5.3.4.3-5 a,c

[ ]

R2.5.3.4.3-6 a,c

[ ]

R2.5.3.4.3-7 a,c

[ ]

2.5.3.4.4 Vessel Vapor Density Calculation

R2.5.3.4.4-1 a,c

[ ]

R2.5.3.4.4-2 a,c

[ ]

R2.5.3.4.4-3 a,c

[ ]

R2.5.3.4.4-4 a,c

[ ]

R2.5.3.4.4-5 a,c

[ ]

R2.5.3.4.4-6 a,c

[ ]

R2.5.3.4.4-7 a,c

[ ]

2.5.3.4.5 Auctioneered High RCS Hot Leg Temperature

R2.5.3.4.5-1 a,c

[ ]

R2.5.3.4.5-2 a,c

[ ]

R2.5.3.4.5-3 a,c

[ ]

R2.5.3.4.5-4 a,c

[ ]

R2.5.3.4.5-5 a,c

[ ]

R2.5.3.4.5-6 a,c

[ ]

2.5.3.4.6 Algorithm for Upper Range Level and Lower Level Calculations

R2.5.3.4.6-1 a,c

[ ]

R2.5.3.4.6-2 a,c

[ ]

R2.5.3.4.6-3 a,c

[ ]

R2.5.3.4.6-4 a,c

[ ]

R2.5.3.4.6-5 a,c

[ ]

2.5.3.4.7 Static Mode Cross-Over

R2.5.3.4.7-1 a,c

R2.5.3.4.7-2 a,c

R2.5.3.4.7-3 a,c

R2.5.3.4.7-4 a,c

R2.5.3.4.7-5 a,c

R2.5.3.4.7-6 a,c

R2.5.3.4.7-7 a,c

R2.5.3.4.7-8 a,c

a,c

a,c

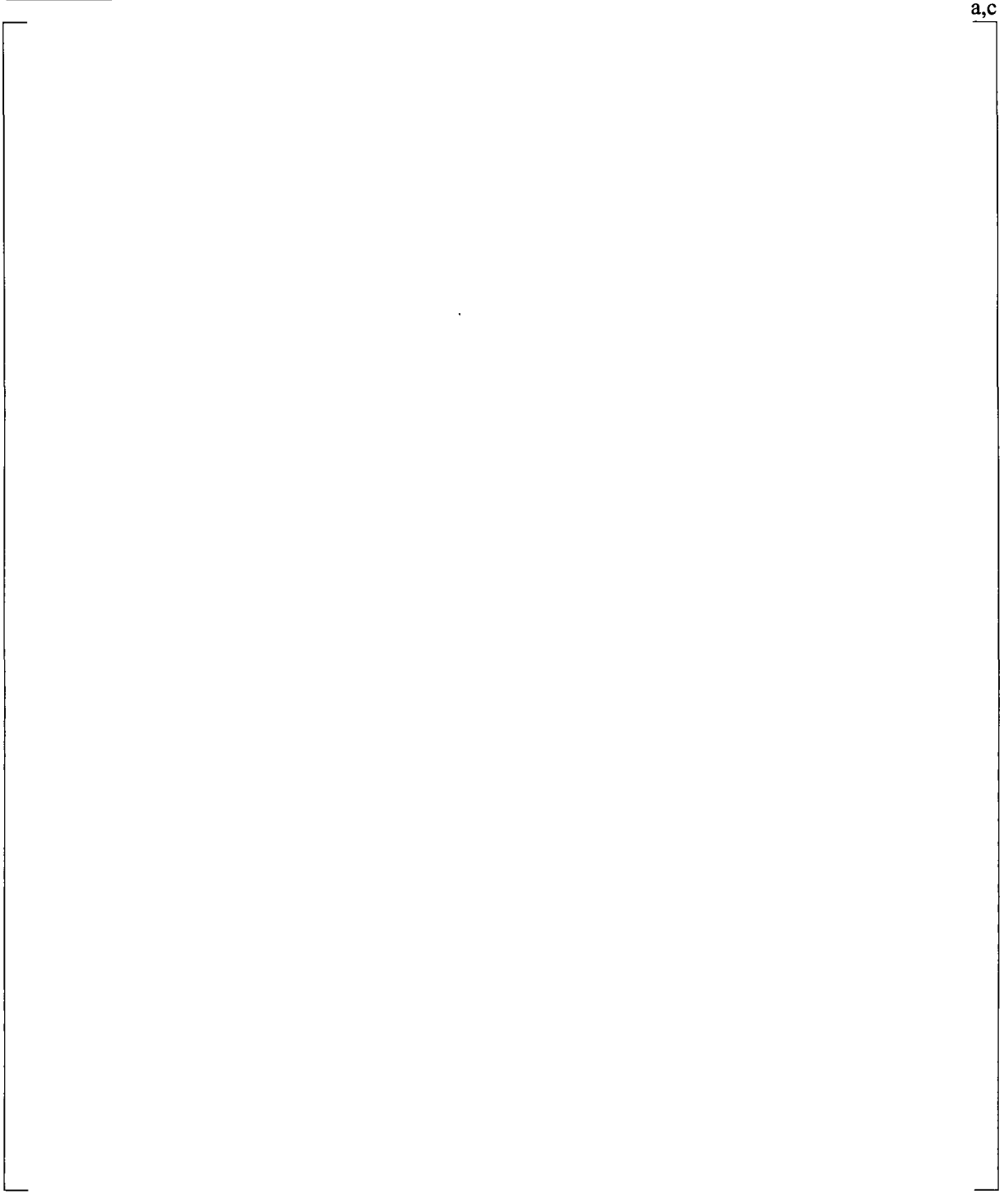

Figure 2.5-3. [ ][a,c]

2.5.3.4.8 Hydraulic Isolator Status Inputs

[a,c]

R2.5.3.4.8-1 [a,c]

R2.5.3.4.8-2 a,c [ ]

R2.5.3.4.8-3 [a,c]

2.5.3.4.9 Pump Status Inputs

R2.5.3.4.9-1 [a,c]

R2.5.3.4.9-2 [a,c]

R2.5.3.4.9-3 [a,c]

R2.5.3.4.9-4 [a,c]

2.5.3.4.10 Algorithm for the Expected Uncompensated Dynamic Head (EUDH) Calculation

R2.5.3.4.10-1 a,c

R2.5.3.4.10-2 a,c

R2.5.3.4.10-3 a,c

R2.5.3.4.10-4 a,c

R2.5.3.4.10-5 a,c

R2.5.3.4.10-6 a,c

2.5.3.4.11 Algorithm for Uncompensated Dynamic Head (UDH) Calculation

R2.5.3.4.11-1 a,c

R2.5.3.4.11-2 a,c

R2.5.3.4.11-3 a,c

R2.5.3.4.11-4 a,c

R2.5.3.4.11-5 a,c

2.5.3.4.12 Algorithm for Power Compensated Head (PDH) Calculation

R2.5.3.4.12-1 a,c

R2.5.3.4.12-2 a,c

R2.5.3.4.12-3 a,c

R2.5.3.4.12-4 a,c

R2.5.3.4.12-5 a,c

R2.5.3.4.12-6 a,c

2.5.3.4.13 Algorithm for NDH Calculation

R2.5.3.4.13-1 a,c

R2.5.3.4.13-2 a,c

R2.5.3.4.13-3 a,c

R2.5.3.4.13-4 a,c

R2.5.3.4.13-5 a,c

Table 2.5-5. [ ]a,c

a,c

R2.5.3.4.13-6 a,c

[ ]

R2.5.3.4.13-7 a,c

[ ]

Table 2.5-6. [ ][a,c]

a,c

R2.5.3.4.13-8 a,c

[ ]

a,c

[

]

R2.5.3.4.13-9 a,c

[

]

Table 2.5-7. [ ][a,c]

a,c

2.5.3.4.14 RVLIS Inaccuracy Period during RCP Starting up and Coasting Down

R2.5.3.4.14-1 a,c

[

]

R2.5.3.4.14-2 a,c

[ ]

R2.5.3.4.14-3 a,c

[ ]

R2.5.3.4.14-4 a,c

[ ]

2.5.3.4.15 Scaling of RVLIS Level Values

R2.5.3.4.15-1 a,c

[ ]

R2.5.3.4.15-2 a,c

[ ]

R2.5.3.4.15-3 a,c

[ ]

R2.5.3.4.15-4 a,c

[ ]

R2.5.3.4.15-5 a,c

[ ]

2.5.3.4.16 Off Scale Calculated Values

R2.5.3.4.16-1 a,c

[ ]

R2.5.3.4.16-2 a,c

[ ]

2.5.3.4.17 RVLIS Setpoints

R2.5.3.4.17-1 a,c

[ ]

R2.5.3.4.17-2 a,c

[ ]

a,c

[ ]

R2.5.3.4.17-3

a,c

[ ]

R2.5.3.4.17-4

a,c

[ ]

a,c

[ ]

R2.5.3.4.17-5 a,c

[ ]

R.2.5.3.4.17-6 a,c

[ ]

R2.5.3.4.17-7 a,c

[ ]

R2.5.3.4.17-8 a,c

[ ]

2.5.3.4.18 Reactor Vessel Level Monitoring

R2.5.3.4.18-1 a,c

[ ]

R2.5.3.4.18-2 a,c

R2.5.3.4.18-3 a,c

R2.5.3.4.18-4 a,c

R2.5.3.4.18-5 a,c

R2.5.3.4.18-6 a,c

R2.5.3.4.18-7 a,c

R2.5.3.4.18-8 a,c

2.5.3.4.19 RVLIS Constants

R2.5.3.4.19-1 a,c

R2.5.3.4.19-2 a,c

R2.5.3.4.19-3 a,c

R2.5.3.4.19-4 a,c

R2.5.3.4.19-5 a,c

R2.5.3.4.19-6 a,c

2.5.3.4.20 RVLIS Capillary RTDs

R2.5.3.4.20-1 a,c

R2.5.3.4.20-2 a,c

R2.5.3.4.20-3 a,c

R2.5.3.4.20-4 a,c

2.5.3.5 CET Processing Function

R2.5.3.5-1 a,c

R2.5.3.5-2 a,c

R2.5.3.5-3 a,c

R2.5.3.5-4 a,c

[ ] a,c

R2.5.3.5-5

[ ] a,c

R2.5.3.5-6

[ ] a,c

R2.5.3.5-7

[ ] a,c

R2.5.3.5-8

[ ] a,c

R2.5.3.5-9

[ ] a,c

R2.5.3.5-10

[ ] a,c

R2.5.3.5-11

[ ] a,c

2.6 PAMS DISPLAY

PAMS displays are provided on the OM and the MTP. The OM and MTP are described in the following sections. Specifications for the generic FPDS are provided in Reference 4.

2.6.1 Operator Interface

R2.6.1-1
[Digital output alarms shall be used to alert the operator that setpoints for minimum subcooled margins, high representative CET temperature, or minimum reactor vessel are being exceeded, or that PAMS problems/troubles are occurring.]

R2.6.1-2
[Analog outputs shall provide information on subcooled margins, CET temperatures, and the RVL which can be monitored by the operator.]

R2.6.1-3
[The OM shall provide human engineered displays of all PAMS information including visual alarms and indications.]

R2.6.1-4
[The MTP shall provide a technician interface for maintenance and test functions.]

2.6.2 OM

R2.6.2-1
[The OM shall be located in the Watts Bar Unit 2 control room panel.]

R2.6.2-2 a,c

R2.6.2-3 a,c

R2.6.2-4
[The OM hardware shall consist of a subset of the hardware as defined by Reference 4.]

R2.6.2-5
[The OM shall consist of a PC node box and a flat panel monitor.]

R2.6.2-6 a,c

R2.6.2-7 a,c

R2.6.2-8 a,c

R2.6.2-9 a,c

R2.6.2-10 a,c

R2.6.2-11 a,c

2.6.2.1 OM Display

R2.6.2.1-1
[The OM display shall contain the following display pages:

1. A directory page with listing for core pages, RCS pages, trend menu pages, system status pages, setpoints and bypass pages, and functional tests and modify timeout/modify default pages.
2. A scrollable system event list page capable of listing all active/current database points with a failed status.
3. A scrollable alarm list page capable of listing all active/current alarms.
4. A scrollable setpoint display that provides a listing of the system setpoints and allows for modification of the setpoints.
5. A scrollable bypass display that provides a listing of signals that can be bypassed and the status of the bypassed signals.
6. A scrollable system event log display that provides a listing of at least the 30 failed database points.
7. A scrollable alarm log display that provides at least the last 30 alarms.
8. An FPD status list page containing at least the last 100 status and diagnostics messages generated by the FPD.]

R2.6.2.1-2 a,c

R2.6.2.1-3 a,c

R2.6.2.1-4 a,c

R2.6.2.1-5 a,c

R2.6.2.1-6 a,c

R2.6.2.1-7 a,c

R2.6.2.1-8 a,c

R2.6.2.1-9 a,c

R2.6.2.1-10 a,c

2.6.2.2 OM Display Architecture

R2.6.2.2-1 a,c

R2.6.2.2-2 a,c

R2.6.2.2-3 a,c

R2.6.2.2-4 a,c

R2.6.2.2-5 a,c

R2.6.2.2-6 a,c

R2.6.2.2-7 a,c

R2.6.2.2-8 a,c

R2.6.2.2-9 a,c

R2.6.2.2-10 a,c

R2.6.2.2-11 a,c

Table 2.6-1. [ ]a,c

a,c

Table 2.6-1. [ ]a,c

a,c

Table 2.6-2. [ ]^{a,c}

a,c

Table 2.6-3. [ ]^{a,c}

a,c

Table 2.6-4. [ ]a,c

a,c

2.6.2.2.1 Core Summary Page

R2.6.2.2.1-1 a,c

2.6.2.2.2 ICC Summary Page

R2.6.2.2.2-1 a,c

2.6.2.2.3 Saturation Margin Page

R2.6.2.2.3-1 a,c

2.6.2.2.4 Core Exit Thermocouples Page

R2.6.2.2.4-1 a,c

2.6.2.2.5 Core Map Page

R2.6.2.2.5-1 a,c

R2.6.2.2.5-2 a,c

R2.6.2.2.5-3 a,c

R2.6.2.2.5-4 a,c

R2.6.2.2.5-5 a,c

a,c

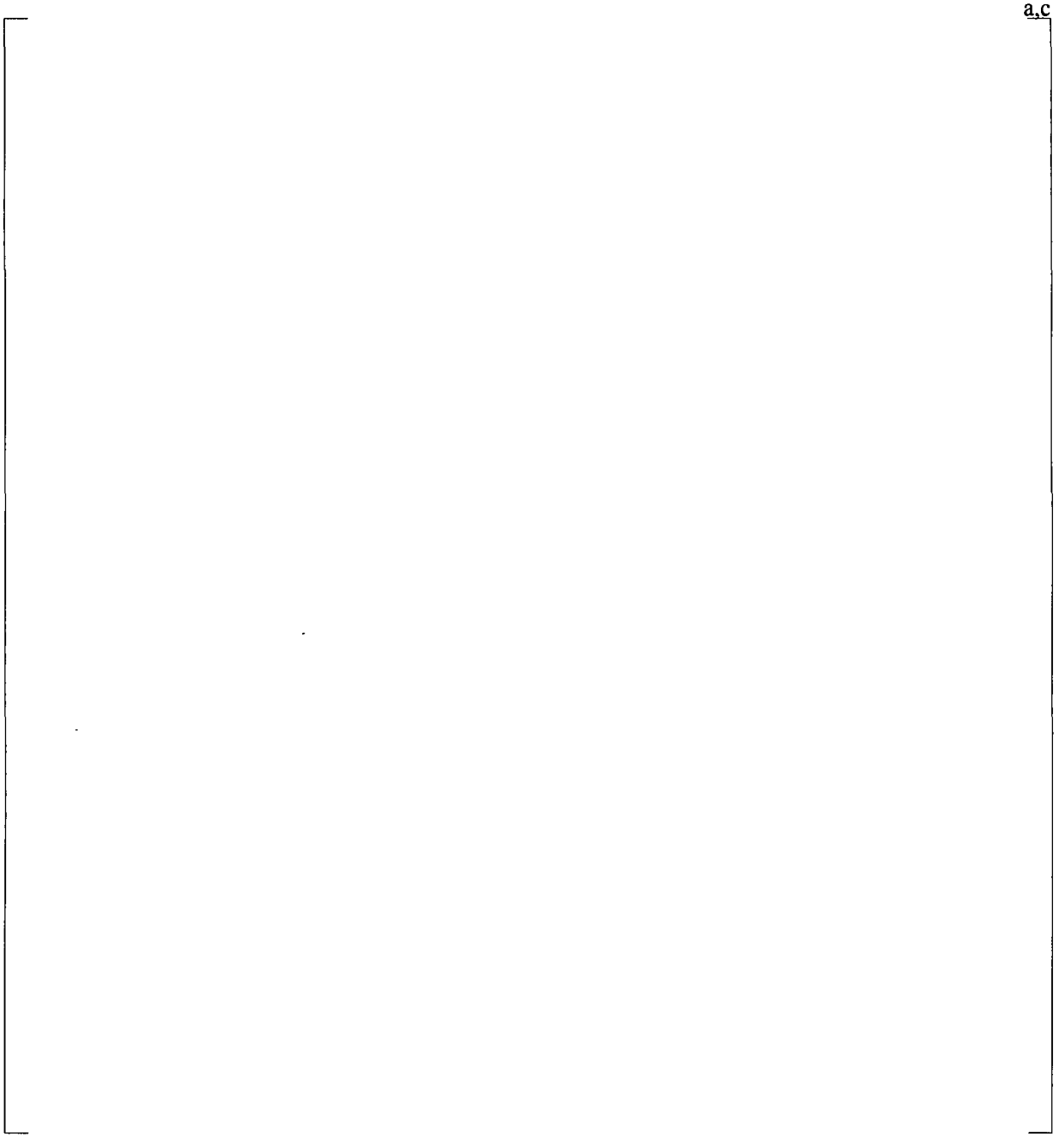

Figure 2.6-1. [ ]a,c

2.6.2.2.6 Reactor Vessel Level Page

R2.6.2.2.6-1 a,c

R2.6.2.2.6-2 a,c

R2.6.2.2.6-3 a,c

R2.6.2.2.6-4 a,c

2.6.2.2.7 Level Bar Graphs

R2.6.2.2.7-1 a,c

R2.6.2.2.7-2 a,c

R2.6.2.2.7-3 a,c

2.6.2.2.8 Reactor Vessel Level Sensors

R2.6.2.2.8-1 a,c

2.6.2.2.9 RCS Page

R2.6.2.2.9-1 a,c

[ ]

R2.6.2.2.9-2 a,c

[ ]

2.6.2.2.10 Trends Page

R2.6.2.2.10-1 a,c

[ ]

R2.6.2.2.10-2 a,c

[ ]

R2.6.2.2.10-3 a,c

[ ]

R2.6.2.2.10-4 a,c

[ ]

R2.6.2.2.10-5 a,c

[ ]

a,c

[ ]

R2.6.2.2.10-6 a,c

[ ]

R2.6.2.2.10-7 a,c

[ ]

2.6.2.2.11 System Event List Page

R2.6.2.2.11-1 a,c

[ ]

2.6.2.2.12 System Event Log Page

R2.6.2.2.12-1 a,c

[ ]

2.6.2.2.13 FPD Status List Page

R2.6.2.2.13-1 a,c

[ ]

2.6.2.2.14 Alarm List Page

R2.6.2.2.14-1 a,c

[ ]

2.6.2.2.15 Alarm Log Page

R2.6.2.2.15-1 a,c

[ ]

2.6.2.2.16 System Health Page

R2.6.2.2.16-1 a,c

[ ]

R2.6.2.2.16-2 a,c

[ ]

2.6.2.2.16.1 CRC and System Information

R2.6.2.2.16-3 a,c

[ ]

2.6.2.2.17 Setpoint Display Page

R2.6.2.2.17-1 a,c

[ ]

R2.6.2.2.17-2 a,c

[ ]

R2.6.2.2.17-3 a,c

[ ]

2.6.2.2.18 Bypass Display Page

R2.6.2.2.18-1 a,c

[ ]

R2.6.2.2.18-2 a,c

[ ]

2.6.2.2.19 Functional Test Page

R2.6.2.2.19-1 a,c

[ ]

R2.6.2.2.19-2 a,c

R2.6.2.2.19-3 a,c

R2.6.2.2.19-4 a,c

R2.6.2.2.19-5 a,c

R2.6.2.2.19-6 a,c

R2.6.2.2.19-7 a,c

R2.6.2.2.19-8 a,c

R2.6.2.2.19-9 a,c

R2.6.2.2.19-10 a,c

R2.6.2.2.19-11 a,c

2.6.2.2.20 Maintenance Page

R2.6.2.2.20-1 a,c

R2.6.2.2.20-2 a,c

R2.6.2.2.20-3 a,c

R2.6.2.2.20-4 a,c

R2.6.2.2.20-5 a,c

R2.6.2.2.20-6 a,c

R2.6.2.2.20-7 a,c

R2.6.2.2.20-8 a,c

R2.6.2.2.20-9 a,c

R2.6.2.2.20-10 a,c

R2.6.2.2.20-11 a,c

2.6.2.2.21 Modify Timeout/Modify Default Page

R2.6.2.2.21-1 a,c

R2.6.2.2.21-2 a,c

R2.6.2.2.21-3 a,c

R2.6.2.2.21-4 a,c

R2.6.2.2.21-5 a,c

2.6.2.3 Display Navigation

R2.6.2.3-1 a,c

2.6.2.4 OM Display Alarm Handling

R2.6.2.4-1 a,c

[ ]

2.6.2.5 Operator Inputs to the OM

R2.6.2.5-1 a,c

[ ]

Table 2.6-5. [ ][a,c]

a,c

Table 2.6-5. [ ][a,c]

a,c

Table 2.6-6. [ ]^{a,c}

a,c

Table 2.6-7. [ ]^{a,c}

a,c

2.6.3 MTP

R2.6.3-1

a,c

R2.6.3-2

a,c

R2.6.3-3

a,c

R2.6.3-4

a,c

2.6.3.1 MTP Display

R2.6.3.1-1

a,c

R2.6.3.1-2

a,c

R2.6.3.1-3

a,c

R2.6.3.1-4

a,c

R2.6.3.1-5

a,c

R2.6.3.1-6

a,c

R2.6.3.1-7 a,c

R2.6.3.1-8 a,c

R2.6.3.1-9 a,c

R2.6.3.1-10 a,c

R2.6.3.1-11 a,c

R2.6.3.1-12 a,c

R2.6.3.1-13 a,c

R2.6.3.1-14 a,c

R2.6.3.1-15 a,c

R2.6.3.1-16 a,c

2.6.3.2 Operator/Technician Inputs to the MTP or OM

R2.6.3.2-1 a,c

2.6.3.3 Surveillance Tests and Diagnostics

R2.6.3.3-1 a,c

R2.6.3.3-2 a,c

R2.6.3.3-3 a,c

R2.6.3.3-4 a,c

R2.6.3.3-5 a,c

R2.6.3.3-6 a,c

R2.6.3.3-7 a,c

2.7 MAJOR SYSTEM CONSTRAINTS

R2.7-1 a,c

R2.7-2 a,c

R2.7-3 a,c

2.8 USER CHARACTERISTICS

R2.8-1 a,c

2.9 PAMS DIAGNOSTIC FUNCTION

R2.9-1 a,c

2.9.1 Communications Interface Diagnostics

R2.9.1-1 a,c

2.9.2 Input/Output (I/O) Diagnostics

R2.9.2-1 a,c

R2.9.2-2 a,c

Table 2.9-1. [ ]a,c

a,c

R2.9.2-3

a,c

R2.9.2-4

a,c

R2.9.2-5

a,c

2.9.3 System Load Calculation

R2.9.3-1

a,c

2.9.4 Response to Loss and Restoration of Power

All system components should have a designed response to the loss and restoration of power. Loss of power is defined as the loss of the AC source supplying each system component. Restoration of power refers to one or both AC sources becoming available to power the system component.

R2.9.4-1 a,c

R2.9.4-2 a,c

R2.9.4-3 a,c

R2.9.4-4 a,c

R2.9.4-5 a,c

R2.9.4-6 a,c

2.9.5 Cabinet Temperature

a,c

R2.9.5-1 a,c

R2.9.5-2 a,c

R2.9.5-3 a,c

a,c

[ ]

R2.9.5-4 a,c

[ ]

R2.9.5-5 a,c

[ ]

R2.9.5-6 a,c

[ ]

2.10 PAMS DATA TRANSFER

R2.10-1 a,c

[ ]

2.10.1 Process Data Transfer

R2.10.1-1 a,c

[ ]

(Last Page of Section 2)

SECTION 3
SYSTEM CAPABILITIES, CONDITIONS, AND CONSTRAINTS

3.1 PHYSICAL

3.1.1 Construction

R3.1.1-1
[The PAMS train cabinets shall be located in a restricted access and environmentally suitable area such as the MCR.]

R3.1.1-2
[Access to the cabinets shall normally be required during system testing, calibration, or maintenance.]

R3.1.1-3 a,c

R3.1.1-4 a,c

R3.1.1-5 a,c

R3.1.1-6 a,c

R3.1.1-7 a,c

R3.1.1-8 a,c

R3.1.1-9
[The Watts Bar Unit 2 PAMS field terminal blocks shall be configured such that all field terminations are made on one side of the terminal blocks.]

3.1.2 Single Failure Requirements

R3.1.2-1 a,c

R3.1.2-2 a,c

3.1.3 Separation Requirements

R3.1.3-1 a,c

3.1.4 Signal Isolation

R3.1.4-1 a,c

3.1.5 Cable Routing

R3.1.5-1 a,c

3.1.6 System Security

R3.1.6-1 a,c

3.1.7 Qualification Requirements

3.1.7.1 Environmental Qualification

R3.1.7-1 a,c

3.1.7.2 Seismic Qualification

R3.1.7-2 a,c

3.1.7.3 Electromagnetic Capability Qualification

R3.1.7-3 a,c

3.1.7.4 Qualification Documentation

R3.1.7-4 a,c

[ ]

R3.1.7-5 a,c

[ ]

R3.1.7-6 a,c

[ ]

R3.1.7-7 a,c

[ ]

R3.1.7-8 a,c

[ ]

R3.1.7-9 a,c

[ ]

R3.1.7-10 a,c

[ ]

a,c

[

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Table 3.1-1. [ ]a,c

a,c

[

]

Table 3.1-2. [ ]a,c

a,c

[

]

3.2 SYSTEM PERFORMANCE CHARACTERISTICS

Accuracy requirements sd be defined for system errors for each type of input, for conversions (input and fluid property calculations), for calculated variables, and for display resolution during normal and abnormal operating conditions. The accuracies and resolution for the PAMS should be demonstrated by calculation and testing to meet or exceed the plant specific requirements for Watts Bar Unit 2. The accuracy and resolution are documented in Section 3.2.1.

3.2.1 Accuracy Requirements

R3.2.1-1 a,c

R3.2.1-2 a,c

R3.2.1-3 a,c

3.2.2 System Response Times

R3.2.2-1 a,c

R3.2.2-2 a,c

3.2.3 Display Resolution Requirements

a,c

R3.2.3-1 a,c

Table 3.2-1. [ ]^{a,c}

a,c

R3.2.3-2

a,c

Table 3.2-2. [ ]^{a,c}

a,c

R3.2.3-3

a,c

R3.2.3-4

a,c

Table 3.2-3. [ ]^{a,c}

a,c

R3.2.3-5 a,c

R3.2.3-6 a,c

Table 3.2-4. [ ]^{a,c}

a,c

R3.2.3-7 a,c

R3.2.3-8 a,c

R3.2.3-9 a,c

3.3 SYSTEM OPERATIONS

3.3.1 System Testing, Calibration, and Maintenance

R3.3.1-1 a,c

3.3.2 System Reliability

R3.3.2-1 a,c

R3.3.2-2 a,c

3.3.3 Availability Requirements

R3.3.3-1 a,c

(Last Page of Section 3)

SECTION 4
SYSTEM INTERFACES

The Common Q PAMS is required to interface with the plant equipment and signals as defined in Reference 2.

Each PAMS train cabinet housing the respective PAMS processor and MTP, interfaces with the following equipment:

- Plant Process Instrumentation Cabinet, Plant Protective Cabinet, or Plant Protection System (PPS) – Each PAMS train obtains signals for each safety-related plant input parameter from one or more of these sources.
- Vital Bus Power Supply System – Each PAMS train cabinet receives 120 Vac power from separate vital buses.
- Plant Annunciator System (PAS) – Each PAMS train provides alarm outputs, which may be provided to the PAS.
- Main Control Board (MCB) – Each PAMS train provides an OM for MCB displays.
- Plant computer – Each PAMS train has an MTP mounted in the respective train cabinet. The MTP provides a fiber optically isolated data link to the plant computer.

4.1 PAMS POWER INTERFACE REQUIREMENTS

R4.1-1 a,c

[ ]

4.2 PAMS INPUT SIGNALS

The PAMS inputs include the inputs required to support the ICC detection function (i.e., the combined CETMS/RVLIS/ICCMS/SMM).

R4.2-1 a,c

[ ]

R4.2-2 a,c

R4.2-3 a,c

4.2.1 Analog Input Signals

a,c

R4.2.1-1 a,c

R4.2.1-2 a,c

R4.2.1-3 a,c

R4.2.1-4 a,c

R4.2.1-5 a,c

4.2.2 PAMS Digital Inputs

The digital inputs provide indications for plant system actuations and for test and maintenance functions. The PAMS algorithms also process these inputs to provide output indications to plant operations.

R4.2.2-1 a,c

R4.2.2-2 a,c

R4.2.2-3 a,c

R4.2.2-4 a,c

R4.2.2-5 a,c

R4.2.2-6 a,c

4.3 PAMS OUTPUT SIGNALS

The two PAMS trains process the channel inputs so as to provide ICC condition monitoring, including RVL monitoring, and provide the following outputs in each train:

- Analog outputs
- Digital outputs
- Data link outputs

4.3.1 Analog Output Signals

The analog outputs provide information on ICC conditions, RVL, and temperatures which can be monitored by the operator. These outputs may be used to trend conditions in the reactor and provide the operator with sufficient time to take appropriate actions to avoid ICC conditions or core uncovering.

R4.3.1-1 a,c

R4.3.1-2 a,c

R4.3.1-3 a,c

R4.3.1-4 a,c

R4.3.1-5 a,c

Table 4.3-1. [ ]a,c

a,c

4.3.2 Digital Output Signals

The digital outputs provide alarms for indication on the plant annunciators and are monitored by operators. These indications provide warnings that a setpoint for minimum RVL are being exceeded and that PAMS problems and/or troubles are occurring. The operator then knows appropriate actions should be implemented to avoid ICC conditions, core uncovering, or further PAMS problems.

R4.3.2-1 a,c

R4.3.2-2 a,c

R4.3.2-3 a,c

R4.3.2-4 a,c

R4.3.2-5 a,c

R4.3.2-6 a,c

R4.3.2-7 a,c

R4.3.2-8 a,c

a,c

[

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a,c

Table 4.3-2. [ ]a,c

a,c

4.3.3 Data Links

R4.3.3-1 a,c

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R4.3.3-2 a,c

[

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R4.3.3-3 a,c

[

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R4.3.3-4 a,c

[

]

R4.3.3-5 a,c

[

]

Table 4.3-3. [ ]a,c

a,c

[

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Table 4.3-3. [ ]a,c

a,c

4.4 BYPASSES

R4.4-1 a,c

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4.4.1 PAMS Watchdog Timer

R4.4.1-1 a,c

[ ]

(Last Page of Section 4)

TVA Letter Dated February 25, 2011

Attachment 11

Westinghouse Electric Company CAW-11-3107, Application for Withholding Proprietary Information from Public Disclosure, WNA-DS-01617-WBT-P, Revision 4, "Nuclear Automation Watts Bar 2 NSSS Completion Program I&C Projects, Post Accident Monitoring System - System Requirements Specification" (Proprietary), Dated February 10, 2011

Westinghouse Electric Company
Nuclear Services
1000 Westinghouse Drive
Cranberry Township, Pennsylvania 16066
USA

U.S. Nuclear Regulatory Commission
Document Control Desk
11555 Rockville Pike
Rockville, MD 20852

Direct tel: (412) 374-4643
Direct fax: (724) 720-0754
e-mail: greshaja@westinghouse.com
Proj letter: WBT-D-2914

CAW-11-3107

February 10, 2011

APPLICATION FOR WITHHOLDING PROPRIETARY INFORMATION FROM PUBLIC DISCLOSURE

Subject: WNA-DS-01617-WBT-P, Rev. 4, "Nuclear Automation Watts Bar Unit 2 NSSS Completion Program I&C Projects, Post Accident Monitoring System – System Requirements Specification" (Proprietary)

The proprietary information for which withholding is being requested in the above-referenced report is further identified in Affidavit CAW-11-3107 signed by the owner of the proprietary information, Westinghouse Electric Company LLC. The affidavit, which accompanies this letter, sets forth the basis on which the information may be withheld from public disclosure by the Commission and addresses with specificity the considerations listed in paragraph (b)(4) of 10 CFR Section 2.390 of the Commission's regulations.

Accordingly, this letter authorizes the utilization of the accompanying affidavit by Tennessee Valley Authority.

Correspondence with respect to the proprietary aspects of the application for withholding or the Westinghouse affidavit should reference this letter, CAW-11-3107, and should be addressed to J. A. Gresham, Manager, Regulatory Compliance, Westinghouse Electric Company LLC, Suite 428, 1000 Westinghouse Drive, Cranberry Township, Pennsylvania 16066.

Very truly yours,

J. A. Gresham, Manager
Regulatory Compliance

Enclosures

CAW-11-3107

AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

ss

COUNTY OF BUTLER:

Before me, the undersigned authority, personally appeared J. A. Gresham, who, being by me duly sworn according to law, deposes and says that he is authorized to execute this Affidavit on behalf of Westinghouse Electric Company LLC (Westinghouse), and that the averments of fact set forth in this Affidavit are true and correct to the best of his knowledge, information, and belief:

J. A. Gresham, Manager
Regulatory Compliance

Sworn to and subscribed before me
this 10th day of February 2011

Notary Public

COMMONWEALTH OF PENNSYLVANIA
Notarial Seal
Cynthia Olesky, Notary Public
Manor Boro, Westmoreland County
My Commission Expires July 16, 2014
Member. Pennsylvania Association of Notaries

(1) I am Manager, Regulatory Compliance, in Nuclear Services, Westinghouse Electric Company LLC (Westinghouse), and as such, I have been specifically delegated the function of reviewing the proprietary information sought to be withheld from public disclosure in connection with nuclear power plant licensing and rule making proceedings, and am authorized to apply for its withholding on behalf of Westinghouse.

(2) I am making this Affidavit in conformance with the provisions of 10 CFR Section 2.390 of the Commission's regulations and in conjunction with the Westinghouse Application for Withholding Proprietary Information from Public Disclosure accompanying this Affidavit.

(3) I have personal knowledge of the criteria and procedures utilized by Westinghouse in designating information as a trade secret, privileged or as confidential commercial or financial information.

(4) Pursuant to the provisions of paragraph (b)(4) of Section 2.390 of the Commission's regulations, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure should be withheld.

(i) The information sought to be withheld from public disclosure is owned and has been held in confidence by Westinghouse.

(ii) The information is of a type customarily held in confidence by Westinghouse and not customarily disclosed to the public. Westinghouse has a rational basis for determining the types of information customarily held in confidence by it and, in that connection, utilizes a system to determine when and whether to hold certain types of information in confidence. The application of that system and the substance of that system constitutes Westinghouse policy and provides the rational basis required.

Under that system, information is held in confidence if it falls in one or more of several types, the release of which might result in the loss of an existing or potential competitive advantage, as follows:

(a) The information reveals the distinguishing aspects of a process (or component, structure, tool, method, etc.) where prevention of its use by any of

Westinghouse's competitors without license from Westinghouse constitutes a competitive economic advantage over other companies.

(b) It consists of supporting data, including test data, relative to a process (or component, structure, tool, method, etc.), the application of which data secures a competitive economic advantage, e.g., by optimization or improved marketability.

(c) Its use by a competitor would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing a similar product.

(d) It reveals cost or price information, production capacities, budget levels, or commercial strategies of Westinghouse, its customers or suppliers.

(e) It reveals aspects of past, present, or future Westinghouse or customer funded development plans and programs of potential commercial value to Westinghouse.

(f) It contains patentable ideas, for which patent protection may be desirable.

There are sound policy reasons behind the Westinghouse system which include the following:

(a) The use of such information by Westinghouse gives Westinghouse a competitive advantage over its competitors. It is, therefore, withheld from disclosure to protect the Westinghouse competitive position.

(b) It is information that is marketable in many ways. The extent to which such information is available to competitors diminishes the Westinghouse ability to sell products and services involving the use of the information.

(c) Use by our competitor would put Westinghouse at a competitive disadvantage by reducing his expenditure of resources at our expense.

(d) Each component of proprietary information pertinent to a particular competitive advantage is potentially as valuable as the total competitive advantage. If competitors acquire components of proprietary information, any one component may be the key to the entire puzzle, thereby depriving Westinghouse of a competitive advantage.

(e) Unrestricted disclosure would jeopardize the position of prominence of Westinghouse in the world market, and thereby give a market advantage to the competition of those countries.

(f) The Westinghouse capacity to invest corporate assets in research and development depends upon the success in obtaining and maintaining a competitive advantage.

(iii) The information is being transmitted to the Commission in confidence and, under the provisions of 10 CFR Section 2.390; it is to be received in confidence by the Commission.

(iv) The information sought to be protected is not available in public sources or available information has not been previously employed in the same original manner or method to the best of our knowledge and belief.

(v) The proprietary information sought to be withheld in this submittal is that which is appropriately marked in WNA-DS-01617-WBT-P, Rev. 4, "Nuclear Automation Watts Bar Unit 2 NSSS Completion Program I&C Projects, Post Accident Monitoring System – System Requirements Specification" (Proprietary), dated February 2011 for submittal to the Commission, being transmitted by Tennessee Valley Authority Watts Bar Unit 2 letter and Application for Withholding Proprietary Information from Public Disclosure, to the Document Control Desk. The proprietary information as submitted by Westinghouse is that associated with the system requirements for the Post Accident Monitoring System and may be used only for that purpose.

This information is part of that which will enable Westinghouse to:

(a) Support Tennessee Valley Authority in licensing and constructing a reliable Post Accident Monitoring System at Watts Bar Unit 2.

(b) Remain competitive in the marketplace.

Further this information has substantial commercial value as follows:

(a) Westinghouse plans to sell the use of similar information to its customers for purpose of licensing and constructing Westinghouse-designed Post Accident Monitoring Systems.

(b) Westinghouse can sell support and defense of the design, construction and operations of the system.

(c) The information requested to be withheld reveals the distinguishing aspects of a methodology which was developed by Westinghouse.

Public disclosure of this proprietary information is likely to cause substantial harm to the competitive position of Westinghouse because it would enhance the ability of competitors to provide similar design and licensing defense services for commercial power reactors without commensurate expenses. Also, public disclosure of the information would enable others to use the information to meet NRC requirements for licensing documentation without purchasing the right to use the information.

The development of the technology described in part by the information is the result of applying the results of many years of experience in an intensive Westinghouse effort and the expenditure of a considerable sum of money.

In order for competitors of Westinghouse to duplicate this information, similar technical programs would have to be performed and a significant manpower effort, having the requisite talent and experience, would have to be expended.

Further the deponent sayeth not.

PROPRIETARY INFORMATION NOTICE

Transmitted herewith are proprietary and/or non-proprietary versions of documents furnished to the NRC in connection with requests for generic and/or plant-specific review and approval.

In order to conform to the requirements of 10 CFR 2.390 of the Commission's regulations concerning the protection of proprietary information so submitted to the NRC, the information which is proprietary in the proprietary versions is contained within brackets, and where the proprietary information has been deleted in the non-proprietary versions, only the brackets remain (the information that was contained within the brackets in the proprietary versions having been deleted). The justification for claiming the information so designated as proprietary is indicated in both versions by means of lower case letters (a) through (f) located as a superscript immediately following the brackets enclosing each item of information being identified as proprietary or in the margin opposite such information. These lower case letters refer to the types of information Westinghouse customarily holds in confidence identified in Sections (4)(ii)(a) through (4)(ii)(f) of the affidavit accompanying this transmittal pursuant to 10 CFR 2.390(b)(1).

COPYRIGHT NOTICE

Tennessee Valley Authority

Letter for Transmittal to the NRC

The following paragraphs should be included in your letter to the NRC:

Enclosed are:

1. 2 copies of WNA-DS-01617-WBT-P, Rev. 4, "Nuclear Automation Watts Bar Unit 2 NSSS Completion Program I&C Projects, Post Accident Monitoring System – System Requirements Specification" (Proprietary)

2. 2 copies of WNA-DS-01617-WBT-NP, Rev. 4, "Nuclear Automation Watts Bar Unit 2 NSSS Completion Program I&C Projects, Post Accident Monitoring System – System Requirements Specification" (Non-Proprietary)

Also enclosed is the Westinghouse Application for Withholding Proprietary Information from Public Disclosure CAW-11-3107, accompanying Affidavit, Proprietary Information Notice, and Copyright Notice.

As Item 1 contains information proprietary to Westinghouse Electric Company LLC, it is supported by an affidavit signed by Westinghouse, the owner of the information. The affidavit sets forth the basis on which the information may be withheld from public disclosure by the Commission and addresses with specificity the considerations listed in paragraph (b)(4) of Section 2.390 of the Commission's regulations.

Accordingly, it is respectfully requested that the information which is proprietary to Westinghouse be withheld from public disclosure in accordance with 10 CFR Section 2.390 of the Commission's regulations.

Correspondence with respect to the copyright or proprietary aspects of the items listed above or the supporting Westinghouse affidavit should reference CAW-11-3107 and should be addressed to J. A. Gresham, Manager, Regulatory Compliance, Westinghouse Electric Company LLC, Suite 428, 1000 Westinghouse Drive, Cranberry Township, Pennsylvania 16066.