Attachment 3
TVA Letter Dated March 31, 2011
Responses to Licensee Open Items to be Resolved for SER Approval

Westinghouse Electric Company WNA-LI-00058-WBT-NP,
"Post-Accident Monitoring System (PAMS) Licensing Technical Report," Revision 3,
Dated March 2011 (non-proprietary)

Westinghouse

Westinghouse Non-Proprietary Class 3

Tennessee Valley Authority (TVA)
Watts Bar Unit 2 (WBN2)

Post-Accident Monitoring System (PAMS)
Licensing Technical Report

WNA-LI-00058-WBT-NP,
Rev. 3

March 2011

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REVISION HISTORY

RECORD OF CHANGES

Revision	Author	Description	Completed
0	William J. Catullo Jr.	Original Issue	6/24/2010
1	Matthew A. Shakun	Common Q Platform record of changes, SPM documentation requirements compliance table, Diversity and Defense-in-Depth Analysis.	10/7/2010
2	Matthew A. Shakun	Description of change process and commercial grade dedication process, SRS compliance to IEEE Std. 830 and RG 1.172, TVA Contract Compliance Matrix, Suitability Evaluations, Applicability of the Common Q PAMS Topical Report, Submitted/Audited Document Tables Minor document editorial and format changes were made.	12/3/10
3	Matthew A. Shakun	Added items 8 through 15 to Table 9-2. Applicability of the Software Program Manual added; updated the Platform's Record of Changes; updated TVA's Contract Compliance Matrix; added SyRS Origin Table; and added additional description for Commercial Grade Dedication. Minor document editorial and format changes were made.	See EDMS

DOCUMENT TRACEABILITY & COMPLIANCE

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OPEN ITEMS

Item	Description	Status
	None.	

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ACRONYMS AND TRADEMARKS

Acronyms used in the document are defined in WNA-PS-00016-GEN, "Standard Acronyms and Definitions" (Reference 37), or included below to ensure unambiguous understanding of their use within this document.

Acronym	Definition
ATR	Approved Topical Report
CMV	Common Mode Voltage
EMI	Electromagnetic Interference
EMC	Electromagnetic Compatibility
HDD	Hard Disk Drive
TVA	Tennessee Valley Authority
SCMP	Software Configuration Management Plan
SPM	Software Program Manual
UP	Upper Potential
ZP	Zero Potential

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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 37), or included below to ensure unambiguous understanding of their use within this document.

Term	Definition

None.

REFERENCES

Following is a list of references used throughout this document.

1. WCAP-16097-P-A, Rev. 1A, "Common Qualified Platform Topical Report," including Appendices 1, 2, 3, 4, Rev. 0 and WCAP-16096-NP-A, Rev. 1A, "Software Program Manual for Common Q Systems," Westinghouse Electric Company LLC.

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24. TR-106439, "Guidelines on Evaluation and Acceptance of Commercial Grade Digital Equipment for Nuclear Safety Applications," Electric Power Research Institute, October 1996.

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39. HTS-AC160-0001, Rev. 15, "Visual Inspection Procedure of AC160 Hardware," Westinghouse Electric Company LLC.

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SECTION 1
INTRODUCTION

This report summarizes the following technical information in support of the licensing effort associated with the WBN2 PAMS:

- Common Q licensing background and a description of the PAMS system.
- Hardware and software changes to the Generic Common Q Platform since issuance of the safety evaluation (SE) and a detailed description of the Common Q Platform Change Process (subsection 2.2.1).
- A description of the resolution of the 10 Generic Open Items (GOIs) associated with the U.S. Nuclear Regulatory Commission's (NRC) review of the Westinghouse Common Qualified (Common Q) Platform identified in the Approved Topical Report (ATR) (Reference 2).
- A description of the resolution of the 14 Plant Specific Action Items (PSAIs) associated with NRC review of the Westinghouse Common Q Platform identified in the ATR (Reference 2).
- Responses to the twenty criteria for bi-directional communications that are described in DI&C-ISG-04, Section 1, "Interdivisional Communications" (Reference 14).
- A table showing compliance to the documentation required by the Software Program Manual for Common Q Systems (Reference 1) and tables of documents that have been submitted and made available for audit (Section 6).
- Overall summary of Commercial Grade Dedication (Section 7).
- A Diversity and Defense-in-Depth Analysis (Section 8).
- Compliance Evaluation of the Watts Bar 2 PAMS Software Requirements Specification to IEEE Standard 830-1998 and Regulatory Guide 1.172 (Section 9).
- Applicability of the Software Program Manual (Reference 1, Section 10)
- Applicability of the Common Q PAMS Topical Report (Reference 1, Section 11).
- TVA Contract Compliance Matrix and Westinghouse's compliance (Section 12).
- Origin Tracing of the System Requirements Specification (Section 13)
- Suitability evaluations of how WBN2 requirements are enveloped by generic requirements for new and changed hardware and software (Section 14).
- Codes and Standards update associated with the Common Q PAMS (Section 15).

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SECTION 2
LICENSING BACKGROUND AND SUMMARY SYSTEM DESCRIPTION

2.1 LICENSING BACKGROUND

By letter dated June 5, 2000, Westinghouse (formerly CE Nuclear Power (CENP)) submitted a topical report (early version of Reference 1) to the NRC for review, describing the design of the Common Qualified (Common Q) platform for safety-related instrumentation and control (I&C) applications in nuclear power plants.

Reference 2 is the NRC safety evaluation (SE) report regarding the Common Q topical report. The SE provided the results of the NRC staff's review of the topical report, the accompanying appendices, and other supporting documents. Based on the information provided and the review conducted, the staff concluded that the design of the Common Q platform meets the relevant NRC regulatory requirements and is acceptable for safety-related instrumentation and control (I&C) applications in nuclear power plants, subject to the satisfactory resolution of ten vendor related generic open items (GOI) listed in Section 7.0 of the SE. Additionally, the NRC stipulated that fourteen plant-specific action items (PSAIs) listed in Section 6.0 of the SE be addressed by applicants requesting approval for installation of a Common Q system. These 14 PSAIs are addressed, in detail, in Section 4. All GOIs (except for GOI 7.8, Loop Controllers, which will not be used in the WBN2 PAMS) have already been addressed by the vendor (References 7 and 8) and are closed (See Section 3, Generic Open Items).

During subsequent meetings between Tennessee Valley Authority (TVA) and the NRC regarding the replacement of the Westinghouse inadequate core cooling monitoring system (ICCM-86) at WBN2 with the Common Q post-accident monitoring system (PAMS), licensing information in addition to the PSAI was requested including:

- A system description of Common Q PAMS
- A list of changes to the Generic Common Q Platform since issuance of the SE
- Resolution of the twenty criteria for interdivisional communications
- Codes and standards that will be included in the design basis for WBN2 specifically revised for the Common Q PAMS (in Section 15)

This information is provided in the subsequent sections of this report.

2.2 SYSTEM DESCRIPTION

The Common Q platform is a computer system consisting of a set of commercial-grade hardware and previously developed software components dedicated and qualified for use in nuclear power plants. The Common Q platform was developed by Westinghouse from the standard AC160 computer system developed by ABB Automation Products, GmbH (ABB Products) of Europe. The Common Q platform is

configured with plant-specific application software to implement various nuclear plant safety system applications. The hardware components of the platform are:

- Advant Controller 160 (AC160) with PM646A processor module (includes Watchdog Timer)
- S600 input and output (S600 I/O) modules
- AF100 Bus communication interface (CI631) modules
- External Network communications interface
- Power supply modules
- Flat-panel display system (FPDS)

The AC160 software, residing on flash PROM in the processor module, consists of a real-time operating system, task scheduler, diagnostic functions, communication interfaces and plant specific application programs. The application program is created using the Asea Brown Boveri (ABB) Master Programming Language (AMPL) Configuration Control (ACC) software development environment that includes a function block library for creating specific logic for the application.

The WBN2 PAMS, based on the application of the safety-grade Common Q platform, will replace the existing inadequate core cooling monitor system (ICCM-86). This digital-to-digital replacement will calculate subcooled margin and reactor vessel level, process core exit temperatures, and provide key data to the control room via the FPDS.

The purpose of the WBN2 PAMS is to provide safety grade processing of instruments used to detect the approach to, the existence of, and the recovery from, an Inadequate Core Cooling (ICC) event and display such information to the operator in the control room. The WBN2 PAMS is based on the requirements in the Common Q Topical Report PAMS Appendix, WCAP-16097-P-A, Appendix 1 (Reference 1) with one significant difference. The WBN2 PAMS is deploying a different design for reactor vessel level monitoring (reactor vessel level indication system, RVLIS) from that described in the Common Q Topical Report. The Common Q Topical Report describes a reactor vessel level monitoring system using heated junction thermocouple technology. The WBN2 PAMS will instead employ a reactor vessel level monitoring function based on the requirements and instrumentation used in Watts Bar Unit 1 (WBN1). The WBN2 PAMS will monitor three reactor vessel differential pressure inputs, upper range differential pressure, lower range differential pressure, and dynamic range differential pressure to measure reactor coolant level in the vessel.

Each PAMS train:

- Is mounted in a dedicated cabinet, with identical hardware. Figure 2.2-1 depicts the hardware architecture of the WBN2 PAMS.

- Has an AF100 communication bus that allows communication within a train between the Operators Module (OM), Maintenance and Test Panel (MTP) and the AC160 Controller rack.

- Has a Common Q 15" flat panel display (FPD) for its OM and MTP. Both the OM and MTP have a fiber-optic (FO) Ethernet interface. The MTP uses the FO Ethernet interface to communicate data to the plant computer and for performing print screen functions. The OM FO Ethernet

interface is not connected when the system is in service. Access to this interface is controlled by design output drawings and maintenance procedures.

The MTP FO Ethernet datalink to the non-safety plant computer system is via a non-class 1E Data Diode device. The MTP transmits PAMS data through the Data Diode to the plant computer on a cyclic basis.
[
]^{a,c} The data link is [
]^{a,c} to the Data Diode. The Data Diode is [
]^{a,c}. The Data Diode is not credited for isolation in accordance with ISG-04, but does provide an additional level of assurance.

The MTP, located in each PAMS train, contains all of the OM pages, except for the default timeout selection page, and provides the human machine interface (HMI) that is used for maintenance and internal alarm functions. The MTP provides displays in support of the following activities:

- Maintenance displays to support corrective maintenance activities.
- Displays for entering RVLIS Constants.
- Displays for storing and retrieving addressable constants to/from external media.
- Display for allowing the MTP to reboot and load the AC160 tool to load software and run AC160 diagnostic programs.

There are two keyswitches at the MTP and one keyswitch at the OM. The Function Enable (FE) keyswitch (at both the OM and MTP) is used as the permissive for bypassing of input signals, enabling PAMS channel testing, for changing selected alarm setpoints, and to print screen. On the OM, the FE keyswitch is not permanently connected. A connector is provided on the OM PC Node Box that enables the FE keyswitch to be installed for maintenance activities.

The Software Load Enable (SLE) keyswitch (only on the MTP) is used to enable booting of the PC Node Box into Microsoft Windows for using the AC160 software load tools to load software and read diagnostic buffers.

Both the MTP and the OM will have the following PAMS status displays:
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The default page for the OM display is user selectable and has an auto restore feature. The time for auto restore is user selectable. The default display and auto restore time will be established by TVA Operations.

Trends can be generated independently at both the OM and MTP with a minimum of 30 minutes of data available.

In addition, both the MTP and the OM will have the following process displays:

Table 2.2-1. PAMS Process Displays

Group	First Level	Second Level
Core		
	Core Summary	
	ICC Summary	
	Saturation Margin	
	CET Summary	
	Core Map	
	Reactor Vessel Level	
	Level Bar Graphs	
	Level Sensors	
RCS		
	RCS	

Table 2.2-1. PAMS Process Displays (cont.)

Group	First Level	Second Level
Trends		
	Trends	
Selectable Trends		
		Trend 1 Parameter
		Trend 2 Parameters
		Trend 3 Parameters
Dedicated Trends		
		ICC Trend
		RVLMS Trend
		RCS Trend

The WBN2 PAMS is housed in a standard Westinghouse cabinet that is seismically qualified. A basic layout of the WBN2 PAMS cabinet is depicted in Figure 2.2-2. The WBN2 PAMS Common Q power supply is housed in the uppermost section of the PAMS cabinet. Top-mounting of the power supply assembly was chosen as this is the biggest heat producer in the cabinet and in this position; this heat will quickly exit the cabinet. The Common Q power supply assembly receives a 120 Vac input feed through a circuit breaker mounted on a breaker panel in the cabinet rear.

The PAMS process inputs are:

- Core exit thermocouples (CETs)
- Cold reference junction resistance temperature detector (RTD) temperature inputs
- RVLIS differential pressure signals
- RVLIS capillary RTD temperature signals
- RVLIS hydraulic isolation contact status
- Reactor coolant system (RCS) wide range pressure and wide range T_{hot}
- Core thermal power based on differential temperature (delta T power)
- Reactor coolant pump on/off contact status

The most significant pieces of the PAMS digital data outputs (digital data link to the plant computer) are:

- CET temperatures (individual, representative, highest, quadrant highest, quadrant next highest)
- CET reference junction temperature
- Reactor vessel level (dynamic, lower, upper, void fraction)
- Reactor vessel level operations setpoint
- RCS and CET subcooled margin (temperature, pressure)
- System status information and alarms

- Reactor coolant pump status
- Reactor vessel differential pressure inputs (dP1, dP2, dP3)
- Delta T core thermal power
- RVLIS RTD temperatures
- Reactor coolant system (RCS) wide range pressure and wide range T_{hot}

The PAMS available analog data outputs are:

- RCS and CET subcooled margin
- Representative CET temperature
- Reactor vessel level
- Three user selectable analog outputs

Note

Only the CET subcooled margin output is planned to be used for WBN2.

The PAMS available alarm contact and digital outputs are:

- Low reactor vessel level alarm
- High representative CET temperature alarm
- Low RCS or CET saturation margin alarm
- System trouble alarm
- ICC trouble alarm

Note

Only the system trouble alarm contact output is used for WBN2. All alarm digital outputs are sent to the plant computer over the digital data link. All alarms are displayed on the OM (no audible alarm).

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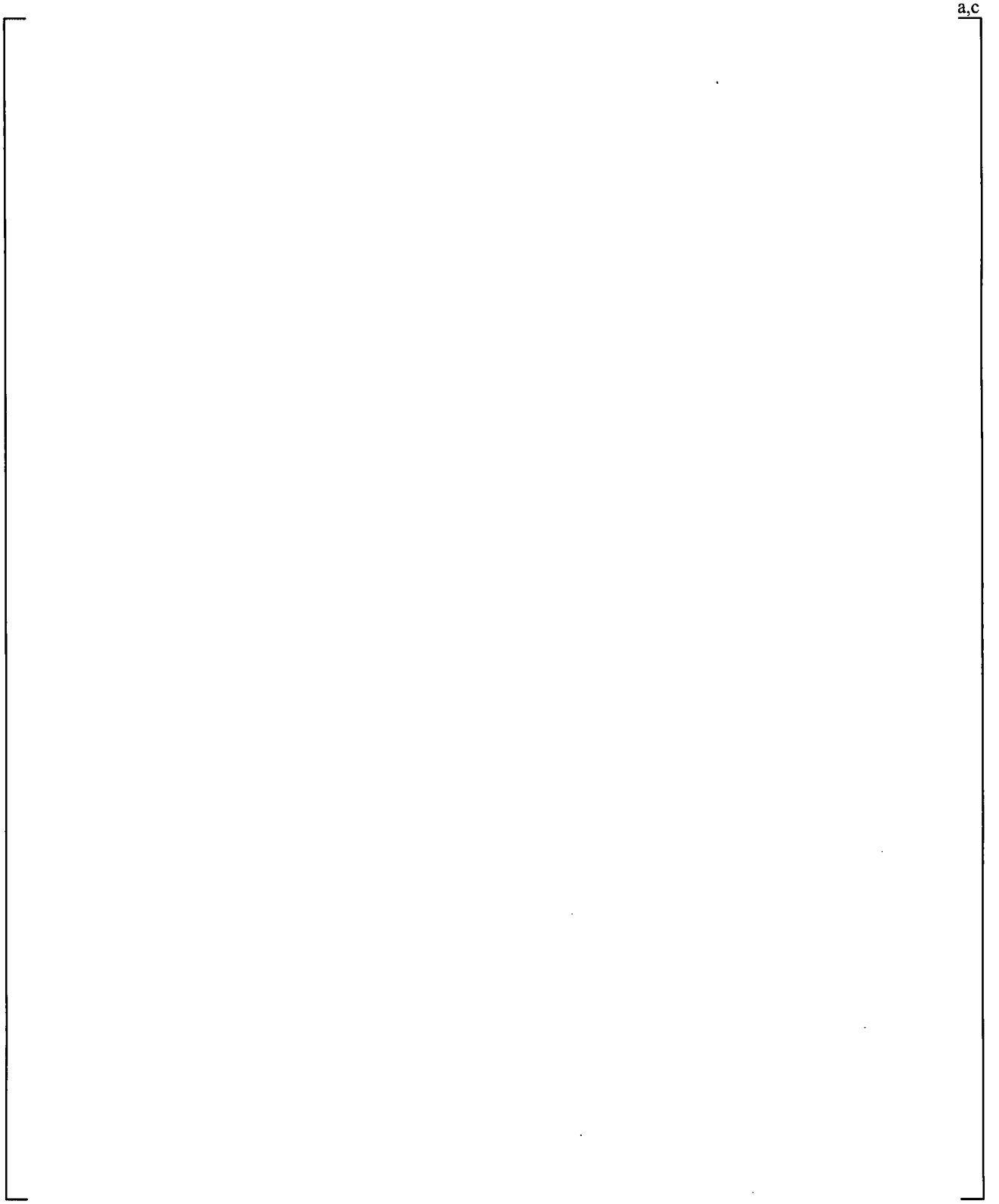

Figure 2.2-1. Watts Bar Unit 2 PAMS Hardware Architecture

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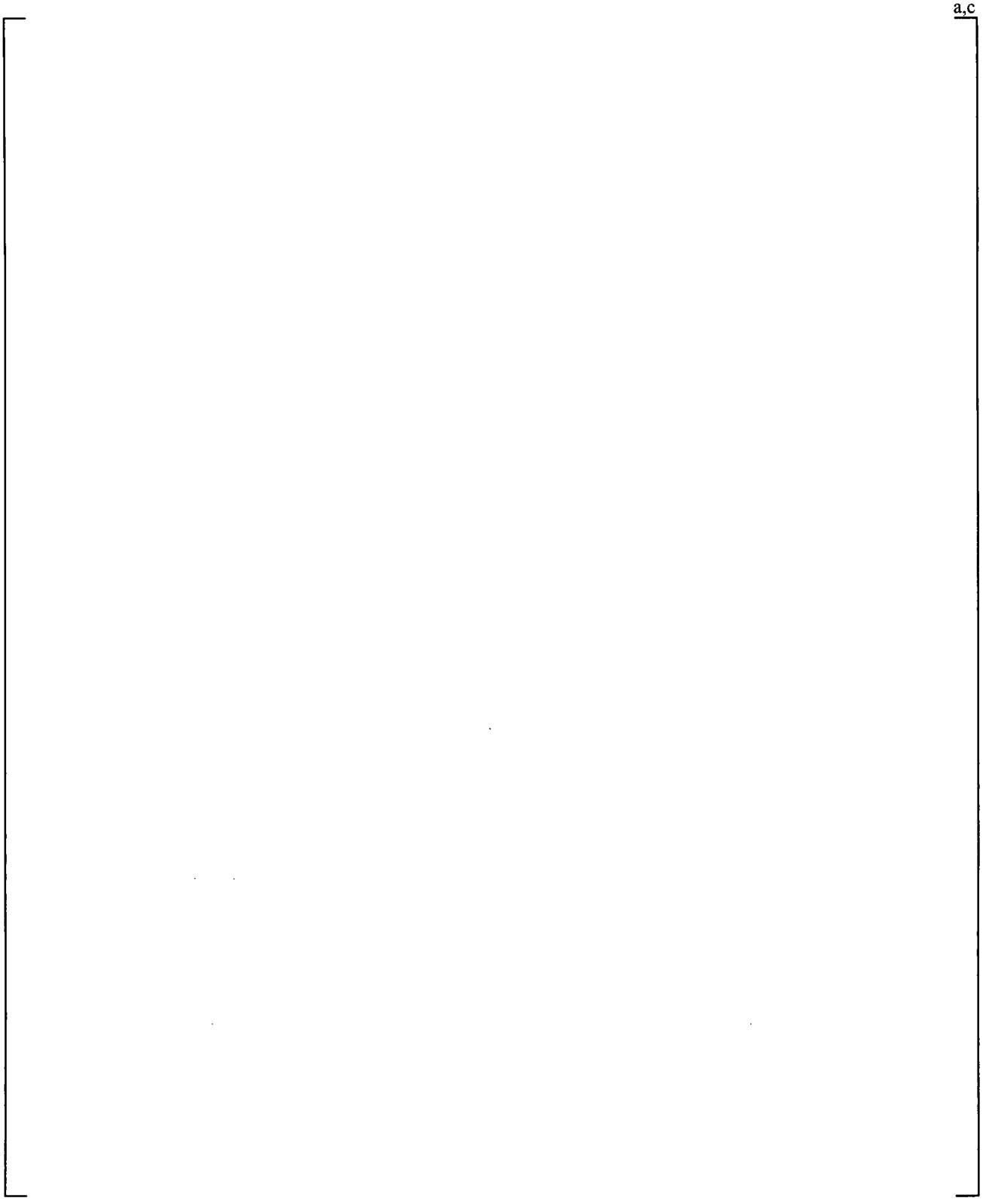

Figure 2.2-2. Watts Bar Unit 1 PAMS Typical Cabinet Layout

2.2.1 Hardware/Software Change Process

2.2.1.1 Screen-out Process

When a change is initiated on the Common Q Platform, it is assessed against screening criteria defined in WCAP-17266-P, "Common Q Platform Generic Change Process," August 2010 (Reference 29), depending on whether or not it is a [ ]^{a,c} change. If the change does not meet specific screening criteria, it "screens-out"; that is, [ ]^{a,c}. The basis for this assessment shall be verified, approved, and documented such that it can [ ]^{a,c}.

2.2.1.2 Automatic Submittal Process

If the change meets specific screening criteria, it "screens-in" and is further assessed to determine if it meets predetermined criteria that would [ ]^{a,c} during the plant installation phase. If it does, then a change summary shall be prepared and included in a [ ]^{a,c}. If the change "screens-in," but does not [ ]^{a,c}, then a detailed engineering analysis (evaluation) shall be performed to determine if the change requires [ ]^{a,c}.

2.2.1.3 Evaluation Process

If the platform change "screened-in" does not meet the [ ]^{a,c}, and the detailed engineering analysis (evaluation) does not meet [ ]^{a,c}; that is, the change [ ]^{a,c}. The basis for this assessment shall be verified, approved, and documented such that it can [ ]^{a,c}. If the change meets specific evaluation criteria, it [ ]^{a,c} and a change summary shall be prepared and included in [ ]^{a,c}, and listed in the [ ]^{a,c}.

Reference 29 has a detailed description of the screening, automatic submittal, and evaluation criteria.

The following is a summary compilation of hardware and software related changes (from that which was approved in the generic Common Q design described in the NRC SERs) applicable to the WBN2 PAMS application:

2.2.1.4 Hardware

1. Common Q power supply (***Evolutionary Product Maintenance/Improvements***)

2. Common Q flat panel display system [ ]^{a,c}

    a. 15" flat panel display
    b. PC node box

c. CI527 AF100 peripheral component interconnect (PCI) interface card

3. Common Q TC514 AF100 fiber optic modems (***Evolutionary Product Maintenance/Improvements***)

4. Common Q AC160 (***Evolutionary Product Maintenance/Improvements, except where noted***)

   a. PM646A processor module
   b. CI631 AF100 communication interface module+
   c. AI687 analog input card (RTDs and T/Cs) (***New Module***)
   d. AI688 analog input card (voltage and current loops) (***New Module***)
   e. DO620 digital output card

The following table contains a detailed description of the hardware changes with a justification of their qualification.

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2.2.2 Software

1. Common Q AC160 (***Fix Errors, except where noted***)

   a. 1.3/0: Revision level at time of SER

   b. 1.3.1: Revision level to correct errors from Oskarshamn system testing

   c. 1.3/2 – /4: Corrected minor field reported errors, many not applicable to Common Q applications

   d. 1.3/5 – /8: (***Modifications to support the Dungeness project in the United Kingdom and inclusion of AI687/AI688 libraries***)

[

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The following table contains a detailed description of the software changes with a justification of their qualification.

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SECTION 3
GENERIC OPEN ITEMS

During its review, the NRC staff identified 10 generic open items (GOIs) in Section 7 of the Reference 2 safety evaluation of the Common Q platform. Resolution was provided by Westinghouse as part of the NRC review process. The NRC issued an SER that generically closed all of the GOIs, with the exception of GOI 7.8 (loop controllers), which will not be used for the WBN2 Common Q PAMS. The generic information provided in the NRC review of Common Q and the additional information provided in this report provides closure of all of the GOI items for WBN2 Common Q PAMS.

Each GOI and its resolution are presented below.

3.1 GOI 7.1

Westinghouse (formerly CENP) has committed to develop a new I/O module or re-design some of those already considered for use in the Common Q platform in order to meet the performance requirements of EPRI TR-107330.

GOI 7.1 Resolution

A new analog input (AI) module, the AI685, has been developed, and qualified per the requirements in EPRI TR-107330 (Reference 25). The previous S600 resistance-temperature detector (RTD) and thermocouple (T/C) modules did not have adequate sampling time for inputs required for protection. The AI685 can be configured for use as a voltage, RTD, or T/C analog input and has been qualified for environmental, seismic and EMC conditions. The AI685 design and qualification are documented in Reference 12. This report was submitted to the NRC in August 2002.

On February 24, 2003 the NRC issued Reference 4. This report states that the AI685 analog input module is acceptable for use in safety systems in nuclear power plants. Also, the staff reviewed the changes that incorporate the AI685 into Revision 2 of the main body of the topical report and concluded that these changes are appropriate and acceptable.

Item GOI 7.1 was previously closed by the NRC by the Common Q review process. The AI685 analog input module will not be used on the WBN2 Common Q PAMS. The WBN2 Common Q PAMS is using the AI687 and AI688 analog input modules. Therefore the resolution of GOI 7.1 is not applicable to the WBN2 PAMS.

3.2 GOI 7.2

Westinghouse (formerly CENP) has not yet finalized the selection of the Common Q power supplies.

GOI 7.2 Resolution

The Common Q power supply system has been developed and qualified for environmental, seismic, and EMC conditions. This is documented in Reference 12. This report was submitted to the NRC in August 2002.

On February 24, 2003 the NRC issued Reference 4. This report states that the staff has audited the development of the supplemental Common Q hardware and finds that Westinghouse has continued to follow its prescribed procedures. The staff concluded on that basis that the Common Q power supplies, as well as the other supplemental Common Q hardware components included in the Summary Qualification Report, are manufactured and/or dedicated in accordance with the applicable regulatory 10CFR Part 50, Appendix B, quality assurance requirements.

Item GOI 7.2 was previously closed by the NRC by the Common Q review process.

3.3 GOI 7.3

Westinghouse (formerly CENP) has not submitted information on the design or dedication of the hardware watchdog timer and it has not yet been subjected to testing for environmental qualification.

GOI 7.3 Resolution

The internal PM646A watchdog timer meets the requirements for this on-line monitoring tool for Common Q system applications. Environmental qualification testing of the PM646A has been completed. This is documented in Reference 12. This report was submitted to the NRC in August 2002. A revision to the Common Q topical report was also submitted that describes the use of the internal PM646A watchdog timer.

On February 24, 2003 the NRC issued Reference 4. This report states that the staff has concluded that the internal PM646A watchdog timer has been qualified to meet the EMC, environmental, and seismic requirements for digital I&C safety systems in nuclear power plants to stated conditions. Westinghouse has acceptably addressed the staff's concerns regarding the qualification of the Common Q components. Also, the staff has reviewed the substitution of the built-in hardware watchdog timer function for the previously planned separate hardware watchdog timer module and concluded that the substitution of the built-in watchdog timer function in the design continues to meet the applicable regulatory requirements. The staff concluded, therefore, that these changes to the text in the topical report and appendices are appropriate and acceptable.

Item GOI 7.3 was previously closed by the NRC by the Common Q review process.

3.4 GOI 7.4

Westinghouse (formerly CENP) has committed to arrange a value-added reseller agreement with QSSL that is similar to BA AUT-99-ADVANT-00, the value-added reseller agreement it has with ABB products. A value-added reseller agreement is needed to satisfy the configuration control and incoming inspection requirements of EPRI TR-106439.

GOI 7.4 Resolution

On June 22, 2001 the NRC issued Reference 7. This report states that the staff has reviewed the value-added reseller agreement with QNX software systems limited (QSSL), the vendor for the flat panel display system (FPDS) operating system and display system, and concludes that it satisfies the configuration control and incoming inspection guidance of EPRI TR-106439 (Reference 24). The reseller agreement is, therefore, acceptable.

Item GOI 7.4 was previously closed by the NRC by the Common Q review process.

3.5 GOI 7.5

Westinghouse (formerly CENP) will perform additional EMC tests and measurements on the PM646.

GOI 7.5 Resolution

The PM646 processor module has been modified to the PM646A. This modification involved the removal of an internal terminating resistor for the High-Speed Data Links (HSLs). The link termination resistor is now external to the module, permitting high-speed data link output to multiple processors using a multi-drop configuration. Additional EMC tests and measurements were performed using the PM646A. These tests are documented in Reference 12. This report was submitted to the NRC in August 2002. A revision to the Common Q topical report was also submitted that describes the modification of the PM646 to the PM646A.

On February 24, 2003 the NRC issued Reference 4. This report states that the staff concluded that the internal PM646A processor module has been qualified to meet the EMC, environmental, and seismic requirements for digital I&C safety systems in nuclear power plants to stated conditions. Westinghouse has acceptably addressed the staff's concerns regarding the qualification of the Common Q components. Also, the staff has reviewed the change in resistor in the processor module and concurred that the resistor change is inconsequential and is, therefore, acceptable. The staff concluded that the PM646 and PM646A processor modules may be used interchangeably to suit the configuration requirements of the specific application.

Item GOI 7.5 was previously closed by the NRC by the Common Q review process.

3.6 GOI 7.6

Westinghouse (formerly CENP) has not yet conducted seismic and environmental qualification testing on the non-AC160 hardware components. Items not yet tested include the FPDS, watchdog timer, and power supply modules.

GOI 7.6 Resolution

Seismic and environmental qualification testing on the non-AC160 hardware components has been completed. These components include the FPDS and the power supply modules. The external watchdog timer is no longer required. The internal PM646A watchdog timer meets the requirements for this on-line

monitoring tool for Common Q system applications (refer to resolution of GOI 7.3 above). The seismic and environmental testing is documented in Reference 12. This report was submitted to the NRC in August 2002. A revision to the Common Q topical report was also submitted that describes the use of the internal PM646A watchdog timer.

On February 24, 2003 the NRC issued Reference 4. This report states that the staff has audited the development of the supplemental Common Q hardware and finds that Westinghouse has continued to follow its prescribed procedures. The staff concluded on that basis that the supplemental Common Q hardware components included in the Summary Qualification Report are manufactured and/or dedicated in accordance with the applicable regulatory 10CFR Part 50, Appendix B, quality assurance requirements. The staff concluded that Westinghouse has acceptably addressed the staff's concerns regarding the qualification of the Common Q components, both AC160 and non-AC160.

Item GOI 7.6 was previously closed by the NRC by the Common Q review process.

3.7 GOI 7.7

The staff has reviewed the information in the SVVP about software module testing and finds that the information provided is not sufficient for the staff to arrive at a conclusion about the adequacy of the scope of the tests for validating a software module.

GOI 7.7 Resolution

On June 22, 2001 the NRC issued Reference 7. This report states that Westinghouse submitted additional information indicating in which sections of CE-CES-195, Rev. 01, "Software Program Manual for Common Q Systems," and topical report CENPD-396-P, Rev. 1, "Common Qualified Platform," the staff would find the Westinghouse procedures for performing software module testing. The staff has reviewed the indicated sections and concludes that the procedures specified therein satisfy the software verification and validation program (SVVP) requirements of IEEE Std 7-4.3.2-1993 with regard to testing of software modules and are, therefore, acceptable.

Item GOI 7.7 was previously closed by the NRC by the Common Q review process.

3.8 GOI 7.8

Westinghouse (formerly CENP) needs to provide in future submittals the design information for the loop controllers to support their diversity from the Common Q components.

GOI 7.8 Resolution

This GOI relates to the "level 3 loop controllers" referenced in the Common Q topical report integrated solution (Appendix 4). The level 3 loop controllers (LCs) provide component control based on signals from the ESFAS. The loop controllers (i.e., Component Interface Modules, CIMS) are not being used in the WBN2 PAMS, therefore the resolution of GOI 7.8 is not applicable to the WBN2 Common Q PAMS.

3.9 GOI 7.9

The staff has reviewed the approach for the integrated solution of using the ITPs and the AF100 buses to provide separation of safety and non-safety signals and finds that there is not sufficient detail to permit an evaluation against the independence requirements set forth in IEEE Std 7-4.3.2. This must be the subject of a future Westinghouse (formerly CENP) submittal.

GOI 7.9 Resolution

On June 22, 2001 the NRC issued a safety evaluation Report, Reference 7. This report states that Westinghouse has revised Appendix 4, "Common Qualified Platform Integrated Solution," to provide additional information on the use of the interface and test processors (ITPs) and the AF100 buses to provide separation of safety and non-safety signals. The staff has reviewed the revised information in Appendix 4, Rev. 2 on the use of the ITPs and the AF100 buses to provide separation of safety and non-safety signals and finds that the conceptual approach as presented therein is consistent with the independence requirements set forth in IEEE Std 7-4.3.2. The staff, therefore, concludes that this conceptual approach may be used for guidance for the anticipated application-specific and plant-specific designs involving the integration of multiple Common Q digital instrumentation and control (I&C) upgrades. This closes GOI 7.9 as far as the conceptual approach is concerned, but the evaluation of each forthcoming design remains a plant-specific action item because the staff finds that the forthcoming details of the actual designs may require an evaluation against the independence requirements for safety systems in specific nuclear power plants.

The Common Q systems installed at WBN2 are the safety related PAMS and the non-safety-related computer enhanced rod position indication (CERPI) system. Neither the PAMS nor CERPI system architectures incorporate the ITP. While both systems utilize the AF100 bus design for communication, there is no connection between the CERPI and PAMS AF100 buses. Therefore, the resolution of GOI 7.9 is not applicable to the WBN2 Common Q PAMS.

3.10 GOI 7.10

The evaluation of the design for the multi-channel operator station control for the integrated solution requires detail beyond the scope of the present submittals.

GOI 7.10 Resolution

Common Q multi-channel operator stations (for control) are not used in the WBN2 design; therefore GOI 7.10 is not applicable to the WBN2 Common Q PAMS.

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SECTION 4
PLANT SPECIFIC ACTION ITEMS

The following information describes TVA's response to the fourteen (14) plant specific action items that the NRC outlined in their SE for WCAP-16097-P-A (Reference 2).

4.1 PLANT SPECIFIC ACTION ITEM 6.1

Each licensee implementing a specific application based upon the Common Q platform must assess the suitability of the S600 I/O modules to be used in the design against its plant-specific input/output requirements.

TVA Response to PSAI 6.1

The suitability of all new components is assessed to meet applicable requirements in accordance with the WBN2 Quality Assurance Program. Performance requirements for these components are assured, for example, by specifying them in purchase contracts, observing vendor testing and analysis, reviewing and commenting on vendor design requirements and specifications, performing design reviews by the engineering department, witnessing the vendor Factory Acceptance Tests (FAT), and by performing post modification and Site Acceptance tests after installation. All these activities are controlled by WBN2 administrative procedures and/or project quality plans.

The PAMS input/output categories and the S600 input/output module used to provide the interface are provided in Table 4.1-1 below.

Table 4.1-1. PAMS Input/Output Signals

Item	I/O Signal Type	S600 I/O Module
	Contact Inputs wetted by the PAMS auctioneered 24Vdc auxiliary power supplies.	DI620
	Type K Thermocouple, 100 Ω platinum RTD	AI687
	4- 20 mA Analog Inputs	AI688
	24 Vdc logic level signals (to interposing relay panel)	DO620
	4-20 mA Analog Outputs	AO650

The S600 Input/Output modules are designed to fully meet the functional and signal interface requirements for the PAMS input sensors and output loads as required by TVA as clarified in the Westinghouse Compliance Matrix (Reference 9). The S600 Input/Output modules are demonstrated to be capable of performing their design function by successful completion of testing, culminating in a Factory Acceptance Test (FAT) to be performed by the vendor at the Westinghouse manufacturing/engineering facility. Acceptance criteria are based on the PAMS System Requirements Specification (Reference 10) and the PAMS System Design Specification (Reference 11).

4.2 PLANT SPECIFIC ACTION ITEM 6.2

A hardware user interface that replicates existing plant capabilities for an application may be chosen by a licensee as an alternative to the FPDS. The review of the implementation of such a hardware user interface would be a plant-specific action item.

TVA Response to PSAI 6.2

The PAMS utilizes the flat panel display system (FPDS) as developed by Westinghouse for Common Q safety systems. An alternative hardware interface is not used. Therefore, PSAI 6.2 is not applicable.

4.3 PLANT SPECIFIC ACTION ITEM 6.3

If a licensee installs a Common Q application that encompasses the implementation of FPDS, the licensee must verify that the FPDS is limited to performing display and maintenance functions only, and it is not to be used such that it is required to be operational when the Common Q system is called upon to initiate automatic safety functions. The use of the FPDS must be treated in the plant specific FMEAs.

TVA Response to PSAI 6.3

The FPDS purchased by TVA is limited to performing display and maintenance functions only. The plant-specific Failure Mode Effects Analysis (FMEA) prepared in accordance with PSAI 6.10 will address the loss of the FPDS. Additionally, the NRC in their safety evaluation for the closeout of several of the Common Qualified Platform Category 1 Open Items Related to Reports CENPD-396-P, Revision 1 and CE-CES-195, Revision 1, dated June 22, 2001 (Reference 7) has stated that this action item (PSAI 6.3) has been generically resolved and is considered closed. Therefore, no further evaluation is required.

4.4 PLANT SPECIFIC ACTION ITEM 6.4

Each licensee implementing a Common Q application must verify that its plant environmental data (i.e., temperature, humidity, seismic, and electromagnetic compatibility) for the location(s) in which the Common Q equipment is to be installed are enveloped by the environment considered for the Common Q qualification testing, and that the specific equipment configuration to be installed is similar to that of the Common Q equipment used for the tests.

Westinghouse configured the Common Q test specimen for seismic testing using dummy modules to fill all the used rack slots. As part of the verification of its plant-specific equipment configuration the licensee must check that it does not have any unfilled rack slots.

TVA Response to PSAI 6.4 (Temperature & Humidity)

The PAMS equipment is located in the Auxiliary Instrument Room (AIR) and Main Control Room (MCR) in a mild environment. The PAMS equipment will be exposed to the following environmental conditions during the life of the plant.

Table 4.4-1. WBN2 PAMS Plant-Specific Operating Environment Parameters

Parameter	Abnormal		Duration
	Min	Max	
Temperature	60°F	104°F	12 Hours
Humidity	20 % RH[1]	90% RH[1]	12 Hours
Pressure	Atmospheric	Atmospheric	Continuous

Note:
1. (non-condensing)

The TVA requirement of a 10% low range relative humidity has been changed to 20% per project letter WBT-D-2558 (Reference 33). Therefore, the environmental drawings for the main control room and the auxiliary instrument room (References 20 and 21) will be revised accordingly. All other requirements in References 20 and 21 are still applicable.

The environmental conditions described below are the abnormal conditions for which the Common Q system is generically qualified (Reference 12). No condensation formed on the test item during any phase of the testing.

Table 4.4-2. WBN2 PAMS Generic Qualification Environment Parameters

Parameter	Abnormal		Duration
	Min	Max	
Temperature	40°F	140°F	12 Hours
Humidity	20% RH	95% RH	12 Hours
Pressure	Atmospheric	Atmospheric	Continuous

During anticipated abnormal transients/accident conditions, the essential HVAC system maintains the essential areas that contain the PAMS equipment (cabinets at AIR Elevation 708', Operators' Module (OM) at MCR Elevation 755') within design ambient temperature, pressure and humidity conditions (References 20, 21, and 33). Based on the above, the environment considered for the Common Q qualification testing envelopes the specific WBN2 temperature and humidity conditions.

The 140°F temperature is the local temperature at which the equipment was tested. The WBN2 Equipment Qualification Summary Report will address the compliance to the equipment qualification of Common Q Platform to the WBN2 environment.

TVA Response to PSAI 6.4 (Seismic)

The seismic qualification of the Common Q equipment for the WBN2 PAMS has been completed by Westinghouse for most of the components except for newly released components (AI687, AI688) and

upgraded components (PC node box, Flat Panel Displays and Common Q power supply). All of the Common Q components being used in the WBN2 PAMS have been qualified, or will be qualified, to seismic levels that envelop the requirements of the Common Q components that make up the WBN2 PAMS. Results of specific qualification testing for both new and existing components will be reported in the WBN2 Final EQ Summary Test Report. TVA has evaluated the Required Response Spectra (RRS) cited in the Westinghouse Seismic Test Plan for OBE, SSE, and Table Limits and has determined that they are higher than the WBN2 floor response spectra curves (Reference 13) for the area where the PAMS equipment will be installed (cabinets at AIR Elevation 708', Operators' Module (OM) at MCR Elevation 755') and therefore, envelopes the seismic criteria for WBN2.

The dummy modules populating the unused chassis slots during seismic testing are essentially the outer cases and front faces of modules similar in size and appearance to the active modules, but lacking the internal electronics and associated hardware.

Installation of the Common Q PAMS hardware at WBN2 will include dummy modules in unused chassis slots. Plant modification document EDCR 52351 used for implementing the Common Q PAMS at WBN2 will specify this requirement. WBN2 administrative procedures, which ensure equipment qualifications (e.g., seismic, etc) are maintained in the design change process, will control all future changes to the PAMS.

TVA Response to PSAI 6.4 (Electromagnetic Compatibility)

Westinghouse has performed specific electromagnetic compatibility tests on the Common Q equipment as defined in Reference 1 in accordance with EPRI TR-102323, Guidelines for Electromagnetic Interference Testing in Power Plants, Revision 1 (Reference 3). For newly released components (AI687, AI688) and upgraded components (PC node box, Flat Panel Displays and Common Q power supply), Westinghouse has tested in accordance with RG 1.180, Rev. 1. As stated in the updated Common Q Topical Report (Reference 50), any new additions to the baseline equipment, whether they are new modules/devices or enhancements to existing modules/devices, will be tested consistent with the requirements of RG 1.180, Rev. 1. No regression EMI testing will be performed; rather the requirements as defined in RG 1.180, Rev. 1, will be followed. Westinghouse will provide a Watts Bar Unit 2 PAMS Equipment Qualification (EQ) summary report (Reference 49) containing the EMC test results. TVA will perform an EMI site survey for the installation PAMS indication system.

4.5 PLANT SPECIFIC ACTION ITEM 6.5

On the basis of its review of the Westinghouse software development process for application software, the staff concludes that the SPM specifies plans that will provide a quality software life cycle process, and that these plans commit to documentation of life cycle activities that will permit the staff or others to evaluate the quality of design features upon which the safety determination will be based. The staff will review the implementation of the life cycle process and the software life cycle process design outputs for specific applications on a plant specific basis.

TVA Response to PSAI 6.5

In accordance with the TVA Quality Assurance Program, TVA uses administrative control procedures to establish software quality assurance and configuration management for process computer software, firmware, software development computer systems, and associated documentation. They ensure that the integrity of a process software product is known and preserved throughout its life cycle from development to retirement. These controls also apply to the development tools and systems used to develop and test process software.

As required by administrative control procedures, TVA will maintain documentation of the Common Q PAMS Software Life Cycle Process provided by Westinghouse for both the Implementation Activities and the required Design Outputs. This documentation is for internal use and to allow for the NRC staff review. This documentation will include life cycle process documentation provided by Westinghouse (i.e., Safety Analysis Activities, V&V plans, V&V results, Testing Results) as well as installation test activities performed and documented by TVA in accordance with SPP 9.3, Plant Modifications and Engineering Change Control (Reference 17) and SPP 2.6, Computer Software Control (Reference 18).

Per procedural requirements, TVA also maintains the requirements documents provided by Westinghouse (i.e., Functional Design Requirements, System Requirements Specifications, Software Requirements Specifications), design output documents (i.e., Software Release Records, executable software on media, and Factory Acceptance Test reports) as well as Operations and Maintenance Manuals.

4.6 PLANT SPECIFIC ACTION ITEM 6.6

When implementing a Common Q safety system (i.e. PAMS, CPCS, or DPPS), the licensee must review Westinghouse's timing analysis and validation tests for that Common Q system in order to verify that it satisfies its plant specific requirements for accuracy and response time presented in the accident analysis in Chapter 15 of the safety analysis report.

TVA Response to PSAI 6.6

The acceptable accuracy requirements associated with the Common Q PAMS are those given in the WBN2 Functional Requirements Document (FRD), Section 21 (Reference 15). TVA will review the WBN2 Common Q PAMS plant-specific system accuracy specifications provided by Westinghouse, and ensure that they are equal to or better than that of the WBN1 ICCM-86. In addition, accuracy verification testing will be performed as part of the PAMS Factory Acceptance Test (FAT) on each train to be installed at WBN2. TVA will review Westinghouse Final Factory Acceptance Test Report to ensure plant specific requirements for accuracy as specified in the WBN2 FRD have been met:

- Common Q PAMS Accuracy; WAT/WBT-300/21.4.4, 21.5.4, and 21.6.4

In addition to the above activities, the following Calculation Notes to support the Setpoint and Scaling Documents to be developed for Common Q. These documents will be reviewed and approved by TVA.

- Core Exit Thermocouples

- Core Exit Thermocouples Reference Junction Temperature
- Reactor Vessel Level Transmitters
- Reactor Vessel Level
- Subcooled Margin Monitor

4.7 PLANT SPECIFIC ACTION ITEM 6.7

The OM and the MTP provide the human machine interface for the Common Q platform. Both the OM and MTP will include display and diagnostic capabilities unavailable in the existing analog safety systems. The Common Q design provides means for access control to software and hardware such as key switch control, control to software media, and door key locks. The human factors considerations for specific applications of the Common Q platform will be evaluated on a plant-specific basis.

TVA Response to PSAI 6.7

As required by WBN2 Plant Modification procedures and as described in subsections 7.5.1.5.1 and 7.5.1.6 of the UFSAR, the PAMS upgrade project undergoes a TVA Human Factors Engineering (HFE) Review in accordance with TVA Design Standard DS-E18.1.24, Human Factors Engineering (Reference 22), prior to the system being installed. The HFE Review will focus on design features and characteristics of the new PAMS to ensure that the system incorporates acceptable human factors engineering principles and that the system provides the necessary system information, control capabilities, feedback, and analytical aids necessary for control room operators to accomplish their functions effectively.

4.8 PLANT SPECIFIC ACTION ITEM 6.8

If the licensee installs a Common Q PAMS, CPCS or DPPS, the licensee must verify on a plant-specific basis that the new system provides the same functionality as the system that is being replaced, and meets the functionality requirement applicable to those systems.

TVA Response to PSAI 6.8

As part of the normal design change process at WBN2, the suitability of all new and upgraded systems is assessed. This review covers the overall function of the system, as well as the design and licensing basis of the system. These design attributes were captured in Westinghouse Letter WBT-D-0088 (Reference 9) for the PAMS upgrade project and detail the conditions of service and general requirements that must be met in the Common Q PAMS. This reference defines the necessary performance requirements to assure functionality is maintained with the new system. Enhancements to the PAMS are occurring as part of the Common Q design evaluation process for WBN2. In every case, performance requirement factors are being taken into account to ensure that the new PAMS will provide, at a minimum, the same functionality as the system that is being replaced.

4.9 PLANT SPECIFIC ACTION ITEM 6.9

Modifications to plant procedures and/or TS due to the installation of a Common Q safety system will be reviewed by the staff on a plant-specific basis. Each licensee installing a Common Q safety system shall submit its plant-specific request for license amendment with attendant justification.

TVA Response to PSAI 6.9

As part of the normal design change process at WBN2, the impact to plant procedures and Technical Specifications (TS) are evaluated for all design changes. TVA will ensure that any plant procedure and/or TS (subsection 3.3.3) change associated with the PAMS is evaluated and dispositioned prior to initial fuel load.

4.10 PLANT SPECIFIC ACTION ITEM 6.10

A licensee implementing any Common Q applications (i.e., PAMS, CPCS, or DPPS) must prepare its plant specific model for the design to be implemented and perform the FMEA for that application.

TVA Response to PSAI 6.10

A plant specific Failure Modes and Effects Analysis (FMEA) for the WBN2 PAMS will be completed by Westinghouse. In general there have been no changes in the way that the PAMS will respond to input failures. This FMEA will confirm that no single failure associated with the replacement PAMS will defeat more than one of the two safety divisions, assuring operability at the system level.

4.11 PLANT SPECIFIC ACTION ITEM 6.11

If a licensee installs Common Q PAMS, CPCS, DPPS or Integrated Solution, the licensee shall demonstrate that the plant-specific Common Q application complies with the criteria for defense against common-mode failure in digital instrumentation and control system and meets the requirements of HICB BTP-19.

TVA Response to PSAI 6.11

The level of Diversity and Defense-in-Depth (D3) for the WBN2 PAMS digital-to-digital replacement is equal to or greater than that provided by the ICCM-86 system. The PAMS supports the monitoring and indicator system echelon of defense that affords the operators accurate plant information to enable them to react to unexpected events.

BTP 7-19 Rev. 5 (Reference 6) requires "A set of displays and controls located in the main control room should be provided for manual system-level actuation of critical safety functions and for monitoring of parameters that support safety functions. The displays and controls should be independent and diverse from the computer-based safety systems identified in Points 1 and 3." The Eagle 21 system is the only computer based safety system installed at WBN2 that is within the engineered safety features actuation system echelon as defined in BTP 7-19 Rev. 5.

The Common Q PAMS receives wide range RCS pressure, wide range T_{hot} and delta T power inputs from the Eagle 21 system. These inputs are used in the subcooled margin monitor (SMM) and RVLIS functions. A failure of one of the Eagle 21 channels would result in a loss of the SMM and RVLIS functions in the associated PAMS train, however, the SMM and RVLIS functions in the other PAMS train would remain operational.

The CET function is diverse at the transmitter and loop level. The CET function is credited as a diverse function for the Eagle 21 T_{hot} indication in the WBN2 licensing basis.

While the Common Q PAMS receives previously identified inputs from the Eagle 21 system for the SMM and RVLIS, it is diverse from the Eagle 21 digital process protection system in the following areas:

- Human Diversity – The Common Q Platform was originally developed by designers in different companies than the Eagle 21 protection system, which results in a high level of functional diversity in the systems. This reduces the possibility of similar design errors.

- Software Diversity – The Common Q PAMS uses different programs designed and implemented by different development groups with different key personnel than that utilized by the Eagle 21 protection system.

- Equipment Diversity – The Common Q PAMS utilizes a different computer architecture and diverse computer equipment than the Eagle 21 protection system. This has resulted in the use of diverse microprocessors, compilers, linkers, and other support software.

The communications between the Eagle 21 and Common Q systems are analog 4-20 ma signals. The 4-20 ma output channels are isolated by hardware within the Eagle 21 system to prevent any faults from affecting the Eagle 21 safety function processors. Therefore, a common cause failure of the Common Q system software cannot cause a failure of the Eagle 21 safety related functions. This provides the necessary isolation between these echelons.

The control echelon at WBN2 is a digital Foxboro intelligent automation (IA) system. There are no shared functions or communications between the Foxboro IA system and the Common Q PAMS system. Therefore, there is no diversity requirement between these echelons.

4.12 PLANT SPECIFIC ACTION ITEM 6.12

A licensee implementing a Common Q DPPS shall define a formal methodology for overall response time testing.

TVA Response to PSAI 6.12

The WBN2 licensing bases documents do not contain any specific response time requirements for the Common Q PAMS. WBN2 Emergency Operating Procedures do not require continuous monitoring of RVLIS, Subcooled Margin or Core Exit Temperatures. These parameters are checked on a periodic basis to determine the effectiveness of operator actions in restoring core cooling. The response time

for any change in the digital or analog input to be processed and displayed on the OM display [ ]^{a,c} ensures that updated data is available to the operator to make accurate assessments more frequently than required by the procedures. Therefore, PSAI 6.12 is not applicable.

4.13 PLANT SPECIFIC ACTION ITEM 6.13

The analysis of the capacity of the shared resources to accommodate the load increase due to sharing.

TVA Response to PSAI 6.13

The shared resource issue relates to multiple Common Q based systems using the same resources, such as the AF100 bus or an Operator Module. The replacement PAMS and CERPI are the only Common Q hardware at WBN2. As previously stated, there is no interaction between and no communications path between the PAMS and CERPI. Therefore, PSAI 6.13 is not applicable.

4.14 PLANT SPECIFIC ACTION ITEM 6.14

The licensee must ascertain that the implementation of the Common Q does not render invalid any of the previously accomplished TMI action items.

TVA Response to PSAI 6.14

TMI action items from 50.34(f)(2) that are relevant to the WBN2 implementation of a new PAMS are as follows:

- 50.34(f)(2)(i) – Provide simulator capability that correctly models the control room and includes the capability to simulate small-break LOCA's. (I.A.4.2)

The Simulator used to train WBN2 Licensed Operators is designed to model the Unit 1 control room including the capability to simulate small-break LOCAs. TVA will address the Unit 1/Unit 2 differences, including the Common Q displays, with operator training.

- 50.34(f)(2)(iii) – Provide, for Commission review, a control room design that reflects state-of-the-art human factor principles prior to committing to fabrication or revision of fabricated control room panels and layouts. (I.D.1)

As stated above, the PAMS replacement project, as required by FSAR and plant procedures, undergoes a TVA Human Factors Engineering (HFE) review in accordance TVA Design Standard DS-E18.1.24, Human Factors Engineering (Reference 22), prior to the system being installed. The HFE review will focus on design features and characteristics of the PAMS to ensure that the system incorporates acceptable human factors engineering principles and that the system provides the necessary information, operator navigation capabilities, feedback, and analytical aids necessary for control room operators to accomplish their functions effectively.

- 50.34(f)(2)(xviii) – Provide instruments that provide in the control room an unambiguous indication of inadequate core cooling, such as primary coolant saturation meters in PWR's,

and a suitable combination of signals from indicators of coolant level in the reactor vessel and in-core thermocouples in PWR's and BWR's. (II.F.2)

The Common Q PAMS digital-to-digital system replacement is a functionally equivalent replacement of the ICCM-86 system. As such, it is a direct replacement for a system that accomplished the aforementioned safety functions.

Therefore, the Common Q PAMS implementation at WBN2 does not render invalid any of the previously accomplished TMI action items.

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SECTION 5
INTERDIVISIONAL COMMUNICATIONS

5.1 SYSTEM FUNCTION

The WBN2 PAMS monitors a subset of the variables listed in Table 2 of Regulatory Guide 1.97, Revision 2 (RG 1.97) in support of the following functions:

- Core exit thermocouple (CET) monitoring
- Reactor vessel level monitoring
- Subcooled margin monitoring

The RG 1.97 variables are displayed on the Operator's Module (OM) and Maintenance and Test Panel (MTP). The algorithms that support the CET Monitoring, Reactor Vessel Level Monitoring, and the Subcooled Margin Monitoring are executed exclusively in the AC160's PM646A processor. The AC160 rack also contains various IO modules to support analog inputs, analog outputs, digital inputs, and digital outputs. Any alarm conditions resulting from these algorithms actuate one or more Digital Outputs that drive relays in the CQ PAMS cabinet. These relays are available for annunciation in the control room. The five relay outputs that annunciate these alarms are:

1. System trouble alarm (for detectable hardware failures and for the manual disabling of the safety function under keyswitch control)
2. Low reactor vessel level alarm
3. Low saturation margin alarm
4. High core exit temperature alarm
5. ICC trouble alarm (the logical OR of the previous 3 annunciators)

5.2 SAFETY CLASSIFICATION

The WBN2 PAMS is classified as safety-grade and is implemented on the Common Q safety platform since it is required to remain operable during and following a design basis event as described in TVA Design Criteria WB-DC-30-7, "Post-Accident Monitoring Instrumentation" (Reference 19).

The SCOPE section of DI&C-ISG-04 (Reference 14), 2nd paragraph, 2nd sentence, states "*This guidance is not applicable to interactions among equipment that are all in the same safety division or that do not involve anything that is safety-related.*" All of the communications channels (the AF100 bus, the field inputs, the signals sent from the Eagle 21 safety computers, and the Ethernet communications to plant computer) are evaluated with respect to this scope statement.

The two PAMS trains, A and B, are outfitted with identical controllers and display equipment. Each train's equipment is independent and electrically isolated from the other train. Field cabling and input

signal transducers used by each train are independent and isolated from the opposite train. Signals received on the analog input cards by either PAMS train from the Eagle 21 safety system are divisionally separated. Additionally, the AF100 bus communications for each train are entirely within the same safety division. Power is provided by the corresponding divisional vital instrumentation bus.

Due to the divisional isolation of the field input signals and the AF100 bus communications, and considering the SCOPE statement above, the 20 DI&C-ISG-04 criteria do not apply to these aspects of the WBN2 PAMS design.

Thus, the only communications interface that the DI&C-ISG-04 guidance applies to is the Ethernet (TCP/IP) communications to the plant computer. [

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Additionally, the Ethernet TCP/IP communications between the MTP and the non-safety plant computer are not vital to the performance of any safety function. Ethernet communications may be allowed to fail without impacting the PM646A processing or the OM/MTP display processing. [

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Relating to the terms used in DI&C-ISG-04, in the Common Q design of the Watts Bar 2 PAMS, the [ ]^{a,c} in this evaluation.

The AC160 High Speed Link (HSL) interface as described in the Common Q Topical Report is not used in the WBN2 PAMS designs and therefore is not considered in this evaluation.

5.3 RESPONSE TO INDIVIDUAL CRITERIA IN DI&C-ISG-04

The WBN2 PAMS design meets each of the 20 criteria listed in the Section 1, Interdivisional Communications, of Revision 1 of DI&C-ISG-04 as explained below.

Criterion 1. A safety channel should not be dependent upon any information or resource originating or residing outside its own safety division to accomplish its safety function. This is a fundamental consequence of the independence requirements of IEEE-603. It is recognized that division voting logic must receive inputs from multiple safety divisions.

The WBN2 PAMS design satisfies this criterion. The WBT PAMS does not receive any information from outside of its own safety division to perform its safety function.

Criterion 2. The safety function of each safety channel should be protected from adverse influence from outside the division of which that channel is a member. Information and signals originating outside the division must not be able to inhibit or delay the safety function. This protection must be implemented within the affected division (rather than in the sources outside the division), and must not itself be affected by any condition or information from outside the affected division. This protection must be sustained despite any operation, malfunction, design error, communication error, or software error or corruption existing or originating outside the division.

The WBN2 PAMS design satisfies this criterion. [

]^{a,c} All signals are contained within each safety division and no data information from outside the safety division is received by either the PM646A controller or the OM.

The MTP display system has an Ethernet port with TCP/IP communications to support printing to the plant computer via a one-way datalink from the MTP when the FE keyswitch is in the ENABLE position. The plant computer is non-safety equipment. The plant computer datalink is a custom protocol designed specifically to broadcast data to the plant computer. [

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No action over this Ethernet port from outside the safety boundary can affect the AC160 PM646A controller. In addition, no actions over this Ethernet port from outside the safety boundary can affect the display of the RG 1.97 variables on the OM.

Criterion 3. A safety channel should not receive any communication from outside its own safety division unless that communication supports or enhances the performance of the safety function. Receipt of information that does not support or enhance the safety function would involve the performance of functions that are not directly related to the safety function. Safety systems should be as simple as possible. Functions that are not necessary for safety, even if they enhance reliability, should be executed outside the safety system. A safety system designed to perform functions not directly related to the safety function would be more complex than a system that performs the same safety function, but is not designed to perform other functions. The more complex system would increase the likelihood of failures and software errors. Such a complex design, therefore, should be avoided within the safety system. For example, comparison of readings from sensors in different divisions may provide useful information concerning the behavior of the sensors (for example, On-Line Monitoring). Such a function executed within a safety system, however, could also result in unacceptable influence of one division over another, or could involve functions not directly related to the safety functions, and should not be executed within the safety system.

Receipt of information from outside the division, and the performance of functions not directly related to the safety function, if used, should be justified. It should be demonstrated that the added system/software complexity associated with the performance of functions not directly related to the safety function and with the receipt of information in support of those functions does not significantly increase the likelihood of software specification or coding errors, including errors that would affect more than one division. The applicant should justify the definition of "significantly" used in the demonstration.

The WBN2 PAMS design satisfies this criterion. All signals are contained within each safety division and no data information from outside the safety division is received by the PM646A controller or the OM.

The WBN2 PAMS processor performs only the functions necessary for the calculation and monitoring of the RG 1.97 variables allocated to this system.

Criterion 4. The communication process itself should be carried out by a communications processor separate from the processor that executes the safety function, so that communications errors and malfunctions will not interfere with the execution of the safety function. The communication and function processors should operate asynchronously, sharing information only by means of dual-ported memory or some other shared memory resource that is dedicated exclusively to this exchange of information. The function processor, the communications processor, and the shared memory, along with all supporting circuits and software, are all considered to be safety-related, and must be designed, qualified, fabricated, etc., in accordance with 10 C.F.R. Part 50, Appendix A and B. Access to the shared memory should be controlled in such a manner that the function processor has priority access to the shared memory to complete the safety function in a deterministic manner. For example, if the communication processor is accessing the shared memory at a time when the function processor needs to access it, the function processor should gain access within a timeframe that does not impact the loop cycle time assumed in the plant safety analyses. If the shared memory cannot support unrestricted simultaneous access by both processors, then the access controls should be configured such that the function processor always has precedence. The safety function circuits and program logic should ensure that the safety function will be performed within the timeframe established in the safety analysis, and will be completed successfully without data from the shared memory in the event that the function processor is unable to gain access to the shared memory.

The WBN2 PAMS design satisfies this criterion. [ ]^{a,c} The processor and memory of the MTP are physically separate from the PM646A controller and the OM, and thus are not shared. [ ]^{a,c}

The PAMS Safety Function does not depend on data received from outside the train to perform its safety function.

Criterion 5. The cycle time for the safety function processor should be determined in consideration of the longest possible completion time for each access to the shared memory. This longest-possible completion time should include the response time of the memory itself and of the circuits associated with it, and should also include the longest possible delay in access to the memory by the function processor assuming worst-case conditions for the transfer of access from the communications processor to the function processor. Failure of the system to meet the limiting cycle time should be detected and alarmed.

The WBN2 PAMS design satisfies this criterion. The cycle time for the safety function processors takes into account the worst case timing constraints. The system load is monitored and an alarm limit applied to insure that the processor has sufficient resources to perform its safety function. There is no shared memory that is used by both the [ ]^{a,c} as they are physically separate.

Criterion 6. The safety function processor should perform no communication handshaking and should not accept interrupts from outside its own safety division.

The WBN2 PAMS design satisfies this criterion. Communications to systems outside of the safety division are handled by a separate [ ]^{a,c}.

Criterion 7. Only predefined data sets should be used by the receiving system. Unrecognized messages and data should be identified and dispositioned by the receiving system in accordance with the pre-specified design requirements. Data from unrecognized messages must not be used within the safety logic executed by the safety function processor. Message format and protocol should be pre-determined. Every message should have the same message field structure and sequence, including message identification, status information, data bits, etc. in the same locations in every message. Every datum should be included in every transmit cycle, whether it has changed since the previous transmission or not, to ensure deterministic system behavior.

The WBN2 PAMS design satisfies this criterion. The [

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Criterion 8. Data exchanged between redundant safety divisions or between safety and non-safety divisions should be processed in a manner that does not adversely affect the safety function of the sending divisions, the receiving divisions, or any other independent divisions.

The WBN2 PAMS design satisfies this criterion. No data is exchanged between safety divisions in this system.

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]^{a,c} It is not possible to adversely affect the safety function of the WBN2 PAMS from the non-safety side by way of the MTP Ethernet interface.

Criterion 9. Incoming message data should be stored in fixed predetermined locations in the shared memory and in the memory associated with the function processor. These memory locations should not be used for any other purpose. The memory locations should be allocated such that input data and output data are segregated from each other in separate memory devices or in separate pre-specified physical areas within a memory device.

The WBN2 PAMS design satisfies this criterion. The WBN2 PAMS has no incoming message data from outside of its safety channel to be used in the safety function processors. Therefore there is no storage of the incoming messages in the safety function processors.

Criterion 10. Safety division software should be protected from alteration while the safety division is in operation. On-line changes to safety system software should be prevented by hardwired interlocks or by physical disconnection of maintenance and monitoring equipment. A workstation (e.g., engineer or programmer station) may alter addressable constants, setpoints, parameters, and other settings associated with a safety function only by way of the dual-processor/shared-memory scheme described in this guidance, or when the associated channel is inoperable. Such a workstation should be physically restricted from making changes in more than one division at a time. The restriction should be by means of physical cable disconnect, or by means of keylock switch that either physically opens the data transmission circuit or interrupts the connection by means of hardwired logic. "Hardwired logic" as

used here refers to circuitry that physically interrupts the flow of information, such as an electronic AND gate circuit (that does not use software or firmware) with one input controlled by the hardware switch and the other connected to the information source: the information appears at the output of the gate only when the switch is in a position that applies a "TRUE" or "1" at the input to which it is connected. Provisions that rely on software to effect the disconnection are not acceptable. It is noted that software may be used in the safety system or in the workstation to accommodate the effects of the open circuit or for status logging or other purposes.

The WBN2 PAMS design satisfies this criterion. Each PAMS division has its own MTP and OM that can only access the PM646A processor within its division. The PAMS design precludes any interconnection of the workstations between the PAMS trains.

Only setpoints can be changed while the system is in operation. Application software can only be changed when the system is offline.

Online changes (i.e., setpoints changes) can be made from the OM or the MTP with the FE keyswitch in the ENABLE position, in the same division as the safety function processor. Thus it is not possible to change a setpoint on the opposite train.

- Setpoint changes are prohibited by software unless that train is first taken out-of-service using the function enable (FE) keyswitch.
- Enabling the FE keyswitch causes the PAMS' "System Trouble" overhead annunciator to be activated in the main control room (via software control).
- A dedicated OM and MTP are permanently installed on each train. Since there are no inter-divisional connections, setpoints can only be changed by the associated train's OM and MTP.
- Access to the key to the FE keyswitch is administratively controlled by TVA in accordance with TI-12.09, Plant Key Control (Reference 23).

Application software (i.e., software loads) changes can only be made with a PAMS train inoperable.

- The PAMS must be taken out of service to load software.
- Software can only be loaded via the MTP. This feature is not available on the OM.
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- The MTP is a permanently connected maintenance workstation used to modify that train's software.

- Each train's MTP and SLE keyswitch is installed in a separate locked cabinet. Access to these cabinets is controlled administratively by TVA via cabinet locks in accordance with TI-12.09, Plant Key Control.

- Enabling the SLE keyswitch causes the PAMS' "System Trouble" overhead annunciator to be activated in the main control room. [ ]^{a,c}

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- Access to the key to the SLE keyswitch is administratively controlled by TVA in accordance with TI-12.09, Plant Key Control.

In addition to the above controls, the OM and MTP are located in vital areas which restrict access to only authorized personnel.

Criterion 11. Provisions for interdivisional communication should explicitly preclude the ability to send software instructions to a safety function processor unless all safety functions associated with that processor are either bypassed or otherwise not in service. The progress of a safety function processor through its instruction sequence should not be affected by any message from outside its division. For example, a received message should not be able to direct the processor to execute a subroutine or branch to a new instruction sequence.

The WBN2 PAMS design satisfies this criterion. As stated previously, the WBN2 PAMS has no incoming message data from outside of its safety channel to be used in the safety function processors. Therefore the progress of the safety function processors through its instruction sequence will not be affected.

Criterion 12. Communication faults should not adversely affect the performance of required safety functions in any way. Faults, including communication faults, originating in non-safety equipment, do not constitute "single failures" as described in the single failure criterion of 10 C.F.R. Part 50, Appendix A. Examples of credible communication faults include, but are not limited to, the following:

- *Messages may be corrupted due to errors in communications processors, errors introduced in buffer interfaces, errors introduced in the transmission media, or from interference or electrical noise.*

- *Messages may be repeated at an incorrect point in time.*

- *Messages may be sent in the incorrect sequence.*

- *Messages may be lost, which includes both failures to receive an uncorrupted message or to acknowledge receipt of a message.*

- *Messages may be delayed beyond their permitted arrival time window for several reasons, including errors in the transmission medium, congested transmission lines, interference, or by delay in sending buffered messages.*

- *Messages may be inserted into the communication medium from unexpected or unknown sources.*

- *Messages may be sent to the wrong destination, which could treat the message as a valid message.*

- *Messages may be longer than the receiving buffer, resulting in buffer overflow and memory corruption.*

- *Messages may contain data that is outside the expected range.*

- *Messages may appear valid, but data may be placed in incorrect locations within the message.*

- *Messages may occur at a high rate that degrades or causes the system to fail (i.e., broadcast storm).*

- *Message headers or addresses may be corrupted.*

The WBN2 PAMS design satisfies this criterion. The signal data acquisition, the algorithms execution, and the setting of the annunciator output relays by the PM646A controller, cannot be impacted by any postulated communications failure at the Ethernet controller in the MTP. Ethernet communications failures in the MTP cannot impact the PM646A processor or the OM displays.

Criterion 13. Vital communications, such as the sharing of channel trip decisions for the purpose of voting, should include provisions for ensuring that received messages are correct and are correctly understood. Such communications should employ error-detecting or error-correcting coding along with means for dealing with corrupt, invalid, untimely or otherwise questionable data. The effectiveness of error detection/correction should be demonstrated in the design and proof testing of the associated codes, but once demonstrated is not subject to periodic testing. Error-correcting methods, if used, should be shown to always reconstruct the original message exactly or to designate the message as unrecoverable. None of this activity should affect the operation of the safety-function processor.

The WBN2 PAMS design satisfies this criterion. "Vital" communications is defined to be communications that are needed to support a safety function and the failure of vital communications could inhibit the performance of a safety function.

Ethernet communications between the MTP and the non-safety equipment (plant computer) are not vital to the performance of any safety function.

Criterion 14. Vital communications should be point-to-point by means of a dedicated medium (copper or optical cable). In this context, "point-to-point" means that the message is passed directly from the sending node to the receiving node without the involvement of equipment outside the division of the sending or receiving node. Implementation of other communication strategies should provide the same reliability and should be justified.

The WBN2 PAMS design satisfies this criterion. "Vital" communications is defined to be communications that are needed to support a safety function and the failure of vital communications could inhibit the performance of a safety function. The WBT PAMS system has no such vital communication interfaces. Ethernet communications between the MTP and the non-safety equipment (plant computer) are not vital to the performance of any safety function.

Criterion 15. Communication for safety functions should communicate a fixed set of data (called the "state") at regular intervals, whether data in the set has changed or not.

The WBN2 PAMS satisfies this criterion. No data is received from outside the safety division.

Criterion 16. Network connectivity, liveness, and real-time properties essential to the safety application should be verified in the protocol. Liveness, in particular, is taken to mean that no connection to any network outside the division can cause an RPS/ESFAS communication protocol to stall, either deadlock or livelock. (Note: This is also required by the independence criteria of: (1) 10 C.F.R. Part 50, Appendix A, General Design Criteria ("GDC") 24, which states, "interconnection of the protection and control systems shall be limited so as to assure that safety is not significantly impaired," and (2) IEEE 603-1991 IEEE Standard Criteria for Safety Systems for Nuclear Power Generating Stations.) (Source: NUREG/CR-6082, 3.4.3)

Per BTP 7-19 Rev. 5 (Reference 6), the WBN2 Common Q PAMS is within the monitoring and indication echelon. It does not connect to or communicate with the control echelon (Foxboro IA). The connection to the ESFAS (Eagle 21) is the receipt of 4-20ma analog signals from Eagle 21. As previously described the Eagle 21 output is isolated electrically within the Eagle 21 system. Since there is no communications protocol in the receipt of an analog signal, a failure of the Common Q PAMS cannot cause a deadlock or livelock of the ESFAS. Therefore this criterion does not apply to the Common Q PAMS.

Criterion 17. Pursuant to 10 C.F.R. § 50.49, the medium used in a vital communications channel should be qualified for the anticipated normal and post-accident environments. For example, some optical fibers and components may be subject to gradual degradation as a result of prolonged exposure to radiation or to heat. In addition, new digital systems may need susceptibility testing for EMI/RFI and power surges, if the environments are significant to the equipment being qualified.

The WBN2 PAMS satisfies this criterion. The WBT PAMS system does not receive any vital communications from outside its own safety division. The MTP out-bound TCP/IP communication is not vital to any PAMS safety function. The WBN2 PAMS is installed in a mild environment. Qualification testing of the equipment for continuous use exceeds the environmental conditions for the installation (see Section 4.4). EMI/RFI testing is performed to industry standards (Reference 3) to insure acceptable performance.

Criterion 18. Provisions for communications should be analyzed for hazards and performance deficits posed by unneeded functionality and complication.

The WBN2 PAMS satisfies this criterion. All MTP TCP/IP communications is out-bound only and is not vital. A failure modes and effect analysis (FMEA) will be prepared for this system and the TCP/IP interface will be included in this analysis.

Criterion 19. If data rates exceed the capacity of a communications link or the ability of nodes to handle traffic, the system will suffer congestion. All links and nodes should have sufficient capacity to support all functions. The applicant should identify the true data rate, including overhead, to ensure that communication bandwidth is sufficient to ensure proper performance of all safety functions. Communications throughput thresholds and safety system sensitivity to communications throughput issues should be confirmed by testing.

The WBN2 PAMS satisfies this criterion. The PM646A controller and the OM do not receive any vital communications from outside their own safety division. A data storm test is required as part of the Factory Acceptance Test in accordance with WBN2 Common Q purchase specification.

Criterion 20. The safety system response time calculations should assume a data error rate that is greater than or equal to the design basis error rate and is supported by the error rate observed in design and qualification testing.

There are no response time criteria in the WBN2 licensing basis for the post-accident monitoring system (see Section 4.12). Therefore, this criterion is not applicable.

The WBN2 PAMS does not perform any actuation functions. Therefore Section 2, Command Prioritization, of Revision 1 of DI&C-ISG-04 is not applicable.

The WBN2 PAMS OM and MTP do not have the ability to control plant equipment and are physically separate and electrically independent of the other PAMS division. Therefore, Section 3, Multidivisional Control and Display Stations, of Revision 1 of DI&C-ISG-04 (Reference 14) is not applicable.

(Last Page of Section 5)

SECTION 6
DOCUMENTATION

6.1 DOCUMENT REQUIREMENTS

The following table provides the document that will be generated for the Watts Bar 2 PAMS for each document called out in Table I in the Common Q Software Program Manual (Reference 1). The latest revision of the document is applicable.

Table 6-1. Document Requirements

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Table 6-1. Document Requirements (cont.)

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Table 6-1. Document Requirements (cont.)

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Table 6-1. Document Requirements (cont.)

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Table 6-1. Document Requirements (cont.)

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Table 6-1. Document Requirements (cont.)

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Table 6-1. Document Requirements (cont.)

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6.2 SUBMITTED DOCUMENTS

Table 6-2 shows the Westinghouse Watts Bar 2 Common Q PAMS documents that have been provided to TVA for submittal to the NRC.

Table 6-2. Westinghouse Watts Bar 2 Common Q PAMS Documents Provided to TVA for Submittal

Letter #/CAW	Date	Document Title	Document #	Rev
WBT-D-1680 CAW-10-2764	3/3/2010	Watts Bar 2 Post Accident Monitoring System – System Requirements Specification	WNA-DS-01617-WBT	1
WBT-D-1680 CAW-10-2764	3/3/2010	Watts Bar 2 Post Accident Monitoring System – System Design Specification	WNA-DS-01667-WBT	1
WBT-D-1747 CAW-10-2783	3/25/2010	Watts Bar 2 NSSS Completion Program I&C Projects IV&V Phase Summary Report (March 2010)	WNA-VR-00283-WBT	0
WBT-D-1729 CAW-10-2783	4/1/2010	Watts Bar 2 NSSS Completion Program I&C Projects IV&V Phase Summary Report (March 2010)	WNA-VR-00283-WBT	0
WBT-D-1786 CAW-10-2792	4/6/2010	RRAS Watts Bar 2 NSSS Completion Program I&C Projects Software Requirements Specification for the Post Accident Monitoring System	WNA-SD-00239-WBT	1
WBT-D-1800 CAW-10-2794	4/6/2010	Tennessee Valley Authority (TVA) Watts Bar Unit 2 (WBN2) Post Accident Monitoring System (PAMS) Licensing Technical Report, (Proprietary)	WNA-LI-00058-WBT	0
WBT-D-2090	6/25/2010	Tennessee Valley Authority (TVA) Watts Bar Unit 2 (WBN2) Post-Accident Monitoring System (PAMS) Licensing Technical Report	WNA-LI-00058-WBT-NP	0

Table 6-2. Westinghouse Watts Bar 2 Common Q PAMS Documents Provided to TVA for Submittal (cont.)

Letter #/CAW	Date	Document Title	Document #	Rev
WBT-D-2090 CAW-10-2866	6/25/2010	Tennessee Valley Authority (TVA) Watts Bar Unit 2 (WBN2) Post-Accident Monitoring System (PAMS) Licensing Technical Report (Westinghouse Proprietary Class 2)	WNA-LI-00058-WBT-P	0
WBT-D-2085	6/28/2010	Tennessee Valley Authority (TVA) Watts Bar Unit 2 (WBN2) Post-Accident Monitoring System (PAMS) Licensing Technical Report	WNA-LI-00058-WBT-NP	0
WBT-D-2085 CAW-10-2866	6/28/2010	Tennessee Valley Authority (TVA) Watts Bar Unit 2 (WBN2) Post-Accident Monitoring System (PAMS) Licensing Technical Report (Westinghouse Proprietary Class 2)	WNA-LI-00058-WBT-P	0
WBT-D-2096 CAW-10-2878	6/30/2010	RRAS Watts Bar 2 NSSS Completion Program I&C Projects Software Requirements Specification for the Post Accident Monitoring System (Proprietary)	WNA-SD-00239-WBT-P	1
WBT-D-2096	6/30/2010	RRAS Watts Bar 2 NSSS Completion Program I&C Projects Software Requirements Specification for the Post Accident Monitoring System (Non-Proprietary)	WNA-SD-00239-WBT-NP	1
WBT-D-2095 CAW-10-2877	7/7/2010	RRAS Watts Bar 2 NSSS Completion Program I&C Projects Post Accident Monitoring System – System Design Specification (Proprietary)	WNA-DS-01667-WBT-P	1
WBT-D-2095	7/7/2010	RRAS Watts Bar 2 NSSS Completion Program I&C Projects Post Accident Monitoring System – System Design Specification (Non-Proprietary)	WNA-DS-01667-WBT-NP	1

Table 6-2. Westinghouse Watts Bar 2 Common Q PAMS Documents Provided to TVA for Submittal (cont.)

Letter #/CAW	Date	Document Title	Document #	Rev
WBT-D-2094 CAW-10-2876	7/7/2010	RRAS Watts Bar 2 NSSS Completion Program I&C Projects Post Accident Monitoring System – System Requirements Specification (Proprietary)	WNA-DS-01617-WBT-P	1
WBT-D-2094	7/7/2010	RRAS Watts Bar 2 NSSS Completion Program I&C Projects Post Accident Monitoring System – System Requirements Specification (Non-Proprietary)	WNA-DS-01617-WBT-NP	1
WBT-D-2166 CAW-10-2891	7/20/2010	Common 0 PAMS Field Programmable Gate Arrays (FPGAs)	WBT-D-2166	N/A
WBT-D-2247 CAW-10-2912	8/17/2010	IV&V Phase Summary Report	WNA-VR-00283-WBT	0
WBT-D-2247 CAW-10-2914	8/17/2010	Requirements Traceability Matrix for the Post Accident Monitoring System	WNA-VR-00279-WBT	0
WBT-D-2247 CAW-10-2918	8/17/2010	Software Design Description for the Post Accident Monitoring System AC 160 Software	WNA-SD-00250-WBT	0
WBT-D-2283 CAW-10-2921	8/26/2010	System Requirements Specification For The Common Q Post Accident Monitoring System	00000-ICE-30156	7
WBT-D-2283 CAW-10-2923	8/26/2010	Software Design Description for the Post Accident Monitoring System Flat Panel Display	WNA-SD-00248-WBT	0
WBT-D-2316 CAW-10-2927	9/3/2010	Common Q Software Requirements Specification Post Accident Monitoring System	00000-ICE-3238	5
WBT-D-2356 CAW-10-2941	9/7/2010	Failure Modes and Effects Analysis (FMEA) for the Post Accident Monitoring System	WNA-AR-00180-WBT	0
WBT-D-2356 CAW-10-2942	9/7/2010	Post Accident Monitoring System Reliability Analysis	WNA-AR-00189-WBT	0

Table 6-2. Westinghouse Watts Bar 2 Common Q PAMS Documents Provided to TVA for Submittal (cont.)

Letter #/CAW	Date	Document Title	Document #	Rev
WBT-D-2436 CAW-10-2904	9/30/2010	AI687 and AI688 for use in Common Q PAMS EMC Test Report and Installation Limitations	EQ-QR-64-GEN	0
WBT-D-2440 CAW-10-2973	10/1/2010	Environmental and Seismic Test Report, AI687 and AI688 Modules and Supporting Components for use in Common Q PAMS	EQLR-171	0
WBT-D-2469 CAW-10-2977	10/1/2010	Comparison of Tested Conditions for the AI687 and AI688 Common Q Modules to the Watts Bar Unit 2 (WBT) Requirements	EQ-EV-62-WBT	0
WBT-D-2441 CAW-10-2975	10/6/2010	Equipment Qualification Report for AC160 Platform – Common Qualified (Common Q) Power Supply	WCAP-16166-P Supplement 1-E06	0
WBT-D-2441 CAW-10-2975	10/6/2010	Equipment Qualification Report for AC160 Platform – QUINT Power Supplies and Input Line Filter	WCAP-16166-P Supplement 1-E07	0
WBT-D-2441 CAW-10-2975	10/6/2010	Equipment Qualification Report for AC160 Platform – AI687 and AI688 Modules and Supporting Components for Use in Common Qualified (Common Q) Post Accident Monitoring System (PAMS)	WCAP-16166-P Supplement 1-E09	1
WBT-D-2473 CAW-10-2969	10/7/2010	Tennessee Valley Authority (TVA) Watts Bar Unit 2 (WBN2) Post-Accident Monitoring System (PAMS) Licensing Technical Report	WNA-L1-00058-WBT-P	1
WBT-D-2487 CAW-10-2981	10/8/2010	Watts Bar Unit 2 ARPI System Upgrade CERPI System Requirements Specification (Proprietary)	WNS-DS-00001-WBT-P	2

Table 6-2. Westinghouse Watts Bar 2 Common Q PAMS Documents Provided to TVA for Submittal (cont.)

Letter #/CAW	Date	Document Title	Document #	Rev
WBT-D-2487	10/8/2010	Watts Bar Unit 2 ARPI System Upgrade CERPI System Requirements Specification (Non-Proprietary)	WNS-DS-00001-WBT-NP	2
WBT-D-2470 CAW-10-2972	10/14/2010	Dynamic Similarity Analysis for the Watts Bar Unit 2 Post Accident Monitoring System (PAMS) (Proprietary)	CN-EQT-10-44	0
WBT-D-2556 CAW-10-2994	10/25/2010	Comparison of Tested Conditions for the AI687 and AI688 Common Q Modules to the Watts Bar Unit 2 (WBT) Requirements (Proprietary)	EQ-EV-62-WBT	1
WBT-D-2568 CAW-10-2999	10/26/2010 11/01/2010	Failure Modes and Effects Analysis (FMEA) for the Post Accident Monitoring System (Proprietary)	WNA-AR-00180-WBT-P	0
WBT-D-2568	10/26/2010	Failure Modes and Effects Analysis (FMEA) for the Post Accident Monitoring System (Non-Proprietary)	WNA-AR-00180-WBT-NP	0
WBT-D-2623 CAW-10-3008	11/8/2010	IV&V Summary Report for the Post Accident Monitoring System	WNA-VR-00283-WBT	1
WBT-D-2656 WBT-D-2659 CAW-10-3020	11/15/2010 11/23/10	Post Accident Monitoring System Test Plan	WNA-PT-00138-WBT	0
WBS-D-2655 WBT-D-2658 CAW-10-3019	11/15/2010 11/17/2010	Nuclear Automation Watts Bar Unit 2 NSSS Completion Program I&C Projects, Post Accident Monitoring System Channel Integration Test/Factory Acceptance Test" (Proprietary)	WNA-TP-02988-WBT	0
WBT-D-2644 CAW-10-3017	11/17/2010	Post Accident Monitoring System - System Requirements Specification (Proprietary)	WNA-DS-01617-WBT-P	2
WBT-D-2644	11/17/2010	Post Accident Monitoring System - System Requirements Specification (Non-Proprietary)	WNA-DS-01617-WBT-NP	2

Table 6-2. Westinghouse Watts Bar 2 Common Q PAMS Documents Provided to TVA for Submittal (cont.)

Letter #/CAW	Date	Document Title	Document #	Rev
WBT-D-2645 CAW-10-3018	11/17/2010	Post Accident Monitoring System - System Design Specification (Proprietary)	WNA-DS-01667-WBT-P	2
WBT-D-2645	11/17/2010	Post Accident Monitoring System - System Design Specification (Non-Proprietary)	WNA-DS-01667-WBT-NP	2
WBT-D-2646 CAW-10-3016	11/17/2010	Software Requirements Specification for the Post Accident Monitoring System (Proprietary)	WNA-SD-00239-WBT-P	2
WBT-D-2646	11/17/2010	Software Requirements Specification for the Post Accident Monitoring System (Non-Proprietary)	WNA-SD-00239-WBT-NP	2
WBT-D-2651 CAW-10-3012	11/22/2010	Post Accident Monitoring System – Common Q Software Requirements Specification (Proprietary) / 00000-ICE-3238, Rev. 5	WCAP-17351-P	0
WBT-D-2651	11/22/2010	Post Accident Monitoring System – Common Q Software Requirements Specification (Non-Proprietary) / 00000-ICE-3238, Rev. 5	WCAP-17351-NP	0
WBT-D-2693 CAW-10-3036	11/24/2010	IV&V Summary Report for the Post Accident Monitoring System (Proprietary)	WNA-VR-00283-WBT	2
WBT-D-2652 CAW-10-3013	12/3/2010	Tennessee Valley Authority (TVA) Watts Bar Unit 2 (WBN2) Post-Accident Monitoring System (PAMS) Licensing Technical Report (Proprietary)	WNA-LI-00058-WBT-P	2
WBT-D-2652	12/3/2010	Tennessee Valley Authority (TVA) Watts Bar Unit 2 (WBN2) Post-Accident Monitoring System (PAMS) Licensing Technical Report (Non-Proprietary)	WNA-LI-00058-WBT-NP	2
WBT-D-2691 CAW-10-3052	12/8/2010	Post Accident Monitoring System - System Design Specification (Proprietary)	WNA-DS-01667-WBT-P	3
WBT-D-2691	12/8/2010	Post Accident Monitoring System - System Design Specification (Non-Proprietary)	WNA-DS-01667-WBT-NP	3

Table 6-2. Westinghouse Watts Bar 2 Common Q PAMS Documents Provided to TVA for Submittal (cont.)

Letter #/CAW	Date	Document Title	Document #	Rev
WBT-D-2692 CAW-10-3051	12/8/2010	Post Accident Monitoring System - System Requirements Specification (Proprietary)	WNA-DS-01617-WBT-P	3
WBT-D-2692	12/8/2010	Post Accident Monitoring System - System Requirements Specification (Non-Proprietary)	WNA-DS-01617-WBT-NP	3
WBT-D-2720 CAW-10-3054	12/8/2010	Software Requirements Specification for the Post Accident Monitoring System (Proprietary)	WNA-SD-00239-WBT-P	3
WBT-D-2720 CAW-10-3054	12/8/2010	Software Requirements Specification for the Post Accident Monitoring System (Non-Proprietary)	WNA-SD-00239-WBT-NP	3
WBT-D-2748 CAW-10-3057	12/10/2010	Watts Bar Unit 2 NSSS Completion Program I&C Projects Qualification Summary Report for Post-Accident Monitoring System (PAMS) (Proprietary)	EQ-QR-68-WBT	0-A
WBT-D-2756 CAW-10-3060	12/10/2010	IV&V Summary Report for the Post Accident Monitoring System (Proprietary)	WNA-VR-00283-WBT-P	3
WBT-D-2756	12/10/2010	Nuclear Automation Watts Bar 2 NSSS Completion Program I&C Projects IV&V Summary Report for the Post Accident Monitoring System (Non-Proprietary)	WNA-VR-00283-WBT-NP	3
WBT-D-2912	2/10/2011	Watts Bar Unit 2 Post Accident Monitoring System - System Requirements Specification (Proprietary)	WNA-DS-01617-WBT-P	4
WBT-D-2912	2/10/2011	Watts Bar Unit 2 Post Accident Monitoring System - System Requirements Specification (Non-Proprietary)	WNA-DS-01617-WBT-NP	4

Table 6-2. Westinghouse Watts Bar 2 Common Q PAMS Documents Provided to TVA for Submittal (cont.)

Letter #/CAW	Date	Document Title	Document #	Rev
WBT-D-2914	2/11/2010	Application For Withholding Proprietary Information From Public Disclosure Subject: WNA-DS-01617-WBT-P, Rev. 4, "PAMS - System Requirements Specification" (Proprietary)	CAW-11-3107	N/A
WBT-D-2910 CAW-11-3102	2/11/2011	Software Requirements Specification for the Post Accident Monitoring System (Proprietary)	WNA-SD-00239-WBT-P	4
WBT-D-2910	2/11/2011	Software Requirements Specification for the Post Accident Monitoring System (Non-Proprietary)	WNA-SD-00239-WBT-NP	4
WBT-D-2916 CAW-11-3108	2/11/2011	Application For Withholding Proprietary Information From Public Disclosure WNA-DS-01667-WBT-P, Rev. 4, "Post Accident Monitoring System - System Design Specification" (Proprietary)	CAW-11-3108	N/A
WBT-D-2916	2/11/2011	Post Accident Monitoring System – System Design Specification (Proprietary)	WNA-DS-01667-WBT-P	4
WBT-D-2916	2/11/2011	Post Accident Monitoring System – System Design Specification (Non-Proprietary)	WNA-DS-01667-WBT-NP	4
WBT-D-2922	2/11/2011	Failure Modes and Effects Analysis (FMEA) for the Post Accident Monitoring System (Proprietary)	WNA-AR-00180-WBT-P	1
WBT-D-2922	2/11/2011	Failure Modes and Effects Analysis (FMEA) for the Post Accident Monitoring System (Non-Proprietary)	WNA-AR-00180-WBT-NP	1
WBT-D-2917 CAW-11-3108	2/14/2011	Application For Withholding Proprietary Information From Public Disclosure, WNA-AR-00180-WBT-P, Rev. 1, "Failure Modes and Effects Analysis	CAW-11-3106	N/A

Table 6-2. Westinghouse Watts Bar 2 Common Q PAMS Documents Provided to TVA for Submittal (cont.)

Letter #/CAW	Date	Document Title	Document #	Rev
		(FMEA) for the Post Accident Monitoring System" (Proprietary)		
WBT-D-2956	2/25/2011	Failure Modes and Effects Analysis (FMEA) for the Post Accident Monitoring System (Proprietary)	WNA-AR-00180-WBT-P	2
WBT-D-2956	2/25/2011	Failure Modes and Effects Analysis (FMEA) for the Post Accident Monitoring System (Non-Proprietary)	WNA-AR-00180-WBT-NP	2
WBT-D-2956 CAW-11-3117	2/25/2011	Application For Withholding Proprietary Information From Public Disclosure, WNA-AR-00180-WBT-P, Rev. 2, "Failure Modes and Effects Analysis (FMEA) for the Post Accident Monitoring System" (Proprietary)	CAW-11-3117	N/A
WBT-D-2978	3/7/2011	IV&V Summary Report for the Post Accident Monitoring System (Proprietary)	WNA-VR-00283-WBT-P	4
WBT-D-2978	3/7/2011	IV&V Summary Report for the Post Accident Monitoring System (Non-Proprietary)	WNA-VR-00283-WBT-NP	4
WBT-D-2978 CAW-11-3121	3/7/2011	Application For Withholding Proprietary Information From Public Disclosure, WNA-VR-00283-WBT-P, Rev. 4, "IV&V Summary Report for the Post Accident Monitoring System" (Proprietary)	CAW-11-3121	N/A
WBT-D-3004	3/9/2011	Westinghouse Generic Improvements from the Watts Bar Unit 2 Post Accident Monitoring System (Non-Proprietary)	N/A	N/A
WBT-D-3004	3/9/2011	Watts Bar Unit 2 Post Accident Monitoring System (WBN2 PAMS) Audit Summary – 2/28/11 (Non-Proprietary)	N/A	N/A

Table 6-2. Westinghouse Watts Bar 2 Common Q PAMS Documents Provided to TVA for Submittal (cont.)

Letter #/CAW	Date	Document Title	Document #	Rev
WBT-D-3004	3/9/2011	Watts Bar Unit 2 Post Accident Monitoring System (WBN2 PAMS) Audit Summary – 3/1/11 (Non-Proprietary)	N/A	N/A
WBT-D-3004	3/9/2011	Watts Bar Unit 2 Post Accident Monitoring System (WBN2 PAMS) Audit Summary – 3/2/11 (Non-Proprietary)	N/A	N/A
WBT-D-3004	3/9/2011	Watts Bar Unit 2 Post Accident Monitoring System (WBN2 PAMS) Audit Summary – 3/3/11 (Non-Proprietary)	N/A	N/A
WBT-D-3004	3/9/2011	Watts Bar Unit 2 Post Accident Monitoring System (WBN2 PAMS) Audit Summary – 3/4/11 – Exit Meeting (Non-Proprietary)	N/A	N/A
WBT-D-3004	3/9/2011	Review of WBN2 SyRS (Non-Proprietary)	N/A	N/A
WBT-D-3004	3/9/2011	List of Attendees (Non-Proprietary)	N/A	N/A
WBT-D-3004	3/9/2011	Commercial Grade Dedication (CGD) Examples (Non-Proprietary)	N/A	N/A
WBT-D-3004	3/9/2011	Assessment of Software Configuration Management Plan for Common Q™ Projects (Non-Proprietary)	N/A	N/A

6.3 DOCUMENTS AVAILABLE FOR AUDIT

Table 6-3 shows Westinghouse documents that have been made available for audit at the Westinghouse Rockville Office.

Table 6-3. Westinghouse Watts Bar 2 Common Q PAMS Documents at Westinghouse Rockville Office

Letter #	Date	Document Title	Document #	Rev
WBT-D-1526 WBT-D-1564	1/28/2010 2/3/10	Commercial Grade Dedication Report for the QNX Operating System for Common Q Applications	00000-ICE-37722	0
WBT-D-1526 WBT-D-1564	1/28/2010 2/3/10	Design and Life Cycle Evaluation Report On Pre-Developed Software in ABB AC160, I/O Modules and Tools	GKWF700777	2
WBT-D-1526 WBT-D-1564	1/28/2010 2/3/10	Generic Operating History Evaluation Report on Pre-Developed Software in ABB AC160, I/O Module and Tool Software	GKWF700778	2
WBT-D-1526 WBT-D-1564	1/28/2010 2/3/10	Preparation of Commercial Dedication Instructions (CDIs)	NA 7.4	0
WBT-D-1526 WBT-D-1564	1/28/2010 2/3/10	Dedication Of Commercial Grade Items	WEC 7.2	1
WBT-D-1526 WBT-D-1564	1/28/2010 2/3/10	COMMERCIAL GRADE SURVEYS	WEC 7.3	0
WBT-D-1526 WBT-D-1564	1/28/2010 2/3/10	COMMERCIAL DEDICATION REPORT FOR QNX 4.25G FOR COMMON Q APPLICATIONS	WNA-CD-00018-GEN	3
WBT-D-1526 WBT-D-1564	1/28/2010 2/3/10	Post Accident Monitoring System – System Requirements Specification	WNA-DS-01617-WBT	1
WBT-D-1526 WBT-D-1564	1/28/2010 2/3/10	Post Accident Monitoring System – System Design Specification	WNA-DS-01667-WBT	0
WBT-D-1526 WBT-D-1564	1/28/2010 2/3/10	Project Plan Title: Common Q Post Accident Monitoring System	WNA-PD-00073-WBT	0
WBT-D-1526 WBT-D-1564	1/28/2010 2/3/10	Testing Process for Common Q Safety Systems	WNA-PT-00058-GEN	0
WBT-D-1526 WBT-D-1564	1/28/2010 2/3/10	Software Requirements Specification for the Post Accident Monitoring System	WNA-SD-00239-WBT	0

Table 6-3. Westinghouse Watts Bar 2 Common Q PAMS Documents at Westinghouse Rockville Office (cont.)

Letter #	Date	Document Title	Document #	Rev
WBT-D-1526 WBT-D-1564	1/28/2010 2/3/10	Element Software Test Procedure	WNA-TP-00357-GEN	4
WBT-D-1961	5/21/2010	Requirements Traceability Matrix for the Post Accident Monitoring System	WNA-VR-00279-WBT	0
WBT-D-1961	5/21/2010	IV&V Phase Summary Report	WNA-VR-00283-WBT	0
WBT-D-1961	5/21/2010	Software Design Description for the Post Accident Monitoring System Flat Panel Display	WNA-SD-00248-WBT	0
WBT-D-1961	5/21/2010	Software Design Description for the Post Accident Monitoring System AC160 Software	WNA-SD-00250-WBT	0
WBT-D-1961	5/21/2010	Environmental Qualification Test Procedure for Next Generation PC Node Box and Flat Panel Display Systems	EQ-TP-33-GEN	1
WBT-D-1961	5/21/2010	Seismic Qualification Test Procedure for Next Generation PC Node Box and Flat Panel Display Systems	EQ-TP-35-GEN	1
WBT-D-1961	5/21/2010	Electromagnetic Test Plan and Procedure for Next Generation PC Node Box and Flat Panel Display Systems	EQ-TP-60-GEN	2
WBT-D-2024	6/9/2010	Next Generation PC Node Box Commercial Dedication Instruction	CDI-3722	7
WBT-D-2024	6/9/2010	Next Generation Flat Panel Display (FPD) Commercial Dedication Instruction	CDI-3803	8
WBT-D-2024	6/9/2010	PC Node Box/Flat Panel Display System Components Qualification Summary	LTR-EQ-10-50	N/A
WBT-D-2024	6/9/2010	System Requirements Specification for the Common Q Post Accident Monitoring System	00000-ICE-30156	6

Table 6-3. Westinghouse Watts Bar 2 Common Q PAMS Documents at Westinghouse Rockville Office (cont.)

Letter #	Date	Document Title	Document #	Rev
WBT-D-2024	6/9/2010	Summary Qualification Report Of Hardware Testing For Common Q Applications	00000-ICE-37764	3
WBT-D-2024	6/9/2010	TWICE Qualification Status Report	WNA-QR-00011-SSP	3
WBT-D-2035	6/11/2010	Commercial Dedication Instruction	CDI- 4057	4
WBT-D-2035	6/11/2010	Electromagnetic Compatibility Test Plan and Procedure for Quint Power Supplies and Safety System Line Filter	EQ-TP-105-GEN	0
WBT-D-2035	6/11/2010	APPENDIX A Monitoring Test Procedure for QUINT System Panels EMC Qualification	EQ-TP-105-GEN (Appendix A)	0
WBT-D-2035	6/11/2010	Seismic Qualification Test Procedure For Common Q Power Supplies, Quint Power Supplies, Line Filter Assemblies, and South Texas Units 3 & 4 Circuit Breakers	EQ-TP-114-GEN	0
WBT-D-2035	6/11/2010	APPENDIX C Monitoring Test Procedure for Common Q PAMS Seismic Qualification	EQ-TP-114-GEN (Appendix C)	0
WBT-D-2035	6/11/2010	APPENDIX D Monitoring Test Procedure for QUINT System Panels Seismic Qualification	EQ-TP-114-GEN (Appendix D)	0
WBT-D-2035	6/11/2010	Environmental Qualification Test Procedure For Common Q Power Supplies, Quint Power Supplies, and Line Filter Assemblies	EQ-TP-117-GEN	0
WBT-D-2035	6/11/2010	APPENDIX A Monitoring Test Procedure for Common Q PAMS Environmental Qualification	EQ-TP-117-GEN (Appendix A)	0
WBT-D-2035	6/11/2010	APPENDIX B Monitoring Test Procedure for QUINT System Panels Environmental Qualification	EQ-TP-117-GEN (Appendix B)	0
WBT-D-2268	8/16/2010	Software Design Description for the Common Q Core Protection Calculator System Database and Utility Functions	00000-ICE-30140	4

Table 6-3. Westinghouse Watts Bar 2 Common Q PAMS Documents at Westinghouse Rockville Office (cont.)

Letter #	Date	Document Title	Document #	Rev
WBT-D-2268	8/16/2010	Common Q Software Design Description	00000-ICE-30152	5
WBT-D-2268	8/16/2010	System Requirements Specification for the Common Q Generic Flat Panel Display	00000-ICE-30155	9
WBT-D-2268	8/16/2010	Common Q Software Requirements Specification	00000-ICE-3238	5
WBT-D-2268	8/16/2010	Software Requirements Specification for the Common Q Generic Flat Panel Display Software	00000-ICE-3239	12
WBT-D-2268	8/16/2010	Commercial Grade Dedication Plan for the QNX Operating System for Common Q Applications	00000-ICE-35444	0
WBT-D-2268	8/16/2010	Commercial Grade Dedication Report for the QNX Operating System for Common Q Applications	00000-ICE-37722	0
WBT-D-2268	8/16/2010	Post Accident Monitoring System Software Preliminary Hazard Analysis for the Common Q Phase 3 PAMS Project	00000-ICE-37727	0
WBT-D-2268	8/16/2010	Coding Standards and Guidelines for Common Q Systems	00000-ICE-3889	10
WBT-D-2268	8/16/2010	Design Specification Sheet	956080	1
WBT-D-2268	8/16/2010	AC160 CPU Loading Restrictions	AN03007Sp	-
WBT-D-2268	8/16/2010	Design Process for Common Q Safety Systems	NABU-DP-00014-GEN	2
WBT-D-2268	8/16/2010	Common Q Software Configuration Management Guidelines	NABU-DP-00015-GEN	2
WBT-D-2268	8/16/2010	Tennessee Valley Authority Watts Bar Nuclear Plant Unit 2 NSSS Completion Project – Final	65717	2
WBT-D-2268	8/16/2010	Common Q Exception Report	VV-769	1
WBT-D-2268	8/16/2010	Common Q Exception Report	VV-770	1

Table 6-3. Westinghouse Watts Bar 2 Common Q PAMS Documents at Westinghouse Rockville Office (cont.)

Letter #	Date	Document Title	Document #	Rev
WBT-D-2268	8/16/2010	Transmittal of Westinghouse Comments on TVA Specification EDCR52351	WBT-D-0088	-
WBT-D-2268	8/16/2010	Safety Related Digital Logic Cards Circuitry & Related Instrument Racks Restriction	WBT-TVA-0070	-
WBT-D-2268	8/16/2010	Contract Work Authorization (CWA) Request	WEST-WBT-2008-025	3
WBT-D-2268	8/16/2010	Commercial Dedication Report for QNX 4.25G for Common Q Applications	WNA-CD-00018-GEN	3
WBT-D-2268	8/16/2010	Commercial Grade Dedication Report For The Abb Advant PM646A/ PM646B Firmware/Base System Software Version 1.3/8, ACC Advanced Version 1.7/1, AC160 PC and DB Element Library Version 1.5/0 For Common Q Applications	WNA-CD-00029-GEN	0
WBT-D-2268	8/16/2010	RRAS/Nuclear Automation Reusable Software Element Document Engineering Units Conversion	WNA-DS-00306-GEN	5
WBT-D-2268	8/16/2010	Reusable Software Element Document CRC for Calibration Data	WNA-DS-00315-GEN	2
WBT-D-2268	8/16/2010	Application Restrictions for Generic Common Q Qualification	WNA-DS-01070-GEN	3
WBT-D-2268	8/16/2010	RRAS Standard General Requirements for Cyber Security	WNA-DS-01150-GEN	0
WBT-D-2268	8/16/2010	RRAS Safety and Monitoring Systems Standard Reusable Software Element Document for Reflash Type Circuit	WNA-DS-01505-GEN	0
WBT-D-2268	8/16/2010	RRAS Safety and Monitoring Systems Standard Reusable Software Element Document for Exclusive Module Error Type Circuit	WNA-DS-01564-GEN	1

Table 6-3. Westinghouse Watts Bar 2 Common Q PAMS Documents at Westinghouse Rockville Office (cont.)

Letter #	Date	Document Title	Document #	Rev
WBT-D-2268	8/16/2010	RRAS Safety and Monitoring Systems Standard Reusable Software Element Document for PM Diagnostics Type Circuit	WNA-DS-01715-GEN	2
WBT-D-2268	8/16/2010	RRAS Safety and Monitoring Systems Standard Reusable Software Element Document for Fourth-Order Polynomial Fluid Density Curve Fit Custom PC Element	WNA-DS-01838-GEN	3
WBT-D-2268	8/16/2010	RRAS Safety and Monitoring Systems Standard Reusable Software Element Document for Summation of Reference Leg Density Correction Custom PC Element	WNA-DS-01839-GEN	3
WBT-D-2268	8/16/2010	RRAS Safety and Monitoring Systems Standard Reusable Software Element Document for 2-Input Maximum Comparison with Status Control Custom PC Element	WNA-DS-01840-GEN	2
WBT-D-2268	8/16/2010	RRAS Safety and Monitoring Systems Standard Reusable Software Element Document for 2-Input Minimum Comparison with Status Control Custom PC Element	WNA-DS-01841-GEN	2
WBT-D-2268	8/16/2010	RRAS Safety and Monitoring Systems Standard Reusable Software Element Document for RVLIS Static Level Calculation Custom PC Element	WNA-DS-01842-GEN	2
WBT-D-2268	8/16/2010	RRAS Safety and Monitoring Systems Standard Reusable Software Element Document for Dynamic Head Compensation Calculation Custom PC Element	WNA-DS-01845-GEN	1

Table 6-3. Westinghouse Watts Bar 2 Common Q PAMS Documents at Westinghouse Rockville Office (cont.)

Letter #	Date	Document Title	Document #	Rev
WBT-D-2268	8/16/2010	RRAS Safety and Monitoring Systems Standard Reusable Software Element Document for Normalized Dynamic Head Compensation Custom PC Element	WNA-DS-01846-GEN	2
WBT-D-2268	8/16/2010	RRAS Safety and Monitoring Systems Standard Reusable Software Element Document for Void Fraction Custom PC Element	WNA-DS-01847-GEN	0
WBT-D-2268	8/16/2010	RRAS Safety and Monitoring Systems Standard Reusable Software Element Document for the Reactor Vessel Level Monitoring Custom PC Element	WNA-DS-01848-GEN	1
WBT-D-2268	8/16/2010	RRAS Safety and Monitoring Systems Standard Reusable Software Element Document for the Reactor Coolant Pump Status Custom PC Element	WNA-DS-01849-GEN	2
WBT-D-2268	8/16/2010	RRAS Safety and Monitoring Systems Standard Reusable Software Element Document for a First Order Lag Filter Custom PC Element	WNA-DS-01994-GEN	0
WBT-D-2268	8/16/2010	RRAS Safety and Monitoring Systems Standard Reusable Software Element Document for Reactor Vessel Level Alarm Custom PC Element	WNA-DS-02065-GEN	2
WBT-D-2268	8/16/2010	Generic Common Q Software Installation Procedure	WNA-IP-00152-GEN	7
WBT-D-2268	8/16/2010	Project Plan Watts Bar Unit 2 NSSS Completion I&C Projects	WNA-PD-00056-WBT	1
WBT-D-2518	10/15/2010	Transmittal of Westinghouse Topical Report WCAP-16096-NP-A, Revision I A, "Software Program Manual for Common Q Systems," dated December 2004.	ML050350234	I A

Table 6-3. Westinghouse Watts Bar 2 Common Q PAMS Documents at Westinghouse Rockville Office (cont.)

Letter #	Date	Document Title	Document #	Rev
WBT-D-2518	10/15/2010	Common Qualified Platform Topical Report (WCAP-16097-P-A, Rev 0, May 2003) previously released as CENPD-396-P	ML003740165	0
WBT-D-2518	10/15/2010	Commercial Grade Dedication Report for the QNX Operating System for Common Q Applications (00000-ICE-37722, Rev 00)	ML003733136	0
WBT-D-2572	10/27/2010	Post Accident Monitoring System – System Requirements Specification	WNA-DS-01617-WBT	2
WBT-D-2572	10/27/2010	Post Accident Monitoring System – System Design Specification	WNA-DS-01667-WBT	2
WBT-D-2572	10/27/2010	Post-Accident Monitoring System (PAMS) Licensing Technical Report	WNA-LI-00058-WBT-P	1
WBT-D-2572	10/27/2010	Software Requirements Specification for the Post Accident Monitoring System	WNA-SD-00239-WBT	2
WBT-D-2572	10/27/2010	Requirements Traceability Matrix for the Post Accident Monitoring System	WNA-VR-00279-WBT	0
WBT-D-2572	10/27/2010	Requirements Traceability Matrix for the Reactor Vessel Level Indication System (RVLIS) Custom PC Elements	WNA-VR-00280-WBT	0
WBT-D-2578	10/29/2010	Standard Reusable Software Element Document for Fourth-Order Polynomial Fluid Density Curve Fit Custom PC Element	WNA-DS-01838-GEN	3
WBT-D-2578	10/29/2010	Standard Reusable Software Element Document for Summation of Reference Leg Density Correction Custom PC Element	WNA-DS-01839-GEN	4
WBT-D-2578	10/29/2010	Standard Reusable Software Element Document for 2-Input Maximum Comparison with Status Control Custom PC Element	WNA-DS-01840-GEN	2

Table 6-3. Westinghouse Watts Bar 2 Common Q PAMS Documents at Westinghouse Rockville Office (cont.)

Letter #	Date	Document Title	Document #	Rev
WBT-D-2578	10/29/2010	Standard Reusable Software Element Document for 2-Input Minimum Comparison with Status Control Custom PC Element	WNA-DS-01841-GEN	2
WBT-D-2578	10/29/2010	Standard Reusable Software Element Document for RVLIS Static Level Calculation Custom PC Element	WNA-DS-01842-GEN	4
WBT-D-2578	10/29/2010	Standard Reusable Software Element Document for Dynamic Head Compensation Calculation Custom PC Element	WNA-DS-01845-GEN	6
WBT-D-2578	10/29/2010	Standard Reusable Software Element Document for Normalized Dynamic Head Compensation Custom PC Element	WNA-DS-01846-GEN	2
WBT-D-2578	10/29/2010	Standard Reusable Software Element Document for Void Fraction Custom PC Element	WNA-DS-01847-GEN	2
WBT-D-2578	10/29/2010	Standard Reusable Software Element Document for the Reactor Vessel Level Monitoring Custom PC Element	WNA-DS-01848-GEN	3
WBT-D-2578	10/29/2010	Standard Reusable Software Element Document for the Reactor Coolant Pump Status Custom PC Element	WNA-DS-01849-GEN	2
WBT-D-2578	10/29/2010	Standard Reusable Software Element Document for a First Order Lag Filter Custom PC Element	WNA-DS-01994-GEN	0
WBT-D-2578	10/29/2010	Standard Reusable Software Element Document for Reactor Vessel Level Alarm Custom PC Element	WNA-DS-02065-GEN	2
WBT-D-2578	10/29/2010	Element Software Test Procedure for DENSO4 Custom PC Element	WNA-TP-02670-GEN	0
WBT-D-2578	10/29/2010	Element Software Test Procedure for RLDCORR Custom PC Element	WNA-TP-02671-GEN	0

Table 6-3. Westinghouse Watts Bar 2 Common Q PAMS Documents at Westinghouse Rockville Office (cont.)

Letter #	Date	Document Title	Document #	Rev
WBT-D-2578	10/29/2010	Element Software Test Procedure for MAX_S Custom PC Element	WNA-TP-02426-GEN	0
WBT-D-2578	10/29/2010	Element Software Test Procedure for MIN_S Custom PC Element	WNA-TP-02591-GEN	0
WBT-D-2578	10/29/2010	Element Software Test Procedure for STLVLCAL Custom PC Element	WNA-TP-02672-GEN	0
WBT-D-2578	10/29/2010	Element Software Test Procedure for DHCALC Custom PC Element	WNA-TP-02673-GEN	0
WBT-D-2578	10/29/2010	Element Software Test Procedure for NDH Custom PC Element	WNA-TP-02674-GEN	0
WBT-D-2578	10/29/2010	Element Software Test Procedure for VOIDFRAC Custom PC Element	WNA-TP-02668-GEN	0
WBT-D-2578	10/29/2010	Element Software Test Procedure for LVLMNTR Custom PC Element	WNA-TP-02675-GEN	0
WBT-D-2578	10/29/2010	Element Software Test Procedure for PUMPSTAT Custom PC Element	WNA-TP-02676-GEN	0
WBT-D-2578	10/29/2010	Element Software Test Procedure for FILTO1 Custom PC Element	WNA-TP-02669-GEN	0
WBT-D-2578	10/29/2010	Element Software Test Procedure for LVLALM Custom PC Element	WNA-TP-02667-GEN	0
WBT-D-2578	10/29/2010	Element Software Test Report for RLDCORR Custom PC Element	WNA-TR-02208-GEN	1
WBT-D-2578	10/29/2010	Element Software Test Report for MAX_S Custom PC Element	WNA-TR-01939-GEN	0
WBT-D-2578	10/29/2010	Element Software Test Report for MIN_S Custom PC Element	WNA-TR-02204-GEN	0
WBT-D-2578	10/29/2010	Element Software Test Report for STLVLCAL Custom PC Element	WNA-TR-02209-GEN	1
WBT-D-2578	10/29/2010	Element Software Test Report for DHCALC Custom PC Element	WNA-TR-02210-GEN	1
WBT-D-2578	10/29/2010	Element Software Test Report for NDH Custom PC Element	WNA-TR-02211-GEN	1

Table 6-3. Westinghouse Watts Bar 2 Common Q PAMS Documents at Westinghouse Rockville Office (cont.)

Letter #	Date	Document Title	Document #	Rev
WBT-D-2578	10/29/2010	Element Software Test Report for VOIDFRAC Custom PC Element	WNA-TR-02205-GEN	2
WBT-D-2578	10/29/2010	Element Software Test Report for LVLMNTR Custom PC Element	WNA-TR-02212-GEN	0
WBT-D-2578	10/29/2010	Element Software Test Report for PUMPSTAT Custom PC Element	WNA-TR-02213-GEN	1
WBT-D-2578	10/29/2010	Element Software Test Report for FILTO1 Custom PC Element	WNA-TR-02206-GEN	1
WBT-D-2578	10/29/2010	Element Software Test Report for LVLALM Custom PC Element	WNA-TR-02214-GEN	0
WBT-D-2578	10/29/2010	Element Software Test Report for DENSO4 Custom PC Element	WNA-TR-02207-GEN	1
WBT-D-2918	2/11/2011	System Requirements Specification System Requirements Specification for the Common Q Post Accident Monitoring System	00000-ICE-30156	8
WBT-D-2944	2/17/2011	Test Summary Report for the Post Accident Monitoring System	WNA-TR-02451-WBT	Draft
WBT-D-2946	2/18/2011	Requirements Traceability Matrix for the Post-Accident Monitoring System	WNA-VR-00279-WBT	4
WBT-D-2956	2/25/2011	Failure Modes and Effects Analysis (FMEA) for the Post Accident Monitoring System (Proprietary)	WNA-AR-00180-WBT-P	2
WBT-D-2956	2/25/2011	Failure Modes and Effects Analysis (FMEA) for the Post Accident Monitoring System (Non-Proprietary)	WNA-AR-00180-WBT-NP	2
WBT-D-2956 CAW-11-3117	2/25/2011	Application For Withholding Proprietary Information From Public Disclosure, WNA-AR-00180-WBT-P, Rev. 2, "Failure Modes and Effects Analysis (FMEA) for the Post Accident Monitoring System" (Proprietary)	CAW-11-3117	N/A
WBT-D-2990	3/7/2011	Design Reviews	WEC 3.3.1	2

Table 6-3. Westinghouse Watts Bar 2 Common Q PAMS Documents at Westinghouse Rockville Office (cont.)

Letter #	Date	Document Title	Document #	Rev
WBT-D-2990	3/7/2011	Document Control	WEC 6.1	2
WBT-D-2990	3/7/2011	Design Verification By Independent Review Or Alternate Calculations	NSNP 3.3.3	3
WBT-D-2990	3/7/2011	Preliminary Design Review Report PDR-10-23	WNA-ER-00105-WBT	0
WBT-D-2990	3/7/2011	Common Q PAMS Final Design Review Report FDR-10-23	WNA-ER-00143-WBT	0
WBT-D-3001	3/9/2011	Common Q Exception Report	V&V-931	N/A

Table 6-4 shows the documents that were made available for the 9/20-21/2010 audit at the Westinghouse Windsor offices.

Table 6-4. Westinghouse Documents at Westinghouse Windsor Office

Document Title	Document #	Rev
Software Design Description For The Common Q Core Protection Calculator System Database and Utility Functions	00000-ICE-30140	4
Software Design Description for the Common Q Post Accident Monitoring System	00000-ICE-30152	5
System Requirements Specification for the Common Q Generic Flat Panel Display	00000-ICE-30155	9
System Requirements Specification for the Common Q Post Accident Monitoring System	00000-ICE-30156	7
Software Design Description for the Common Q Generic Flat-Panel Display Software	00000-ICE-30157	19
Hardware Requirements Specification for the Common Q Power Supply System	00000-ICE-30159	2
Software Design Description for the Common Q Post Accident Monitoring System Flat Panel Display	00000-ICE-30161	1
Software Design Description For The Common Q Core Protection Calculator System Flat Panel Display	00000-ICE-30168	3

Table 6-4. Westinghouse Documents at Westinghouse Windsor Office (cont.)

Document Title	Document #	Rev
Software Requirements for the Common Q Post Accident Monitoring System	00000-ICE-3238	5
Software Requirements Specification for the Common Q Generic Flat-Panel Display Software	00000-ICE-3239	14
Post Accident Monitoring System Software Preliminary Hazard Analysis for the Common Q Phase 3 PAMS Project	00000-ICE-37727	0
Coding Standards and Guidelines for Common Q Systems	00000-ICE-3889	12
Design Process for Common Q Safety Systems	NABU-DP-00014-GEN	2
Common Q Software Configuration Management Guidelines	NABU-DP-00015-GEN	3
Safety Platform System Design Requirements	NABU-DS-00092-GEN	2
Safety System Standard Definitions	NABU-DS-00115-GEN	0
Transmittal Westinghouse Comments on TVA Specification EDCR 52351	WBT-D-0088	0
Commercial Dedication Report for QNX 4.25G for Common Q Applications	WNA-CD-00018-GEN	3
Commercial Grade Dedication Report for the ABB ADVANT PM646A/PM646B Firmware/Base System Software Version 1.3/8, ACC Advanced Version 1.7/1, AC160 PC and DB Element Library Version 1.5/0 for Common Q Applications	WNA-CD-00029-GEN	1
Watts Bar 2 NSSS Completion Program I&C Projects User Configurable Setpoints for the Post Accident Monitoring System	WNA-CR-00010-WBT	1
Reusable Software Element Document – Engineering Units Conversion	WNA-DS-00306-GEN	5
Reusable Software Element Document – CRC for Calibration Data	WNA-DS-00315-GEN	2
Application Restrictions for Generic Common Q Qualification	WNA-DS-01070-GEN	4
Common Q Platform Hardware Design Specification	WNA-DS-01141-GEN	0
General Requirements for Cyber Security	WNA-DS-01150-GEN	0
Standard Reusable Software Element Document for Reflash Type Circuit	WNA-DS-01505-GEN	0
Standard Reusable Software Element Document for Exclusive Module Error Type Circuit	WNA-DS-01564-GEN	2

Table 6-4. Westinghouse Documents at Westinghouse Windsor Office (cont.)

Document Title	Document #	Rev
Post Accident Monitoring System – System Requirements Specification	WNA-DS-01617-WBT	2
Post Accident Monitoring System – System Design Specification	WNA-DS-01667-WBT	2
Standard Reusable Software Element Document for PM Diagnostics Type Circuit	WNA-DS-01715-GEN	4
Standard Reusable Software Element Document for Fourth-Order Polynomial Fluid Density Curve Fit Custom PC Element	WNA-DS-01838-GEN	3
Standard Reusable Software Element Document for Summation of Reference Leg Density Correction Custom PC Element	WNA-DS-01839-GEN	4
Standard Reusable Software Element Document for 2-Input Maximum Comparison with Status Control Custom PC Element	WNA-DS-01840-GEN	2
Standard Reusable Software Element Document for 2-Input Minimum Comparison with Status Control Custom PC Element	WNA-DS-01841-GEN	2
Standard Reusable Software Element Document for RVLIS Static Level Calculation Custom PC Element	WNA-DS-01842-GEN	4
Standard Reusable Software Element Document for Dynamic Head Compensation Calculation Custom PC Element	WNA-DS-01845-GEN	6
Standard Reusable Software Element Document for Normalized Dynamic Head Compensation Custom PC Element	WNA-DS-01846-GEN	2
Standard Reusable Software Element Document for Void Fraction Custom PC Element	WNA-DS-01847-GEN	2
Standard Reusable Software Element Document for the Reactor Vessel Level Monitoring Custom PC Element	WNA-DS-01848-GEN	3
Standard Reusable Software Element Document for the Reactor Coolant Pump Status Custom PC Element	WNA-DS-01849-GEN	2
Standard Reusable Software Element Document for a First Order Lag Filter Custom PC Element	WNA-DS-01994-GEN	0
Standard Reusable Software Element Document for Reactor Vessel Level Alarm Custom PC Element	WNA-DS-02065-GEN	2
Generic Common Q Software Installation Procedure	WNA-IP-00152-GEN	7
Watts Bar Unit 2 NSSS Completion I&C Projects	WNA-PD-00056-WBT	1
Project Plan Common Q Post Accident Monitoring System	WNA-PD-00073-WBT	0

Table 6-4. Westinghouse Documents at Westinghouse Windsor Office (cont.)

Document Title	Document #	Rev
Watts Bar Unit 2 NSSS Completion I&C Projects Project Quality Plan	WNA-PQ-00220-WBT	1
Standard Acronyms and Definitions	WNA-PS-00016-GEN	5
Testing Process for Common Q Safety Systems	WNA-PT-00058-GEN	0
Verification and Validation Process for the Common Q Safety Systems	WNA-PV-00009-GEN	3
Common Q Generic Flat Panel Display System Software – Release 09-00	WNA-RL-00279-GEN	4
Software Release Record for the RVLIS AC160 Library	WNA-RL-00441-GEN	5
Common Q Software Release Record for Watts Bar Unit 2 PAMS Train A, PAMA	WNA-RL-00646-WBT	0
Common Q Software Release Record for Watts Bar Unit 2 PAMS Train B, PAMB	WNA-RL-00648-WBT	0
Watts Bar 2 NSSS Completion Program I&C Projects Software Requirements Specification for the Post Accident Monitoring System	WNA-SD-00239-WBT	1
Software Design Description for the Post Accident Monitoring System Flat Panel Display	WNA-SD-00248-WBT	0
Software Design Description for the Post Accident Monitoring System AC160 Software	WNA-SD-00250-WBT	0
Watts Bar 2 NSSS Completion Program I&C Projects Post Accident Monitoring System Flat Panel Display System Screen Design Details	WNA-SD-00277-WBT	1
Element Software Test Procedure for MAX_S Custom PC Element	WNA-TP-02426-GEN	0
Element Software Test Procedure for MIN_S Custom PC Element	WNA-TP-02591-GEN	0
Element Software Test Procedure for LVLALM Custom PC Element	WNA-TP-02667-GEN	0
Element Software Test Procedure for VOIDFRAC Custom PC Element	WNA-TP-02668-GEN	0
Element Software Test Procedure for FILTO1 Custom PC Element	WNA-TP-02669-GEN	0
Element Software Test Procedure for DENSO4 Custom PC Element	WNA-TP-02670-GEN	0
Element Software Test Procedure for RLDCORR Custom PC Element	WNA-TP-02671-GEN	0

Table 6-4. Westinghouse Documents at Westinghouse Windsor Office (cont.)

Document Title	Document #	Rev
Element Software Test Procedure for STLVLCAL	WNA-TP-02672-GEN	0
Element Software Test Procedure for DHCALC Custom PC Element	WNA-TP-02673-GEN	0
Element Software Test Procedure for NDH Custom PC Element	WNA-TP-02674-GEN	0
Element Software Test Procedure for LVLMNTR Custom PC Element	WNA-TP-02675-GEN	0
Element Software Test Procedure for PUMPSTAT Custom PC Element	WNA-TP-02676-GEN	0
Element Software Test Report for MAX_S Custom PC Element	WNA-TR-01939-GEN	0
Element Software Test Report for MIN_S Custom PC Element	WNA-TR-02204-GEN	0
Element Software Test Report for VOIDFRAC Custom PC Element	WNA-TR-02205-GEN	2
Element Software Test Report for FILTO1 Custom PC Element	WNA-TR-02206-GEN	1
Element Software Test Report for DENSO4 Custom PC Element	WNA-TR-02207-GEN	1
Element Software Test Report for RLDCORR Custom PC Element	WNA-TR-02208-GEN	1
Element Software Test Report for STLVLCAL Custom PC Element	WNA-TR-02209-GEN	1
Element Software Test Report for DHCALC Custom PC Element	WNA-TR-02210-GEN	1
Element Software Test Report for NDH Custom PC Element	WNA-TR-02211-GEN	1
Element Software Test Report for LVLMNTR Custom PC Element	WNA-TR-02212-GEN	0
Element Software Test Report for PUMPSTAT Custom PC Element	WNA-TR-02213-GEN	1
Element Software Test Report LVLALM Custom PC Element	WNA-TR-02214-GEN	0
Watts Bar 2 NSSS Completion Program I&C Projects Requirements Traceability Matrix for the Post Accident Monitoring System	WNA-VR-00279-WBT	0
Watts Bar 2 NSSS Completion Program I&C Projects Requirements Traceability Matrix for the Reactor Vessel Level Indication System (RVLIS) Custom PC Elements	WNA-VR-00280-WBT	0

6.4 DOCUMENTS TO BE PROVIDED TO TVA FOR SUBMITTAL TO THE NRC

Table 6-5 shows the Westinghouse Watts Bar 2 Common Q PAMS documents that will be provided to TVA for submittal to the NRC.

Table 6-5. Westinghouse Watts Bar 2 Common Q PAMS Documents to be Provided to TVA for Submittal to the NRC

Date	Document Title	Document #	Rev
3/25/2011	Test Summary Report for the Post Accident Monitoring System	WNA-TR-02451-WBT	0
3/25/2011	IV&V Phase Summary Report	WNA-VR-00283-WBT	5

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SECTION 7
COMMERCIAL GRADE DEDICATION PROCESS

Westinghouse, as an approved 10CFR50 Appendix B Supplier, will provide the WBN2 PAMS as a Safety-related System consistent with commitments defined in the U.S. NRC approved Westinghouse Quality Management System (QMS). Westinghouse performs PAMS Design, Documentation, Drawings, Testing, QA, and Certification in house under this QMS.

Certain components and services required for the WBN2 PAMS are not provided from either Westinghouse or from other 10CFR50 Appendix B Vendors. Westinghouse applies the QMS level 2 process, WEC 7.2, referred to as Dedication of Commercial Grade Items, to those components and services. The implementation of this process supplements the quality process those vendors utilize for the products and services they supply to Westinghouse for inclusion into the WBN2 PAMS.

The WEC 7.2 process provides reasonable assurance that the commercial grade items procured by Westinghouse for use in the WBN2 PAMS will perform their intended safety function and would be deemed equivalent to an item designed, manufactured, or provided under a 10CFR50, Appendix B QA program.

The WEC 7.2 process, which results in a Commercial Dedication Instruction (CDI), adapts guidelines identified in EPRI NP-5652 and supplemented in EPRI TR-106439 to provide guidance on the evaluation and acceptance of Commercial Grade Digital Equipment. WEC 7.2, Appendix F, defines this guidance for using commercial digital equipment for safety-related applications. Westinghouse utilizes [ ]^{a,c} to evaluate commercial equipment used in the WBN2 PAMS. This process is also consistent with the defined and approved process for the Common Q Platform.

To illustrate this process, an example of a WBN2 PAMS component that has not yet been reviewed by the U.S. NRC in the Westinghouse submitted revision to the Common Q Topical Report will be described as to the process steps implemented.

AC160 AI687 Commercial Dedication Process

The WBN2 PAMS design requires the use of a new AC160 Analog Input Module (AI687) to perform necessary signal processing. In order to be able to utilize this commercial grade digital module, a process conforming to the defined requirements of WEC7.2 was created/invoked in a manner similar to those AC160 modules previously addressed in the Common Q Topical Report. Westinghouse CDI-2625 (Reference 38) defines required implementation of WEC 7.2 for this commercial item.

The process starts with a Technical Evaluation of the desired features of the AI687 Module which took the form of a specification that was provided to ABB for the development of the module. [

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Specific documentation is also required [

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Functional test records are required/delivered to provide objective evidence that each AI687, by unique serial number, performs in the factory as required.

Westinghouse then utilized AI687 specimens from the initial ABB production run and subjected them to a Seismic, Environmental and EMI Qualification Test program that would, in addition, meet the specific needs of WBN2 site installation requirements. The satisfactory completions of this qualification test program in conjunction with the attributes defining the configuration are then captured in Westinghouse documents.

The Commercial Grade Dedication Instruction, CDI-2625, for AC160 was revised to include the new AI687 module and require the above defined documentation be provided by ABB. This identified Life Cycle Design Process was already in place for the previously developed Common Q AC160 items. The Westinghouse [

]a,c was also updated. The Westinghouse [
]a,c was also revised to include the verification requirements of the AI687.

Westinghouse, as the dedicating entity for this process, then executes the recurring activities of CDI-2625 on the AI687s provided by ABB to confirm the required critical characteristics. The configuration of the individual modules is verified through the commercial grade surveys, inspections, and testing performed by Westinghouse, thus providing reasonable assurance that the module is equal to or better than the original tested AI687. This process is validated by [

]a,c what process steps and functions were performed during manufacturing of the AI687s. Functional Test Records are also evaluated for acceptability on an individual AI687 serial number basis. [

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]a,c This document allows for a validation of components that are critical to the configuration of the AI687s. [

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[ ]^{a,c} Upon satisfactory completion of the AI687 inspections and a satisfactory review of the delivered documentation, the processed AI687s are released to inventory as accepted. The AI687s are then assigned to the production floor for installation into their respective cabinets.

The AI687s are installed into required locations within the PAMS racks and subjected with the rest of the deliverable system hardware to a system-level Cabinet Hardware Test (CHT) and a Cabinet Integration Test (CIT). Upon satisfactory completion of these tests, acceptable system performance of the AI687s (along with the rest of the WBN2 PAMS equipment) is verified.

This process is typical of the process used for the acceptance and assignment of commercial digital equipment used for the WBN2 PAMS.

Software Commercial Dedication Process

For software, the process is more aligned with the description in the Common Q Topical Report (Reference 1). Since the software is already developed, the formal Verification and Validation (V&V) activities cannot be performed on an existing vendor. A review team conducts a V&V audit to determine the quality of the vendor activities associated with the software based on the presence of, or lack of, the following during the software life cycle to date:

1. Well-defined system (software) requirements

2. Comprehensive software development methodologies

3. Comprehensive test procedures

4. Strict configuration management and maintenance procedures

5. Complete and comprehensive documentation

The degree to which each of these were employed during all phases of the vendor software design, development, integration, testing and maintenance are determined based on the information to be obtained by following the review plan. The judgment of the reviewers is documented in a commercial grade dedication report. Should the reviewers judge that some aspect of any phase of the vendor process does not compare favorably, they will recommend specific actions to remedy the situation. These actions will be for Westinghouse to complete. Upon satisfactory completion and review of these actions, a satisfactory commercial grade dedication report will allow use of the vendor's software in safety-related applications.

The SPM requirements for a change in the software that has been commercially dedicated include:

a. Review the changes to commercial off the shelf (COTS) software and determine their impact on the system. Evaluate the reported errors for new releases and determine their impact on the application. Revise the Commercial Grade Dedication report, including recommended tests to be conducted where an impact is identified.

b. Verify that the changes to the COTS software were performed in accordance with acceptable industry standards (e.g., IEEE 7-4.3.2 or IEC-880). Revise the Commercial Grade Dedication report.

AC160 Firmware

References 44 - 46 are firmware commercial dedication reports on theAC160 modules that were qualified with the original SER. [

]^{a,c} So, for the case of the AI687/688, Reference 48 is the V&V report for the AI687/688 firmware.

Commercial Grade Dedication Instructions

As explained at the beginning of this section, Westinghouse Electric Company QMS Level 2 Procedure 7.2 requires a Commercial Dedication Instruction that contains the information necessary to support dedication for nuclear safety-related use of a commercial grade item. For software, a CDI defines the need for a commercial grade survey of the software supplier to ensure their practices for software development have not changed. This commercial grade survey is conducted every three years. The CDI also references the commercial dedication report demonstrating acceptability of a specific version. For QNX, the CDI is Reference 52 and for the AC160 PM646A software, the CDI reference is 51.

Software Example: AC160 Software Commercial Dedication Process

The AC160 software was commercially dedicated as part of the original Common Q platform submittal and approval by the NRC. Westinghouse submitted GWK F 700 778, Rev. 01, dated February 18, 2000, "Generic Operating History Evaluation Report on Previously-Developed Software in ABB AC160, I/O Modules and Tool Software" and GWK F 700 777, Rev. 02, dated February 22, 2000, "Design and Life Cycle Evaluation Report on Previously-Developed Software in ABB AC160, I/O Modules and Tool Software."

Since then, Westinghouse Electric Company commercially dedicated changes to the AC160 software. This is documented in the following:

- 00000-ICE-37618, Rev. 01, "Commercial Grade Dedication Report For The ABB Advant PM646A Firmware/Base System Software Version 1.3/1 Through 1.3/4 for Common Q Applications"
- WNA-CD-00021-GEN, Rev. 00, "Commercial Grade Dedication Report For The ABB Advant PM646A Firmware/Base System Software Version 1.3/5 Through 1.3/6 for Common Q Applications"
- WNA-CD-00026-GEN, Rev. 1, "Commercial Grade Dedication Report For The ABB Advant PM646A/PM646B Firmware/Base System Software Version 1.3/7 For Common Q Applications"
- WNA-CD-00029-GEN, Rev. 01, "Commercial Grade Dedication Report For The ABB Advant PM646A/PM646B Firmware/Base System Software Version 1.3/8, ACC Advanced Version 1.7/1, AC160 PC and DB Element Library Version 1.5/1 For Common Q Applications"

According to the SPM, if the dedicated software has changed, then a review of the changes to the software and their impact on Common Q applications must be conducted. [ ]^{a,c}

The SPM also requires that the reported errors for new releases and their impact on the application must be conducted. [ ]^{a,c}

The SPM requires that the Commercial Grade Dedication report include any recommended tests to be conducted where an impact is identified. [ ]^{a,c}

The SPM requires an evaluation to ensure that the changes to the COTS software were performed in accordance with acceptable industry standards. This is done via the QA commercial grade survey referenced in the AC160 Commercial Grade Dedication Instruction (Reference 38). Reference 43 is the latest ABB Commercial Grade survey that was conducted by the Westinghouse QA department.

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SECTION 8
DIVERSITY AND DEFENSE-IN-DEPTH ANALYSIS

The WBN Unit2 Common Q PAMS provides redundant signal processing and indication of two RG-1.97 Type A variables: Core-Exit Temperature (CET) and Subcooled Margin. In the event of a common-cause failure of the Common Q PAMS, instrumentation diverse from Common Q is available for these two variables. Wide Range (WR) Hot Leg Temperature indication is specified as a diverse variable for CET in the Post-Accident Monitoring Design Criteria, WB-DC-30-7 (Reference 19). WR Hot Leg Temperature indication from all four hot legs is available on control board indicators and plant computer displays.

Temperature and pressure saturation margin calculations are also performed in the plant computer independently of Common Q utilizing different hardware and software. Isolated outputs from the Eagle 21 protection system are provided to the plant computer for four WR Hot Leg Temperature channels and four WR RCS Pressure channels. The temperature channels and two of the pressure channels are the same as those used in the Common Q saturation margin calculations.

The plant computer temperature saturation margin is calculated as the difference in the maximum temperature input and the saturation temperature of the minimum pressure input. The temperature saturation margin is displayed as point ID U0987.

The plant computer pressure saturation margin is calculated as the difference in the minimum pressure input and the saturation pressure of the maximum temperature input. The pressure saturation margin is displayed as point ID U0984.

Reactor Vessel Level Indication (RVLIS) is defined as a Type B1 variable. Redundant indication for this variable is provided by the core exit thermocouples/T_{hot} and reactor coolant system (RCS) pressure. So long as the RCS pressure is greater than the saturation pressure for the temperature indicated by the core exit thermocouples/T_{hot}, there is reasonable assurance that a steam void has not formed in the core and the vessel is full. This is indicated by the subcooled margin monitor/plant computer previously discussed.

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SECTION 9
COMPLIANCE EVALUATION OF THE WATTS BAR 2 PAMS SOFTWARE REQUIREMENTS SPECIFICATION TO IEEE STANDARD 830-1998 AND REGULATORY GUIDE 1.172

9.1 DISCUSSION

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9.2 CONCLUSION

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The following table shows the Software Requirements Specification's, WNA-SD-00239-WBT (Reference 30), compliance to IEEE Standard 830-1998.

Table 9-1. IEEE Std 830-1998 Compliance

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Table 9-1. IEEE Std 830-1998 Compliance (cont.)

Table 9-1. IEEE Std 830-1998 Compliance (cont.)

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Table 9-1. IEEE Std 830-1998 Compliance (cont.)

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Table 9-1. IEEE Std 830-1998 Compliance (cont.)

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Table 9-1. IEEE Std 830-1998 Compliance (cont.)

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Table 9-1. IEEE Std 830-1998 Compliance (cont.)

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Table 9-1. IEEE Std 830-1998 Compliance (cont.)

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Table 9-1. IEEE Std 830-1998 Compliance (cont.)

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Table 9-1. IEEE Std 830-1998 Compliance (cont.)

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Table 9-1. IEEE Std 830-1998 Compliance (cont.)

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Table 9-1. IEEE Std 830-1998 Compliance (cont.)

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Table 9-1. IEEE Std 830-1998 Compliance (cont.)

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Table 9-1. IEEE Std 830-1998 Compliance (cont.)

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Table 9-1. IEEE Std 830-1998 Compliance (cont.)

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Table 9-1. IEEE Std 830-1998 Compliance (cont.)

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Table 9-1. IEEE Std 830-1998 Compliance (cont.)

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Table 9-1. IEEE Std 830-1998 Compliance (cont.)

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Table 9-1. IEEE Std 830-1998 Compliance (cont.)

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The following table shows the Software Requirements Specification's, WNA-SD-00239-WBT (Reference 30), compliance to Regulatory Guide 1.172.

Table 9-2. Regulatory Guide 1.172 Compliance

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Table 9-2. Regulatory Guide 1.172 Compliance (cont.)

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Table 9-2. Regulatory Guide 1.172 Compliance (cont.) a,c

Table 9-2. Regulatory Guide 1.172 Compliance (cont.)

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Table 9-2. Regulatory Guide 1.172 Compliance (cont.)

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Table 9-2. Regulatory Guide 1.172 Compliance (cont.)

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Table 9-2. Regulatory Guide 1.172 Compliance (cont.) a,c

Table 9-2. Regulatory Guide 1.172 Compliance (cont.) a,c

Table 9-2. Regulatory Guide 1.172 Compliance (cont.)

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Table 9-2. Regulatory Guide 1.172 Compliance (cont.) a,c

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SECTION 10
APPLICABILITY OF WCAP-16096-NP-A, "SOFTWARE PROGRAM MANUAL FOR COMMON Q SYSTEMS"

The Watts Bar Unit 2 Post Accident Monitoring System complies with the Software Program Manual for Common Q Systems (Reference 1) except for the deviations listed below, which are a result of changes to the Westinghouse Electric Company process since the Common Q SER.

10.1 WBN2 PAMS CONFIGURATION MANAGEMENT PROCESS

The Software Program Manual for Common Q Systems (Reference 1) describes the software configuration management role to be the responsibility of IV&V. Since the Common Q SER, Westinghouse Electric Company has changed that responsibility to the design team. Therefore, all requirements for software configuration management in the SPM are applied to the design team and its management for the WBN2 PAMS project.

In subsection 6.3.4 of the SPM (Reference 1), the following requirement is stated: "A physical review shall be performed in accordance with Section 4.6.2.6 by the design team to verify that the as-built software and its documentation are complete, meet all project technical requirements, and that the software change control process was adequately followed." The Physical review discussed in subsection 4.6.2.6 of Reference 1 is performed by the QA department. The IV&V Summary Report will verify that the as-built software and documentation are complete, meet all project technical requirements, and that the software change control process was adequately followed.

Subsection 6.3.1 of the SPM (Reference 1) identifies the process for labeling media. Westinghouse Electric Company's labeling procedures have changed since the last submittal of the SPM. A typical media label for WBN2 PAMS would be of the following format:

Project identity: Watts Bar Unit 2
Software identity: PAMS Train A (PAMA) Application Code
Software release record as listed in EDMS: WNA-RL-00646-WBT
Software optical media creation date: mm/dd/yy

Section 6.3.1 of the SPM requires:

"*Source File - The source file should contain a program header block that includes the following information:*

Project ####### Module NNNNNNN-VV-RR

where:

####### is the System number

NNNNNNN is the Module name (up to 64 alphanumeric characters beginning with a letter, length depending upon the requirements of the file management system utilized)

VV is the Version number (2 digit sequential number beginning with 00) for successive versions which implement revised software requirements.

RR is the Revision number (2 digit sequential number beginning with 00 for successive versions which correct errors in the code and require no changes to the software requirements)

The header block should contain a complete revision history of the software item, including comments on each version and revision. In addition, the header block should contain the following information:

- *Programmer*
- *Brief description of the program*
- *Date*
- *Other information as necessary in a comment field"*

For the WBN2 PAMS project the following SPM source file information and header block attributes were implemented:

FPDS and Custom PC Element C and H source files: All attributes were implemented except for the system number.

AC160 Function Chart Type Circuits and Application Programs: The name and version/revision of the type circuit or application program is in the diagram, but not the system number or header block information is included.

The SPM requires that software items that are to be controlled via the Software Configuration Management Plan (SCMP) be identified in the requirements phase. For Common Q there are two parts to the software system for a given Common Q project. There is the generic software and then the project-specific software. In the case of WBN2 PAMS there is the generic software for the subcooled margin monitor and core exit thermocouple monitor functions, as well as other generic functions like engineering unit conversion. Generic software like this is defined in the baseline report for the project, WNA-BR-00299-WBT (Reference 60) by referencing the Reusable Software Element Documents for these functions. The project-specific application cannot be identified to this level of detail in the requirements phase and therefore it is identified as the AC160 application program in the WBN2 Project Plan (Reference 59).

The SCMP also requires the IV&V team to review the adequacy and completeness of the configuration management methods defined in the SCMP (Section 6) of the SPM. The IV&V team had already performed this task by reviewing the SPM SCMP and documenting that review by signing off as reviewer for the SPM.

10.2 WBN2 PAMS TESTING PROCESS

The Common Q SPM (Reference 1) states, "Test procedure(s) shall be ... prepared by the V&V team and independently reviewed by the design team" Since the Common Q SER, Westinghouse Electric Company now has all testing activities under the auspices of IV&V. This is described in the new SPM that has been submitted to the NRC for review and approval. All IV&V Test Procedures were independently reviewed and approved by IV&V team members not involved in the development of the test procedure. This review process satisfies Appendix B independent reviewer requirements. The new revision of the SPM, Exhibit 5-1, reflects this process.

10.3 WESTINGHOUSE ELECTRIC COMPANY SELF ASSESSMENT OF WBN2 PAMS COMPLIANCE TO THE SPM

Westinghouse Electric Company performed self assessments in four areas:

1. Test Plan Compliance to the SPM
2. Test Plan Compliance to IEEE-829
3. IV&V Phase Summary Report Compliance to the SPM
4. Test Procedures/Reports Compliance to the SPM

For each discrepancy that was found, a mitigating action was recorded as well as a suggestion for improvement to prevent the discrepancy from occurring in future projects. In all cases, either this document, or a future revision to the IV&V Phase Summary Report (Reference 41) or the WBN2 PAMS Test Summary Report provide the missing information or justification for the discrepancy.

The suggestions for improvement entail 1) revising the Revision 2 of the SPM currently under review by the NRC for clarification and the addition of items in the IV&V checklists and 2) providing future training on the SPM to both the design and IV&V teams.

Westinghouse will also perform a self assessment of how the WBN2 PAMS project was compliant to all of the V&V requirements in the SPM. The self assessment will show compliance by citing specific sections of V&V output documentation, or it will provide a justification of why the project deviated from the SPM requirements. The results of this self assessment will be made available at the Westinghouse Rockville offices for the NRC to review.

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SECTION 11
APPLICABILITY OF WCAP-16097-P-A, APPENDIX 1, "COMMON QUALIFIED PLATFORM POST ACCIDENT MONITORING SYSTEMS"

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SECTION 12
TVA CONTRACT COMPLIANCE MATRIX

The following table contains the technical requirements extracted from the Purchase Specification for the Common Q PAMS.

Rqt #	Section	Wording	Comply, OOS (Not In WEC scope), Clarify, NIC (Not In compliance with Purchase Spec)	Response	Proof req. Met
	1.0 INTRODUCTION				
1	**1.1 Overview**	A completely engineered Monitoring System shall be provided for Watts Bar Unit 2 for the replacement of the existing obsolete Reactor Vessel Level Instrumentation System (RVLIS) and In Core Temperature Monitoring System. The Monitoring System shall be a redundant, self-contained monitoring device, composed of two identical microprocessor-based monitoring channels (Train A & B) complete with all necessary hardware and software, system logic, system graphics, and power supplies meeting the functional requirements of this specification.	Clarify	WEC shall supply two cabinets for the PAMS system, Train A and Train B. There will be redundant power supplies provided and two Flat Panel Displays per Train (MTP in the cabinet, OM on the MCB). The AC160 controller does support redundancy however the generic CQ PAMS design is not redundant since the technical specifications allow 30 days to repair a single Train and 7 days if both are out of service	
2		The Monitoring System shall be a Class 1E, safety related, distributed digital microprocessor based monitoring system, comprised of two redundant and isolated trains, designed and implemented specifically for power plant applications in terms of materials of construction, industry accepted design conventions, and application software. The Monitoring System architecture shall be functionally composed of a number of building blocks which can be expanded or modified during or after installation. The basic components are micro-processors, associated input/output hardware, operator interface, and the communications network. This specification details the minimum requirements of the Monitoring System. The required quantities of I/O, peripherals, and equipment summarized in this specification are an estimate for the basis of bidding. The Offerer shall have ownership of the system databases and shall complete all fields.	Comply		SyRS R2.2-1, SyRS R2.3.1-1, R2.5.3.2-1, R2.5.3.2-2, & R2.3.1-11, R2.5.3.3-11, R2.5.3.3-1 through 17, R2.9.2-1, R2.5.3.5-1, R2.6.2.2.4-1, R2.6.2.2.5-1 and R2.6.2.2.3-1
3		This Monitoring System shall also be designed to perform Post Accident Monitoring. This would include a Flat Panel Display and an Operators' Module and a Maintenance and Test panel.	Comply		SyRS 1.2, SyRS R2.2-1
4		The upgrade consists of the monitoring system equipment located in the Auxiliary Instrument Room (AIR) and the Main Control Room (MCR).	Comply		SyRS 2.6.2-1 for OM, rack in AIR per EDCR 52351
5		Overview of the functions required to be performed by the Monitoring System are:	Comply		N/A
6		• Assists in detecting the presence of a gas bubble or void in the reactor vessel	Comply		General purpose of system SyRS R2.5.3.3-11
7		• Indicates loss of subcooling margin	Comply		General purpose of system SyRS 1.2, SyRS R2.3.1-1, R2.5.3.2-1, R2.5.3.2-2, & R2.3.1-11

Rqt #	Section	Wording	Comply, OOS (Not In WEC scope), Clarify, NIC (Not In compliance with Purchase Spec)	Response	Proof req. Met
8		• Assists in the detection of the approach to inadequate core cooling	Comply		General purpose of system SyRS 1.2, SyRS R2.3.1-1
9		• Indicates the formation of voids in the reactor coolant system during forced flow conditions	Comply		General purpose of system SyRS R2.5.3.3-1, SyRS R2.3.1-1, R2.5.3.3-11, R2.5.3.3-1
10		• Calculation and display of reactor vessel water level (RVLIS)	Comply		General purpose of system SyRS 1.2, SyRS R2.5.3.3-1 through 17
11		• Display of the sensor diagnostic information	Comply		SyRS R2.9.2-1
12		A. Core exit temperature monitoring and display	Comply		SyRS R2.3.1-1, R2.5.3.5-1, R2.6.2.2.4-1 & R2.6.2.2.5-1
13		B. Subcooled margin monitoring and display	Comply		SyRS R2.3.1-1, R2.5.3.2-1, R2.5.3.2-2, R2.6.2.2.3-1
		RVLIS Function			
14		The RVLIS function uses various parameters to calculate and display the water level height in the reactor vessel during all plant conditions.	Comply		SyRS R2.5.3.3-4
15		RVLIS utilizes two sets of three d/p (differential pressure) cells to measure the pressure drop from the bottom of the reactor vessel to the top of the vessel, and from the hot legs to the top of the vessel. This differential pressure measuring system utilizes cells of differing ranges to cover different flow behavior with and without pump operation.	Comply		SyRS R2.5.3.3-5, -7, -8, -9, -10 & -11
		Core Exit Temperature Function			
16		The core exit temperature (CET or Thermocouple) function uses inputs from all the incore thermocouples and from the integral reference junction to calculate the display temperature of the reactor coolant as it exists the core.	Comply		SyRS R2.5.3.5-1, -2, -3 & -4,
17		Integral reference junction internal RTD circuitry measures the integral reference cold junction temperature that is used by the software program algorithm to calculate and provide the necessary temperature compensation prior to displaying the coolant temperature.	Comply		SyRS R2.5.3.5-3
		Subcooled Margin Function			
18		The subcooled margin function uses various parameters to calculate saturation temperature and subcooled margin during all plant conditions. These input parameters provide the operator with complete information on core cooling. Graphic displays provide detailed core cooling information for the operator.	Comply		SyRS R2.5.3.2-1, -2 & -3

Rqt #	Section	Wording	Comply, OOS (Not in WEC scope), Clarify, NIC (Not in compliance with Purchase Spec)	Response	Proof req. Met
19		Reactor pressure is used by software algorithms in the calculations which determine the equivalent saturation temperature (T_{SAT}). This T_{SAT} value is used to determine the subcooled margin for either the high core quadrant average of the thermocouple temperatures or the auctioneered THot value.	Clarify	The CQ PAMS uses a statistically calculated value called Tcrep (Representative Core Exit Temperature) instead of the high core quadrant average. This is a more conservative value than the ICCM86.	SyRS R2.5.3.2-3 & -6
20	**1.2 Equipment, Material, And Services To Be Supplied By The Offerer**	Equipment, material and services supplied by the Offerer shall include, as a summary, the following equipment and services. The actual requirements are described throughout the specification, attached databases and appendices. NOTE: Should the database, descriptions, and/or appendices be in conflict, the Offerer shall promptly seek clarification from TVA. TVA retains the sole right to determination of the issue and/or requirement.	Comply		N/A
56	**2.6 Software Requirements**	*The Offerer shall meet the requirements of TVA Standard Specification SS E18.15.01* (see 3.15.B of this specification) as defined in this specification. The standard spec classification is "Other Safety Related". See Appendix B and section 3.5 for details and requirements.	NIC	WEC shall supply the CQ PAMS in accordance with the WEC CQ Software Program Manual approved by the NRC.	Project Plan WNA-PD-00073-WBT Section 9.1
57	**2.7 Digital Interface Requirements**	All digital communications interfaces must be fully documented, both hardware and software, to allow TVA/Bechtel to develop interface software to interrogate, program, and exchange data with the subject monitoring system. Proper security (i.e., firewalls, etc.) shall be included.	Comply		ICS interface - SyRS R4.3.3-1, -2 & -3; SDS 5.1; WBT-D-0899; WBT-D-1953 AF100 - SyRS R2.6.2-7, -8, R2.10-1, R4.3.3-4, R4.3.3-5, SDS 5.2; WBT-D-0899
	2.8 Deliverables				
	2.8.1 Hardware				
		A. Monitoring System Hardware			
58		The Offerer shall supply all system hardware required to meet the specifications of this document. The system supplied is not required to be in strict compliance with ANSI/IEEE Standard 379, "Single Failure Criteria", but should (if an available) be configured and designed in such a manner that the failure of a single device or component, excluding a catastrophic failure of the entire cabinet, will not affect the operation of the system. All system components shall be capable of being removed one at a time with the system powered and operational without affecting system operation (to be tested during FAT).	Clarify	WEC shall supply two cabinets for the PAMS system, Train A and Train B in order to meet the single failure criteria for the system. There is limited redundancy within a train for increased availability.	SyRS R3.1.2-1, R3.1.3-1, R3.3.2-1, & R3.3.2-2
		B. Indicators			

Rqt #	Section	Wording	Comply, OOS (Not in WEC scope), Clarify, NIC (Not in compliance with Purchase Spec)	Response	Proof req. Met
59		Replacement of any existing indicators with new indicators will be in TVA/Bechtel's scope of supply.	OOS		SMM digital panel meters replaced under EDCR 52351 and MR 25402-011-MRA-JC07-00015
		C. Critical Outputs (PAMS)			
60		Critical outputs such as an outputs, Indication and Recording, for Post Accident Monitoring shall be redundancy.	Clarify	The CQ PAMS is two Trains and each train will provide the same outputs. However, within a train, the outputs are not redundant.	analog outputs - SyRS R3.1.2-1 and R2.6.1-2 digital outputs - SyRS R3.1.2-1 and R2.6.1-1 SDS Table 4.4-4 through 4.4-6 and SDS 2.1 (3rd paragraph)
		D. Maintenance and Configuration Devices			
61		The Offerer shall supply any devices or components that are required for the normal maintenance of the supplied hardware.	Clarify	The loading of software to the AC160 or FPD is accomplished using the CD ROM drive on the MTP/OM. An external USB drive is provided for storing of addressable constants. Should a PC Node Box fail and have to be replaced with a new one, the USB drive will allow retrieving the addressable constants from the disk and storing them on the new PC Node Box. This is provided as a convenience and time saver as the operator can individually enter addressable constants via the FPD setpoint screen.	SyRS R2.6.2.2.20-8, -9, R2.6.3-3 The external USB disk drive will be provided to TVA. The part shall be listed in the Technical Manual.
		2.8.2 Software			
		C. Configuration Control Software			
64		The Offerer shall develop and supply software to assist in the establishment and maintenance of system software configuration control. This software shall provide documentation (printed output and/or files) of system configuration to allow comparison to the baseline configuration as established by the FAT. Successful completion of the FAT with no open test deficiencies shall establish the Control and Monitoring System software baseline (rev 0).	Comply	The Software Release Records (SRR) for the AC160 and FPD code defines the configuration of the software.	SyRS R2.4-1 SRS R2.3.2-2 through 17
		D. Maintenance and Configuration Devices			-

Rqt #	Section	Wording	Comply, OOS (Not in WEC scope), Clarify, NIC (Not in compliance with Purchase Spec)	Response	Proof req. Met
65		The Offerer shall supply any devices or components that are required for the normal maintenance of the supplied software.	Comply	The MTP is the only hardware needed for maintaining the AC160 software. The loading of software to the AC160 or FPD is accomplished using the CD ROM drive on the MTP/OM. An external USB drive is provided for storing of addressable constants. Should a PC Node Box fail and have to be replaced with a new one, the USB drive will allow retrieving the addressable constants from the disk and storing them on the new PC Node Box. This is provided as a convenience and time saver as the operator can individually enter addressable constants via the FPD setpoint screen.	SyRS R2.6.2.2.20-8, -9, R2.6.3-3 The external USB disk drive will be provided to TVA. The part shall be listed in the Technical Manual.
		H. Component Accuracy and Drift Data			
86		The Offerer shall supply accuracy and drift data for all components supplied. This shall include as a minimum the inaccuracies due to temperature, power supply, time dependent drift, and repeatability.	Clarify	The information provided will be limited to the information supplied from the vendors of the equipment (e.g. ABB AC160).	Information to be provided in the Technical manual
		I. Seismic Qualification Information			
		1. Common-Q PAMS - Auxiliary Instrument Room			
87		The Offerer shall supply cabinets to house PAMS monitoring system hardware, power supplies, I/O hardware, and Maintenance and Test Panels. Offerer shall perform walkdown to scope out size, placement, and mounting for cabinets as specified by offerer. The Offerer shall supply the equipment qualified for the as installed configuration in compliance with WBN Design Criteria, WB-DC-40-31.2, "Seismic Qualification of Category I Fluid System Components and Electrical or Mechanical Equipment". See Appendix D for Seismic Design Parameters for AIR Elevation 708' (711.50).	Clarify	The hardware is being provided to the Common Q qualification criteria documented in WCAP-16097-P-A. Which encompasses the TVA requirements.	No walkdown by the offerer was ever documented. Size of cabinets and OM are acceptable. Seismic - SyRS R3.1.7-2, -4, -9 &-10.
		2. Operators' Module (OM)			
88		The OM must be installed within the existing main control boards with a minimum impact on the control boards. The Offerer shall supply the equipment qualified for the as installed configuration in compliance with WBN Design Criteria, WB-DC-40-31.2, "Seismic Qualification of Category I Fluid System Components and Electrical or Mechanical Equipment". See Appendix D for Seismic Design Parameters for AIR Elevation 755' (755.50).	Clarify	The hardware is being provided to the Common Q qualification criteria documented in WCAP-16097-P-A. Which encompasses the TVA requirements.	No walkdown by the offerer was ever documented. Size of cabinets and OM are acceptable. Seismic - SyRS R3.1.7-2, -4, -9 &-10.
		J. EMI/RFI Test Plan			

Rqt #	Section	Wording	Comply, OOS (Not in WEC scope), Clarify, NIC (Not in compliance with Purchase Spec)	Response	Proof req. Met
89		An EMI/RFI Test Plan in accordance with TVA SS-E18.14.01 shall be submitted for approval by TVA/Bechtel. TVA/Bechtel shall be notified prior to test to determine if attendance by TVA/Bechtel is required.	NIC	WEC shall supply a Qualification Summary report defining the EMC, Environmental, & Seismic qualification of the CQ PAMS.	SyRS R3.1.7-3, -5 & -6
		Special Testing Requirements			
90		1. Testing shall be performed with rack enclosures and wiring configuration similar to the actual plant installation.	NIC	Standard CQ design provided. No qualification testing will be perform specific to TVA.	SyRS R3.1.7-3, -5 & -6
91		2. The EMI/RFI tests shall be perform with the rack doors open and closed.	NIC	Standard CQ design provided. No qualification testing will be perform specific to TVA.	SyRS R3.1.7-3, -5 & -6
		K. EMI/RFI Test Report			
92		An EMI/RFI Test Report in accordance with TVA SS-E18.14.01 shall be submitted for approval by TVA/Bechtel.	NIC	Standard CQ design provided. No qualification testing will be perform specific to TVA.	SyRS R3.1.7-5, R3.1.7-3
107		The system shall provide ability to verify error free download configurations, such as checksum, etc.	Comply		SRS 5.3.2, 5.3.3, 5.3.4, 5.3.14, and 5.3.15 all requirements, R6.1.2-1, R6.1.2-2, R6.1.2-3, R6.1.2-4, 7.2.18, and 7.2.40 all requirements
		3.0 GENERAL SYSTEM REQUIREMENTS			
		3.1 Overview			
173	**3.1.1 InCore Temperature Monitoring System Upgrade**	A Monitoring System shall be provided for Watts Bar Unit 2. The Monitoring System shall be Class 1E safety related for PAMS alarms and displays consisting of two independent trains, complete with all necessary hardware and software, system logic, system graphics, and power supplies meeting the functional requirements of this specification.	Comply		SyRS R2.3.1-1
174		The Monitoring System shall be a distributed digital microprocessor based monitoring system, designed and implemented specifically for power plant applications in terms of materials of construction, industry accepted design conventions, and application software. The system architecture shall be functionally composed of a number of building blocks that can be expanded or modified during or after installation. The basic components are the micro-processor, associated input/output hardware, operator interfaces, and a redundant communications network. This specification details the minimum requirements of the system. The required quantities of I/O, peripherals, and equipment summarized in this specification are an estimate for the basis of bidding.	Comply		SyRS R2.3.1-1

Rqt #	Section	Wording	Comply, OOS (Not in WEC scope), Clarify, NIC (Not in compliance with Purchase Spec)	Response	Proof req. Met
175	**3.1.2 Specific Groupings**	PAMS Train A with Maintenance and Test Panel will be located in the Unit 2 Auxiliary Instrument Room in a new cabinet supplied by Offerer with 120V AC Vital Instrument Power supplied by TVA/Bechtel (new Rack preferred number 2-R-179)	Comply		Power R4.1-1, EDCR 52351
176		PAMS Train B with MTP will be located in the Unit 2 Auxiliary Instrument Room in a new cabinet supplied by Offerer with 120V AC Vital Instrument Power supplied by TVA/Bechtel (new Rack preferred number 2-R-180)	Comply		Power R4.1-1, EDCR 52351
177	**3.2 Hardware Requirements**	A. The proposed system shall be a microprocessor based distributed system.	Comply		SyRS R2.3.1-1
178		B. The proposed system shall have a Mean Time Between Failure (MTBF) of greater than 40 years. A failure for this case is considered the loss of system ability to Monitor/Display. The Offerer shall provide MTBF data for the proposed system and the rationale behind it.	Comply	MTBF = 40 yrs * 365.25 days/yr * 24 hrs/day = 351000 Hrs	WEC Reliability Analysis contains MTTR and MTBF data WNA-AR-00189-WBT
179		C. The proposed system shall have a Mean Time To Repair (MTTR) of less than 2 hours. The Offerer shall provide MTTR data for the proposed system and the rationale behind it. See Section 3.2.3D of this spec for guidance.	NIC	MTTR = 7.2 hours Technical Specification 3.3.3 Post Accident Monitoring (PAM) Instrumentation Action A provides a 30 day completion time for any of the Common Q PAMS functions with one required channel inoperable. If the completion time is not met, then a report must be filed with the NRC. The most limiting condition for a PAMS function is loss of both channels for a single function. This places the plant in a 7 day shutdown LCO. Based on the 30 day and 7 day LCO requirements, a Mean Time To Repair of 7.2 hours is acceptable.	WEC Reliability Analysis contains MTTR and MTBF data WNA-AR-00189-WBT
180		D. The proposed system shall provide power for 4 to 20 ma inputs/outputs and specified digital outputs.	Comply		SyRS R2.6.1-1, -2 R4.3.1-1 & -2 SDS SDS4.4.1.2-6
181		E. All system inputs, including power inputs, shall be filtered to remove high frequency EMI/RFI, and process noise (see required testing in section 3.11.1).	Comply		SDS SDS4.4.1.5-2 BOM 10000A193 item 17
182		F. All rack mounted hardware, unless otherwise noted, is to be located in new Auxiliary Instrument Room (AIR) Racks (2-R-179 and 2-R-180) and the MCR. Each Offerer shall assume that all components are front mounted into the racks. Unless otherwise noted, all indicators will be located in the MCR.	Comply		EDCR 52351 SyRS 1.3
183		G. For the Engineering Workstations and flat panel display units (ODUs), removable storage devices, mouse/trackballs, and keyboards shall be provided for maintenance and operations use.	Clarify	CD ROM drive is provided.	mouse/trackball - SyRS R2.6.2-2 storage device - SyRS R2.6.3-3 Keyboard - SyRS R2.6.3.3-4

Rqt #	Section	Wording	Comply, OOS (Not in WEC scope), Clarify, NIC (Not in compliance with Purchase Spec)	Response	Proof req. Met
184		H. The hardware supplied for mounting in the existing panels shall be configured in such a way as to simplify installation. For example, component racks should be supplied with all hardware necessary to allow for direct bolt-in installation without panel modifications. TVA will provide plans for clear mounting space in existing cabinets and to be verified by the Offerer prior to final hardware design drawings and documents being issued (prior to 100% Design Review).	NIC	New cabinets are being provided therefore requirement does not apply. The Operators Modules will require modifications to the MCB to install.	
185		I. The proposed system configuration shall be tested and qualified for susceptibility and omission (EMI/RFI) as specified in TVA Standard Spec SS-E18.14.01. However, the Offerer may substitute his standard EMI/RFI test if approved by TVA.	Clarify	WEC shall provide a qualification summary report documenting the performance of qualification testing to the WEC standards.	SyRS R3.1.7-5
186		J. The proposed system shall be capable of interfacing with the plant Integrated Computer System (ICS).	Clarify	CQ PAMS provides a 100FX fiber optic output to the ICS.	SyRS R4.3.3-1 WBT-D-1953
187		1. The proposed system hardware interface to the ICS shall be twisted pair or fiber optic Ethernet conforming to IEEE Standard 802.3.	Clarify	CQ PAMS provides a 100FX fiber optic output to the ICS.	SyRS R4.3.3-1 WBT-D-1953
188		2. The proposed system hardware interface protocol to the ICS shall be TCP/IP using OPC format. See Figure 4.4 of the proposed control system and ICS interface.	NIC	WEC shall provide a TCP/IP interface with the WEC standard protocol.	SRS R7.2.34-1
189		3. The proposed system shall transmit analog data with the following information:	Clarify	WEC shall provide a TCP/IP interface with the WEC standard protocol. Information listed provided Value, Bypass (off-scan), and Failure statuses are transmitted. Point ID is implied by sequence order only. Out-of-range is indistinguishable from other failure statuses.	SyRS R4.3.3-2, -3, R2.6.1-2, R4.3.3-1, SRS 7.2.34-5
190		Point Identifier	NIC		
191		Point Value	Comply		
192		Point Quality (e.g. bad, off scan, out of range, alarm, etc.)	NIC		
193		4. The proposed system shall transmit digital data with the following information:	NIC	WEC shall provide a TCP/IP interface with the WEC standard protocol. Information listed provided Value, Bypass (off-scan), and Failure statuses are transmitted. Point ID is implied by sequence order only. Out-of-range is indistinguishable from other failure statuses. Digital point values are not "packed" but are sent individually.	SyRS R4.3.3-2, 3, R4.3.3-1, R4.4.3-3, SRS 7.2.34-5
194		Point Identifier	NIC		
195		Point Value	Comply		
196		Point Quality (e.g. bad, off scan, out of range, alarm, etc.)	NIC		
197		or			
198		Packed digitals with 1 bit per point. Packing is acceptable only if point quality is also transmitted.	NIC		
199		5. The proposed system shall associate a time stamp with each data point corresponding to the time the data was acquired and transmit this time stamp with the point value. If all values in a transmission are acquired within the update rate (a maximum of 200 milliseconds) then a single time stamp may be associated with the data block rather than individual points.	NIC	The AF100 interface to the MTP has an update rate based on powers of 2 (256 ms). Therefore the CQ PAMS data blocks have a time resolution of 256 ms. The data is sent to the ICS every 1 sec. Data sent from MTP is not time stamped. Time stamping can be performed by the ICS.	SRS R5.2.3-3 SRS R7.2.34-2

Rqt #	Section	Wording	Comply, OOS (Not in WEC scope), Clarify, NIC (Not in compliance with Purchase Spec)	Response	Proof req. Met
200		6. The proposed system shall be capable of transmitting updates of all data points (including existing and spare capacity) at a minimum rate of five times each second. Faster update rates are desirable for selected points. The system must provide the capability to slow down or throttle the data transfer to the minimum rate if necessary.	NIC	System transmits to the ICS once a second. The AC160 cycle time is 256 ms. Unused (spare) data points are not transmitted to the ICS. Rate of transmission is not adjustable by the end user.	SRS R5.2.3-3 SRS R7.2.34-2
202		8. The proposed system shall be capable of notifying the ICS of internal self-test results/values.	NIC	MTP provides notification of self-test results which is local to an operator. System trouble alarm provided to ICS	self test - SyRS R4.3.3-2 SRS R7.1.5.4-2 and R7.2.34-5
203		9. A failure in the ICS shall not affect the monitoring system. Example: ICS failure results in repeated requests for information shall not affect the response time of the monitoring system and shall be proven by test. Testing shall be based upon type of communication buffering device (e.g. firewall), ICS broadcast capability, communication and protocol being used. Any required configuration limits (e.g., amount of allow requests within a specific time and/or authorized IP requests) for the buffering device shall be documented and placed under configuration control.	Comply		SRS R7.2.34-4 and R7.2.34-9
205		L. The proposed system shall have self-diagnostics and identify any hardware watchdog timers to detect any inadvertent software loops/failures. ~~The Offeror shall specify the level of coverage in percent of the system self-diagnostics.~~	Clarify	TVA has elected to remove the level of coverage requirement as it is an inherently weak definition.	self diagnose - SyRS R2.9-1, R2.9.1-1, R2.9-2, R2.9.2-1, -2, -3, -4 & -5 W/Dog - SyRS R4.4.1-1
206		M. All proposed system components such as power supplies, computational modules, I/O modules, etc., shall be removable one at a time for maintenance with the system energized without loss of system functionality or component damage.	NIC	The power supply is redundant. The MTP or OM can be powered down and replaced without impacting system operation. The AC160 is not redundant, although IO modules can be replaced without powering down the rack. There will be loss of system functionality in this case.	Power Supply SDS R4.4.1.5-1 through R4.4.1.5-7

Rqt #	Section	Wording	Comply, OOS (Not in WEC scope), Clarify, NIC (Not in compliance with Purchase Spec)	Response	Proof req. Met
207		N. For indication and alarm functions, the proposed system input sampling through output processing (output is updated) time shall be at 500 millisecond intervals or less. This parameter shall be verified as acceptable by testing.	Clarify	The response time for any change in the digital or analog input to be processed and displayed on the OM or MTP shall be less than or equal to 2.5 seconds. The response time for any change in the alarm condition to be processed and annunciated on the annunciator panel shall be less than or equal to 550 milliseconds. A step change with the setpoint at the 50% level of the step change is applied to the analog input. The time from when the step change occurs at the input to when the relay contact output, in the Common Q PAMS cabinet, changes state will be within the response time defined above. These times tested in FAT.	SyRS R3.2.2-1 and R3.2.2-2
208		O. The proposed system trending and history sampling shall be 500 millisecond intervals or less.	Clarify	Standard trends allow selection of scan interval from 0.5 seconds to hours	SRS R7.2.13-15 and R7.2.13-20
209		P. The proposed system Operator's Module (OM), Maintenance and Test Panel (MTP) screens and MCR Handstation/controllers shall be updated every 1 second or less.	Clarify	MTP and OM are updated every 500 ms.	SyRS R3.2.2-1 & R3.2.2-2
210		Q. Offerer should provide panel wiring and cable that uses PVC free insulation material and jacket. It is understood that it is not possible to achieve 100% conformance so the offerer should strive to supply non-PVC insulated wiring/cabling and minimize the usage of PVC wiring/cabling where feasible and achievable.	Comply	Westinghouse cables are manufactured using Halogen free cables. Some vendor supplied cabling (e.g. internal PCNB wiring) may contain PVC. The use of PVC wire is minimized in the CQ PAMS system.	SDS R4.4.3-1
211		R. All Offerer installed panel wiring shall be installed in accordance with accepted industry standards and practices, with all external interface wiring utilizing ring tongue lugs where feasible. The Offerer shall describe the proposed wiring standards or procedures to be utilized. Particular attention shall be directed at termination and bend radii (see reference 3.15.G "TVA General Engineering Specification G-38".	Clarify	The termination units provide Phoenix Combicon compression connections.	SDS R4.4.2.3-2
	3.2.2 Hardware Requirements for the InCore Monitoring System	A. System Safety Classification			
213		This Monitoring system is classified as Class 1E, safety related, for PAM.	Comply		SyRS R4.1-1, R4.3.1-2
		B. System Architecture			

Rqt #	Section	Wording	Comply, OOS (Not in WEC scope), Clarify, NIC (Not in compliance with Purchase Spec)	Response	Proof req. Met
214		The proposed system shall consist of two trains which are functionally identical but electrically isolated and have the capability for distributed architecture. A control processor (one each Train) will be located in an individual rack to meet all the performance requirements of this specification which includes areas such as response time requirements, failure modes requirements, system segmentation requirements, etc. Systems that require a centralized computer for normal operation are not acceptable (i.e., a personal computer or mainframe computer). The system architecture shall be fault tolerant consisting of two redundant Trains and microprocessor based multiple I/O interface modules with remote mount capability. The system shall be linked together by a network of redundant digital communication paths to form a completely integrated, distributed process system. The system will interface with the existing main control board, the plant Annunciator Systems, the plant's Integrated Computer System (ICS), the operator's OM console displays, Westinghouse In-Core Information Surveillance and Engineering (WINCISE) system, Reactor Protection Set (Eagle-21), and Plant Process Equipment.	Clarify	The proposed CQ PAMS Is not design for redundancy in the AC160 rack. There are redundant networks to the MTP. Redundancy can be priced if desired. CQ PAMS does not interface with WINCISE	SyRS and SDS
215		In order to perform its function, the system shall also be responsible for receiving, conditioning, and automatically selecting valid process measurement signals and providing the necessary interlocks and alarms.	Comply	PAMS provides no interlock functions and only the system trouble alarm is utilized.	SyRS and SDS
		C. Redundancy			
216		Each Train will be physically and electrically isolated from each other with redundant power supplies.	Comply		SyRS R3.1.2-1, R3.1.3-1, R3.1.4-1, R3.1.5-1 SDS R4.4.1.5-2
		1. Inputs			
217		Input signals shall interface with the system using independent input channels so that a loss of an input channel would result in the loss of only one input signal. These requirements shall be tested in the FAT.	Clarify	The AI modules have 16 independent channels. The DI module is isolated in groups of 8 channels. Testing is not done in the FAT.	Suitability Evaluation ABB S600 IO Reference Manual
		3. Data Highway			
219		Communications between the redundant components and certain peripherals (operator's OM, Maintenance and Test Panel (MTP), and ICS) shall occur over redundant digital data busses. Isolation between the busses shall prevent failure in one bus from affecting the alternate bus. The loss of any bus shall be alarmed. Data transmission shall occur simultaneously on the redundant busses. The data highway shall be robust enough to carry worst case data transmission.	Clarify	- The AF100 bus is redundant SyRS R2.6.2-8 - ICS link is not redundant. This is acceptable since it is a non safety function.	SyRS R2.6.2-3, -7 and -8, R4.3.3-4, and R4.3.3-5,
		4. ICS Interface			
220		For communications interfacing to ICS, TVA/Bechtel defined interfaces shall be utilized. The interface should provide buffered digital to digital communication with the plant computer.	Clarify	CQ PAMS provides a 100FX fiber optic output to the ICS.	SyRS R4.3.3-1 WBT-D-1953
		E. Process Signals			

Rqt #	Section	Wording	Comply, OOS (Not in WEC scope), Clarify, NIC (Not in compliance with Purchase Spec)	Response	Proof req. Met
223		Critical signals for PAM are identified in Section 3.2.2. Non-critical signals would include those used for alarms, indication only, and not required for PAM. Any redundancy shall be designed with physical and electrical isolation such that a single failure in any portion of the string (A/D, signal conditioning, computation, output, etc.) shall not cause a loss of final output to PAM Indicators or recorders. Analytical redundancy may be used for critical signals in addition to the above requirement and for fault detection.	Clarify	WEC compliance is through the Common Q "train" configuration	SyRS R3.1.2-1, R3.1.3-1 and R3.1.4-1
		F. Input/Output System			
224		Input/output (I/O) modules shall be provided which shall convert signals to/from field devices to digital communications compatible with the distributed control processors. These modules shall be capable of being distributed throughout the plant as required by geographical location. All modules communicating back to the processors will provide fault tolerant communications in either a centralized or geographically distributed system.	NIC	The AC160 system is designed with rack mounted IO modules.	SyRS R4.2-1
		1. Isolation			
225		All inputs and outputs shall be isolated to 600 Vac and 250 Vdc between any I/O point and ground or between any pair of I/O points.	Clarify	The ABB IO Modules are isolated for 500 Vrms and 700 VAC. The AO and AI card are isolated on a channel basis. The DI and DO cards are isolated in groups of 8 (32 channels/card)	Isolation requirement for the IRP relays: SDS R4.4.2.1-1, ABB S600 I/O manual
226		All discrete sourcing inputs and outputs shall be current limited to prevent damage to the I/O system due to inadvertent dead shorts in the field wiring. A dead short in the wiring of any field device shall not affect the proper operation of any other sourcing input and/or output of the I/O System.	Comply		ABB S600 Reference Manual
		2. Field Power Supplies			
227		Input loop power supplies shall be dedicated at a module/input card level so that grounding problems (i.e.., multiple grounds) will only affect one input channel. These power supplies shall be capable of supplying the voltage required for the existing field devices where applicable (i.e. RVLIS transmitters, etc.) These higher voltage power supplies may be external to the input card but should be designed to minimize the effects of multiple grounds (ground loops). These power supplies shall be supplied by the Offerer.	Clarify	The only loop input power supplies are for the RVLIS transmitters. The Common Q Power Supply has 3 redundant DC to DC converters that provide power for each of the DP transmitters.	SDS R4.4.1.5-5
		3. Accuracy			

Rqt #	Section	Wording	Comply, OOS (Not in WEC scope), Clarify, NIC (Not in compliance with Purchase Spec)	Response	Proof req. Met
228		The total loop accuracy (input to output) of the system signal processing shall be less than ± 0.5% of calibrated span. This accuracy shall include as a minimum the reference accuracy, 18 months of time related drift, temperature effects over the stated operating range, software induced errors, etc. Digital processing effects (where applicable) such as analog-to-digital conversion, software round-off error, and digital-to-analog conversion shall not contribute any additional inaccuracies greater than ± 0.03% of channel span to the uncertainties specified in the system requirements sections. See ISA Standard 67.04 for methods on combining individual uncertainties.	NIC	The AC160 shall comply with the ±0.5% total loop accuracy from the input to the CQ PAMS to the output. The High Level AI card accuracy is ±0.05% span (includes linearity, hysteresis, noise, accuracy) as defined in the manufacturer's reference manual.	Suitability Evaluations SyRS R3.2.1-1, -2 and -3 AI card accuracy – ABB S600 Reference Manual
		4. Input Filtering and Noise Sources			
229		All inputs susceptible to EMI/RFI noise shall have hardware filtering. All inputs shall have the capability of adjustable software filtering of process noise to prevent control system upsets.	Clarify	The input cards have all been tested and qualified to meet R.G. 1.180. The AI card supports selection of 50/60Hz or 5Hz filtering.	RG 1.180 – SyRS R3.1.7-3 AI card – SRS R4.2-7, R4.2-9
230		All DC and AC contact outputs shall be rated to interrupt the maximum design load current at the maximum design voltage and shall have noise suppression to prevent EMI/RFI noise generation. Interposing relays can be used to meet this requirement but must be approved by TVA/Bechtel on a case by case basis.	Clarify	CQ PAMS uses interposing relays for the alarm/annunciator outputs.	ABB S600 I/O manual
231		DC Contacts with inductive loads shall be evaluated with respect to contact ratings, reduced reliability, and noise generation. Arc suppression shall be supplied based upon the results of these evaluations.	Clarify	This will be done only for inductive loads connected to the CQ PAMS Output Contacts	N/A
		5. Input and Output Types			
232		The system must accept all the process signals listed below without additional devices conversion.	Clarify	The AC160 complies except as noted below:	
		Inputs	**Outputs**		
233		4 to 20 mA	4 to 20 mA (Loop Impedance 600 ohm max)	Comply	SyRS R4.2.1-1 SDS R4.4.1.2-2, and -3
234		Thermocouple/milli-volt	0 to 10 VDC	The CQ PAMS interfaces with incore probe TC directly. ie not thru WINCISE electronics.	SyRS R4.2.1-2, SDS R4.4.1.2-7, -8 -9 and -10
235		Dry Contact (Non-Mercury Wetted Contacts)	Dry Contacts	Comply	SyRS R4.2.2-2 ABB S600 I/O manual

Rqt #	Section	Wording	Comply, OOS (Not in WEC scope), Clarify, NIC (Not in compliance with Purchase Spec)	Response	Proof req. Met
236		RTD inputs (Foxboro Types NR-226 and NR-266 IEC platinum; nickel; and 2, 3, and 4 wire types)		The AI Card accepts 4 wire Pt100 or Pt200 RTDs. External signal conditioners can be used to support/convert the other signals to useable signals for the AC160	SyRS R4.2.1-3, SDS R4.4.1.2-7, -8 -9 and -10
238		100 Ω Platinum (RVLIS Capillary Line RTD's)		Comply	SyRS R4.2.1-3 SDS R4.4.1.2-7, -8 -9 and -10
		6. I/O Density			
239		TVA is concerned about the number of points that must be forced when a single I/O card is replaced. No more than 8 points per card are allowed (4 max is preferred) to be utilized in the delivered system. Because a particular vendor may incorporate more than 8 points in their card design, TVA will permit a larger point count card to be used, but will not permit greater than 8 points per card to be assigned. Please note that in calculating the number of spare I/O points provided, the points in excess of 8 per card will NOT be counted. In any case, each of the points on a card will be individually addressable and useable to the fullest extent. Subsystems I/O not fully addressable and/or incapable of being individually monitored are specifically forbidden.	NIC	CQ PAMS configuration has more than 8 signals per card and spares are provided per system but not per card.	SDS R4.4.1.2-1 through -10
		7. Forced Inputs/Outputs or Bypass			
240		The system shall allow any input or output to be individually removed from actual scan, in which the point shall freeze to last value. At the users' option, the point can be subsequently forced such that any digital point can be set to "on" or "off" and any analog point can be set to any value within its defined range. This function shall be restricted to authorized users by password protection. Any point that is bypassed (frozen or forced) shall be indicated to the operator via an alarm point and engineering stations with distinctive and consistent color and/or text change to the extent that it is intuitively obvious that the indicated value is not based on live data. The operator and engineering consoles shall include the capability to list all points not in scan, which points are forced, and what values are in use by the system.	NIC	CQ PAMS does not have password protection. Protection is via key switch. System has bypass function available	SyRS R2.5.2.1-1, R2.5.3.4.20-1, R2.6.2.1-1, R2.6.2.2.18-1, R2.6.2.4-1, R2.6.3.1-1 & R4.4-1, Bypass – Add R2.5.2.1.2-1, R2.5.2.1.2-2, R2.5.2.1.2-3, R2.6.2.2.17-3, and R2.6.2.2.18-1
242		Immediately Available I/O points (wired spares, including Tas) – For each Train cabinet, the Offerer shall provide a minimum of 15% functional spare capacity for each I/O type used. The installed spare capacity shall be consistent with the utilized I/O to the extent that wired spare capacity can be utilized by terminating the field device and configuring the database to accept the point without additional procurement. Note: If I/O cards with greater than 8 points per card are utilized, all points shall be wired to termination units and available to TVA for future use. In calculating the spare I/O point count, however, only the unassigned points within the first 8 addresses will be utilized. The spare memory/processor/etc. capacity shall be that capacity that exists over and above the addressing of all points delivered, including those above 8 points per card. In essence, TVA will permit use of high count I/O, but will not credit the vendor, or make allowances in any calculation for their presence.	NIC	The CQ PAMS does not account for the spare capacity as defined. System does provide spare capacity.	SDS Requirements: R4.4.1.2-1, R4.4.1.2-3, R4.4.1.2-5, R4.4.1.2-6, R4.4.1.2-7, R4.4.1.2-8, R4.4.1.2-9, R4.4.1.2-10, R4.4.3-20

Rqt #	Section	Wording	Comply, OOS (Not in WEC scope), Clarify, NIC (Not in compliance with Purchase Spec)	Response	Proof req. Met
	3.2.3 Critical System Signals	A. PAM			
244		The generic PAM input signals are safety related to support the Inadequate Core Cooling (ICC) detection function post accident. The digital inputs apply only for PAM which includes SPDS functions.	Comply		SyRS R3.1.3-1, R3.1.4-1 and R3.1.5-1
		B. Signal Validation Failure			
245		The signal selection feature itself shall be designed in a fail/operative manner; i.e., the signal used prior to the failure of the signal selection function shall be retained during and after the failure of the selection functions. In addition, no failure of this feature shall disable its bypass capability. The Maintenance and Test Panel can be used to indicate when the signal has failed.	Comply		This is a general requirement that is being met by having the "suspect" feature built into all algorithms. SyRS R2.5.3.2-12
256		e. Multiple failures of inputs to the system where these failures are credible due to common cause (Loss of a common input, break of a common instrument line, loss of power that feeds multiple instruments, etc.). TVA will supply input data for common cause initiator outside the system such as power supply feeds.	Comply	Power supplies, signals, and sensing lines are trained and independent	
		2. Failure Response			
		The system shall be designed to maintain the following minimum capabilities in the above failure modes:			
257		a. The System shall include sufficient redundancy such that a single element failure does not affect the controlled process. Upon the failure of a single element, the transfer to the alternate element/algorithm shall be completely bumpless and automatic. Any single element failure shall be alarmed.	NA	The CQ PAMS is not designed with redundant IO	SyRS R3.1.2-1, R3.3.2-1, R4.3.3-4 and R4.3.3-5, SDS4.4.1.5-3, R4.4.1.5-5, R4.4.1.5-7, Project agrees, there is no redundant I/O
261		The system shall be designed such that a single fault occurring here in the system (from input to output) will not affect plant operation. This fault tolerant, 100 percent backup requirement, is required for all data acquisition portions of the system.	Clarify	Two train CQ PAMS design meets requirement	SyRS R3.3.2-1
263		Any system component must be capable of being taken out of service without affecting the plant operation generation. Communication between the primary and backup shall allow rapid detection of a hardware or software fault. This transfer will occur in a defined amount of milliseconds and will be oblivious to the process.	NIC	CQ PAMS has no redundancy within a train. PAMS does not impact plant operation and any failure will be annunciated to the operator. SyRS R2.6.2.1-3, R2.6.2.1-4, R2.6.3.1-5, R2.6.3.1-6, R2.6.3.1-11, R2.9.2-4, R2.9.4-1, R2.9.4-4, R2.9.5-4, R2.9.5-5, R2.9.5-6	SyRS R2.6.1-1
		E. System Diagnostics			

Rqt #	Section	Wording	Comply, OOS (Not in WEC scope), Clarify, NIC (Not in compliance with Purchase Spec)	Response	Proof req. Met
264		Continuous, online self diagnostics, including I/O status and quality monitoring, shall be provided for the total system down to the individual module level. This shall include self check of the hardware, memory, and firmware/software. The Offerer shall describe their self diagnostic scheme in detail. Example: Each processor shall read the input, perform the application, and cross check the output value being sent to the final element. If the devices disagree, they shall have the ability of diagnosing which one is at fault. System failures detected during this system validation process shall be annunciated in the main control room via audible alarms and information made available to allow immediate response by maintenance personnel.	Comply		SyRS R2.9-1, R2.9.1-1, R2.9.2-1, R2.9.2-2, R2.9.2-3, R2.9.2-4, R2.9.2-5, R2.9.3-1
		The system shall include extensive hardware and software self checks, including the following:			
265		▪ I/O Quality	Comply		SyRS R2.9.2-1 and SyRS R2.9.2-2
266		▪ Input out of range	Comply		SyRS R2.9.2-1
267		▪ Computational check	Comply		SRS R6.1.2-3
268		▪ Two way Communication check	Comply		heart beat – SyRS R2.6.2.1-2, R2.6.2.1-3, R2.6.2.1-4, R2.6.2.1-5, R2.6.3.1-5, R2.6.3.1-10, R2.6.3.1-11, R2.9.4-4, R2.9.2-1
269		▪ Memory error detection	Comply		SRS 5.3.2, 5.3.3, 5.3.4, 5.3.8, 5.3.14, 5.5, and 6.1.2
270		▪ Central processing unit time out	Comply		SRS R5.1-1, 5.3, 5.3.1, and 5.3.10, SyRS R4.4.1-1
271		▪ Power supply threshold checks (both upper and lower detection must be identified)	Comply		SyRS R4.2.2-4
		F. System Security			
272		The system must be designed for online maintenance and tuning capability. The system must be protected from unauthorized modifications of system functional configuration by limited access through a password and key-lock security measures.	Clarify	Keylock security only.	SyRS 2.5.2.1 and 2.5.2.2 all requirements R2.6.2.2.20-6, R2.6.2.2.20-11, R2.6.3-2, R2.6.3.3 all requirements, R2.9.5-3
		G. Power Supply Design			
		1. AC Power Distribution			

Rqt #	Section	Wording	Comply, OOS (Not in WEC scope), Clarify, NIC (Not in compliance with Purchase Spec)	Response	Proof req. Met
273		a. Power distribution for the control system shall be designed such that the loss of a single AC power source will not result in the loss or degradation of system operation. A minimum of two independent AC power sources shall be provided to critical components and Operator Interfaces of the system. Alarms shall be provided to identify the loss or degradation of any AC source.	Clarify	The Cabinet power supply is redundant. The OM and MTP have a single AC power supply.	SDS4.4.1.5-2, SDS SDS4.4.1.5-3, R4.4.1.5-5, R4.4.1.5-7
274		b. The system shall be designed for continuous operation when supplied with 120 VAC +/- 10 percent and 60 Hz +/-5 percent, single phase, with a harmonic content not to exceed 5 percent total and with a 10 percent peak maximum deviation from the sine wave. *The system shall be designed not to consume more than the available analyzed* supply capability of plant's AC vital inverters. This is TVA/Bechtel scope of work and shall use the plant's loading calculations along with the Offerer's power consumption specifications as the basis for meeting this requirement. This requirement must be further developed based upon actual selection of the AC power sources.	Comply		SyRS 4.4-1 – AC power requirements. SyRS 3.1.7.3 defines that the Cabinet and OM are EMC qualified. The Conducted Emission test results confirm compliance to the harmonic content
275		c. All AC loads shall be evaluated by the Offerer to ensure proper ride through capability (no effect on system or output loads) for a complete loss of one AC source.	NA	The CQ PAMS System only has one AC input and thus the requirement does not apply	N/A
276		d. Diverse AC power source shall be provided to the Train cabinets such that the loss of power from any one source will not affect the operation of the other Train (i.e. Train A separate from Train B).	Comply		SyRS R4.1-1
		2. DC Power Distribution			
278		a. The DC distribution system shall employ redundant DC power supplies with a single AC power source. Auctioneering of the supplies' outputs should be performed at the lowest level practicable (individual card, module, nest, etc.). Fault protection and detection shall be provided for the auctioneered DC power supplies. The failure of any power supply shall be alarmed. Power supply status shall be indicated on the power supply itself. The System design shall employ sufficient means to replace failed power supplies, while online, without affecting control system's operation and shall be easily accessible.	Comply		redundant DC supplies – SDS SDS4.4.1.5-2, SDS R4.4.1.5-5, R4.4.1.5-7 auctioneering – SDS SDS4.4.1.5-3 fault protection – SyRS 4.2.2-4 failure cause alarms – SyRS R4.2.2-4, R2.9.2-3, -4 & -5,; SDS SDS4.4.1.5-12; SRS table 7.1-2. I status displayed – E-00000-435-112 replace while online – See CQ PS Manual in Technical Manual
279		b. A power supply failure in the high direction shall not result in the complete loss of power.	Comply	Each individual supply has overvoltage protection. An overvoltage condition will not result in loss of both supplies.	SDS R4.4.1.5-2, SDS4.4.1.5-13
		3. Loss and Restoration of Power			

Rqt #	Section	Wording	Comply, OOS (Not In WEC scope), Clarify, NIC (Not In compliance with Purchase Spec)	Response	Proof req. Met
		The control system shall be designed to meet the following requirements on the loss and restoration of power:			
280		a. Upon the loss of one redundant power supply, the system shall be capable of recognizing the failure, transferring power to prevent system upset, and alarming.	Comply		SDS SDS4.4.1.5-2
281		b. Upon the loss of all power, the system shall be designed so that all indicators and recorders associated with that system are readily detectable as in the failed state (i.e.., fail downscale).	Comply		See SDS Table 4.4-4 and 4.4-5 for 4-20 mA analog outputs. The system provides a "system trouble" annunciation at MCR for loss of power as per SyRS R2.9.4-1
282		c. Upon the restoration of power (AC, DC, or both), indication shall be provided to the main control room to indicate the restoration of power (Annunciation will clear).	Comply		SyRS R2.9.4-3 clearing of SysTrbl not until initialization of all hardware
283		d. On restoration of power, the system shall be capable of restoring normal operation without requiring a manual download of program from a central computer system (i.e. program must be stored within the CPU).	Comply		SyRS R2.9.4-2
285		a. Each load shall be individually isolated such as transformer isolation so that multiple grounds on fields will not affect the system.	NIC	WEC exception, current design utilizes a Termination Unit that has one supply for 16 transmitters.	SyRS R3.1.4-1
286		b. Uses differential input design to reduce the potential for noise.	Clarify	AI cards only.	SyRS R4.2.1-1
287		c. Shall be capable of supplying voltages required for each field load.	Comply		accomplished with power supply – Replace with SDS R4.4.1.5-6, R4.4.1.5-7
		H. Grounding Requirements			
288		Each Rack enclosure shall have an electrical safety ground bus ~~and an isolated instrument ground bus~~. A compression fitting suitable for connection to a 4/0 AWG main plant grounding cable shall be provided in the appropriate enclosures. The Offerer shall provide all engineering and materials required to ensure the adequacy of their cabinet ground system as it pertains to the installed system.	Comply	The WBT PAMS Cabinet is supplied with a single ground connection. This requirement was changed per WBT-D-2583	SyRS R3.1.1-7 exception made, see WBT-D-2048 and 25402-011-G26-GAKS-03871-001 SDS SDS4.2.1-3
289		AC power connection wiring that is ground system related shall be green, green with a trace color or yellow with a green trace.	Comply	For AC grounds only. DC grounds are shields. The ground wire is yellow with green strip	Drawing 10047E66 (Wiring Diagram) shows two AC Cables. Drawings 10042D14 and 2B10128 show the AC cable and wire colors.
		I. Internal Rack Cabling Requirements			

Rqt #	Section	Wording	Comply, OOS (Not in WEC scope), Clarify, NIC (Not in compliance with Purchase Spec)	Response	Proof req. Met
290		All cabling provided by the Offerer shall use documented cable and wiring good practices for internal panel wiring. These good wiring practices should encompass such issues as proper wire sizing associated with current loading; EMI/RFI protection by the use of shielding and proper termination, use of twisted pair wiring, enclosure protection, separation of noise generation circuit (relays), etc.; and proper termination as specified in this specification.	Comply		very general requirement - see SDS R4.4.3-1 to R4.4.3-22 and SDS4.4.3-1
		1. System Cabling			
		Interconnecting System rack cables, network cables, and the like shall be supplied by the Offerer.			
292		Where prefabricated cables are furnished by the Offerer, the cables shall be terminated with the use of Cannon plugs, or approved equal. The connectors (plug and receptacle) shall have rugged metal shells or be manufactured of high-strength insulating material. When separate, the live part shall be a female contact so that shorting of pins is not possible. Adequate cable strain-relief clamps shall be provided. There shall be no exposed live parts on the rear of the plug. An environmental seal is preferred. The plug and receptacle design shall be such that electrical contact cannot be established until the plug and receptacle are correctly aligned.	Clarify	All cables provided are internal to the CQ PAMS Cabinet except those associated with the OM. The OM is connected to the cabinet via Fiber Optic cables terminated with ST connectors. These cables are not supplied by the Offerer.	WBT-D-0899
		2. Cabinet Wiring			
293		All wiring shall be securely installed and neatly bundled with flame resistant, nonmetallic tie bands. All electrical connections shall be readily accessible. It shall be possible to inspect, remove, and add connections to any device without removal of the device, mounting steel, piping, wire-ways, or tubing. Where wiring must cross sharp metal edges, adequate protection shall be provided, preferably by Autolyze or by approved grommets. In addition, each device shall be removable without disturbing other devices, mounting steel, etc.	Comply		securely installed - SDS R4.4.3-13 neatly bundled - SDS R4.4.3-13 tie bands - using wireway - SDS R4.4.3-13 accessibility of terminations - yes - see rack layout drawings 10047E63 series removable w/out disturbing - SyRS R4.2.1-4
294		All terminal points shall be clearly and permanently labeled and conveniently located. All terminal points shall be clearly labeled in accordance with the Offerer's wiring drawings, which shall contain physical location by cabinet, rack, terminal block, and terminal.	Comply		Drawing 10047E63 (Cabinet Assembly) shows the label locations and markings for the terminal points.
295		Offerer factory wiring shall all be terminated on the same side of the terminal block or column of terminal blocks. All electrical connections between cabinets shall be by Offerer supplied prefabricated cables. Prefab cable plugs shall be keyed.	Comply		R3.1.1-9 was added to SyRS Rev. 3. SDS4.4.2.3-2 was added to SDS Rev. 3

Rqt #	Section	Wording	Comply, OOS (Not in WEC scope), Clarify, NIC (Not in compliance with Purchase Spec)	Response	Proof req. Met
296		The Offerer shall segregate by voltage level all terminal blocks for internal wiring and field cable connections. The Offerer shall make provisions for terminating and grounding individual shield and overall cable shield wires for all analog inputs. Provisions for powering of interposing relay coils shall be the responsibility of the Offerer.	Comply		Voltage level segregation of terminal blocks – See 10047E66 and 10047E67 Individual Shield Grounding – See WNA-WD-00814-WBT and 10047E67 IRP power – See 10047E66 and SDS R4.4.1.5-7
297		High density I/O termination panels or blocks are not acceptable. The intent is to provide ease of installation and maintenance of the system.	Comply		The density of the IO terminations shown in Cabinet Assembly drawing 10047E63 meets the intent of this requirement
300	**3.3 Environmental Requirements**	Following requirements are based upon the system not requiring forced cooling such as cabinet fans. The equipment will be mounted in cabinets relying on natural convection ventilation. It is a reliability requirement that the system does not require forced cooling to achieve its reliability numbers. Forced cooling will be considered and evaluated as an exception to this specification.	Clarify	The system cabinet includes forced cooling but system was qualified without cooling.	SDS R6.2-1 and R6.2-2
301	**3.3.1 Auxiliary Instrument Room**	The PAMS and MTP shall be designed to operate in the following ambient environmental conditions. These are general requirements; therefore, when applicable plant specific requirements are available or are more stringent, they should be followed:	Clarify		
		Parameter	**Design Range**		
		Temperature (°F)	60 - 104°F*		SyRS R3.1.7-6
		Pressure (psig)	Atmospheric		SyRS R3.1.7-6
		Relative Humidity (%)	20 - 90% (non-condensing)	20-95% RH: This requirement was changed per WBT-D-2583	SyRS R3.1.7-6 making exception since SyRS states 20-95% RH
		Radiation	< 1 x 10^3 Rads (40 year Total Integrated Dose).	< 1 x 10^3 Rads (40 year Total Integrated Dose). This requirement was changed per WBT-TVA-1546	SyRS R3.1.7-6
		Applies to the ambient environment outside the system cabinets and envelops the temperature profile for the auxiliary instrument room (Reference WBN Reference Dwg. 47E235-17)			N/A

Rqt #	Section	Wording	Comply, OOS (Not in WEC scope), Clarify, NIC (Not in compliance with Purchase Spec)	Response	Proof req. Met
302	**3.3.2 MCR Instrumentation**	The PAMS Operators' Module shall be designed to operate in the following ambient control room environmental condition. These are general requirements; therefore, when applicable plant specific requirements are available or are more stringent, they should be followed:	Comply		
		Parameter	**Design Range**		
		Temperature (°F)	60 - 104°F*		SyRS R3.1.7-7
		Pressure (psig)	Atmospheric		SyRS R3.1.7-7
		Relative Humidity (%)	20 - 90% (non-condensing)	This requirement was changed per WBT-D-2583	SyRS R3.1.7-7 making exception since SyRS states 20-95% RH
		Radiation	Background < 1 x 10^3 Rads (40 year Total Integrate Dose)		SyRS R3.1.7-7
		Applies to the ambient environment outside the Main Control Board enclosures and envelops the temperature profile for the Main Control Room (Reference WBN Reference Dwg. 47E235-16)			N/A
		3.4 Man Machine Interfaces			
303	**3.4.1 PAMS Operators' Module and Maintenance and Test Panel**	A fully manual operator module shall be provided. The manual system shall be sufficiently independent to preclude any single failure from rendering the rack inoperable.	Comply	A failure of the OM cannot cause the AC160 rack to become inoperable since it is Fiber Optically isolated from the AC160 and independent from the AC160 rack	SyRS R2.6.2-3 SyRS figure 2.1-1, figure 2.1-2, SyRS R2.6.2-3, and R4.3.3-5
	3.4.4 Graphics	A. Graphic Displays Configuration			
308		The design, coordination, implementation, programming, and testing of all displays shall be the Offerer's responsibility. This shall include, but not be limited to, navigation displays, process mimics/faceplates, interlock help displays, system status displays, control loop status displays, diagnostic displays, alarm summary displays, and trend displays as defined elsewhere in this document.	Clarify	CQ has no control loop status displays	general screen requirements - see SyRS section 2.6.2.2 all requirements
		B. Graphic Display Types			

Rqt #	Section	Wording	Comply, OOS (Not in WEC scope), Clarify, NIC (Not in compliance with Purchase Spec)	Response	Proof req. Met
309		1. Navigation (Menu) displays - Navigation displays help the operator/engineering in locating specific graphics for monitoring. In addition to the main navigation displays, every graphic should contain navigation aids to assist the operator.	Clarify	The standard CQ Directory display will be provided, This allow navigation to all lower displays and is easily navigated back to.	SyRS R2.6.2.3-1, SyRS Table 2.6-1
310		2. Process Mimic / Faceplate Displays - Process mimic and faceplate displays are P&ID and single line schematics showing the different plant systems with associated data (status of active components and indications of flows, temperatures, pressures, levels, etc.).	Clarify	CQ PAMS has a standard display of the RCS with the PAMS related data.	SyRS R2.6.2.1-1, R2.6.2.2.1-1, R2.6.2.2.2-1, R2.6.2.2.3-1, R2.6.2.2.4-1, R2.6.2.2.5-1 to 5, R2.6.2.2.6-1 to 4, R2.6.2.2.7-1 to 3, R2.6.2.2.8-1, R2.6.2.2.9-1
311		3. System Status Displays - The system shall be provided with graphic displays for all man-machine interface points to permit the monitoring of system components, peripheral devices and communication circuits. Information shall be provided to the individual component level utilizing the system diagnostic capabilities. From these displays, the engineer shall be able to restore system communications, mark Control System devices in or out of service, and generally monitor the conditions of each piece of hardware included in the system.	Clarify	The standard CQ System Status display shall be provided. This display does provide status of individual components of the system. This display does not allow the user to restore system communications, or mark Control System devices in or out of service.	SyRS R2.6.2.1-1, R2.6.2.2.11-1, R2.6.2.2.12-1, R2.6.2.2.13-1, R2.6.2.2.14-1, R2.6.2.2.15-1, R2.6.2.2.16-1, R2.6.2.2.16-2, R2.6.2.2.16.1-1
312		4. Alarm Summary Displays - Alarm summary displays provide the operator with information on alarm status of process points, system failures, etc. The alarm message shall be a single line description of the alarm condition for each alarm on the operator module. The operator shall not require any index or decoding to understand the nature of the alarm nor the point in alarm. A point tag blinking as the sole indication does not constitute acceptable alarm notification.	Clarify	The standard CQ Alarm Log display shall be provided. This display does provide alarm status of process points. The CQ System Status log display will be provided to indicate system failures.	SyRS R2.6.2.1-1, SyRS R2.6.2.2.14-1, R2.6.2.2.15-1
		C. Color Convention			
313		All ODU based displays proposed for the PAMS System shall be in accordance with TVA Design Standard E18.1.24, except as noted below. The color and display conventions below are intended to ensure that the PAMS System displays are similar to the Integrated Computer System (ICS) displays.	NIC	The displays will use CQ standard color convention.	
314		1. All graphics must be presented on a gray background.	Comply	CQ displays based on a black background.	WNA-SD-00277-WBT
315		2. White is used for operator prompts/static text, object outlines, bar graph outlines, etc.	Comply		WBT-D-2348
316		3. Green is used to show valid data, de-energized equipment, closed valves, etc.	Comply		valid data - SyRS R2.6.2.4-1, SyRS R2.6.3.1-2 to 4 de-energized and closed valves are not applicable
317		4. Red is used to show energized equipment, open valves, upper/lower alarm points exceeded.	Comply		SyRS R2.6.2.4-1, SyRS R2.6.3.1-2 to 4
318		5. Variables in alarm should change to red on a white (or light gray) background.	NIC	CQ variables in alarm shown in white on a red background.	SyRS R2.6.2.4-1, SyRS R2.6.3.1-2 to 4

Rqt #	Section	Wording	Comply, OOS (Not in WEC scope), Clarify, NIC (Not in compliance with Purchase Spec)	Response	Proof req. Met
319		6. Current acknowledged alarms should be red on a black background, and unacknowledged alarms that have returned to normal should be green on a white (or light gray) background.	NIC	CQ variables in alarm shown in white on a red background.	SyRS R2.6.2.4-1, SyRS R2.6.3.1-2 to 4
320		7. Current unacknowledged alarms should have a blinking background, and non-current unacknowledged alarms should have a blinking foreground.	NIC	CQ unacknowledged alarms have a solid RED background except the PAMS Trouble Alarm will blink until acknowledged.	SyRS R2.6.2.4-1, SyRS R2.6.3.1-2 to 4
321		8. All blink rates should be at a rate of approximately once per second.	Comply	The CQ FPD has a 500ms cycle time and uses it to generate a blink rate of OFF, ON, ON (three 500mS periods).	00000-ICE-30157, Rev 18, subsection 5.4.3
322		9. Blue shall be used to indicate an inoperable or out of range variable.	NIC	CQ variables indicate a channel error when signal is out of range.	SyRS R2.6.2.4-1 ICE-30156 app A
323		10. Alarm message displays should be consistent with the variable display colors.	NIC	CQ alarm messages shown Red text on black background.	SyRS R2.6.2.4-1
324		11. Yellow should be used as a cautionary alarm color, or to indicate sub-component trouble.	Clarify	Pre-alarm is indicated with YELLOW. Alarms and component failures are indicated using RED.	SyRS R2.6.2.4-1, SyRS table 2.6-5
325		12. Dark blue should be used for selectable objects.	NIC	CQ displays use dark green for selectable objects.	SyRS R2.6.2.4-1, WBT-D-2348 or WNA-SD-00277-WBT for selectable objects
326		13. White should be used for static, non- selectable objects	Comply		SyRS R2.6.2.4-1WBT-D-2348
327		14. White should be used for process piping.	Comply		SyRS R2.6.2.4-1 WBT-D-2348
328		15. Cyan is used to denote substituted data.	Clarify	CQ displays use BLACK text on a CYAN background for substitution.	SyRS R2.6.2.4-1
		NOTE			
329		Even though we specified black background on displays, the Offerer shall provide a color reversing scheme to allow printing screens on a white background.	NIC	Item 1. states grey background. CQ displays do not have a color reversing scheme. Print Screen prints display as seen.	
	3.4.5 Alarms	A. Annunciation Alarms			
330		A method of inhibiting an alarm shall be provided once it has been acknowledged to meet the annunciator black board concept and to prevent the masking of new alarms that are in the same annunciator grouping. The system shall permit maintenance to inhibit alarm checking (via password protection).	Clarify	Can bypass a high TC. CQ provides capability to bypass any input. No maintenance inhibit is provided.	SyRS R2.6.2.4-1

Rqt #	Section	Wording	Comply, OOS (Not in WEC scope), Clarify, NIC (Not in compliance with Purchase Spec)	Response	Proof req. Met
331		The built-in alarm system shall not result in nuisance alarms. The Offerer shall provide, with TVA/Bechtel guidance, an alarm implementation scheme for TVA/Bechtel review and approval. Appropriate front end alarm management design methods such as filtering and alarm categorization and grouping are to be implemented to prevent nuisance alarms.	Clarify	The signal of concern identified by TVA was the RCS Pressure because when the pressure is 0 psig, nuisance alarms occur. The CQ PAMS AI card has overrange and underrange capability and the signal is not alarmed as failed unless it is outside the range of the AI card or below a live zero setpoint.	SyRS R2.5.3.4-2
		B. Alarm Monitoring Requirements			
332		The system shall specifically provide "bad" input detection and alarming of:	Comply		
333		1. Open thermocouple inputs.	Comply		SyRS R2.5.3.1-1
334		2. Out of range input signal levels for analog inputs, both high and low.	Comply		SyRS R2.5.3.1-1
		3.5 Software Quality			
	3.5.1 Requirements	Software requirements associated with the proposed system are as follows:			
336		A. Process variable signal validation for all inputs shall be performed. Any input signal greater than nominal ±5% out of range (an input deviation from the Medium Signal Select/Averaged output) shall be considered automatically invalid. The out of range limit selection shall allow for deviation during transient conditions.	NIC	CQ PAMS low out of range shall be at least 0.5 % of span less than the minimum input voltage and the high out of range limit shall beat least 0.5 % of span greater than the maximum input voltage.	Suitability Evaluation
337		B. All process variable signal inputs, including TEs and RTDs, shall be linearized and converted into proper engineering units. All scaling input to be provided by TVA/Bechtel must have second party review by TVA/Bechtel and incorporated by Offerer. Offerer shall also perform and document second party review of this scaling once it is implemented.	Comply		SyRSR2.6.2.2-6 contractual - N/A
338		C. Only one redundant input shall be manually bypassed at a given time. The User shall have the capability of setting the input value for the bypassed input.	Clarify	The two train design as described in SyRS Section 1.3 meets the intent.	SyRS R2.5.3.4.20-1 Modify bypass value – SyRS R2.6.2.2.17-2 and R2.6.2.2.17-3
		D. An alarm shall be generated upon loss of:			
339		1. Any input signal as a result of an input validation scheme.	Clarify	Alarm generated on out of range only	SyRS R2.5.3.1-1
340		2. This alarm shall be capable of being individually manually bypassed for maintenance/operational purposes.	NIC	Standard CQ design does not provide this function. TVA will handle via alternate means	
341		3. A trouble alarm shall be generated upon loss or degradation of any process variable or system diagnostic failure.	Comply		SyRS R2.5.3.1-1, R2.6.2.1-4; R2.6.2.4-1, R2.6.3.1-5, R2.6.3.1-11, R2.9.2-2, R2.9.5-4, -5 & -6

Rqt #	Section	Wording	Comply, OOS (Not in WEC scope), Clarify, NIC (Not in compliance with Purchase Spec)	Response	Proof req. Met
342		4. A trouble alarm shall be generated upon loss of power to any system component, or the failure of any system power supply.	Comply		SyRS R2.9.2-3, R4.2.2-4 SRS table 7.1-2
343		5. Non-catastrophic system faults shall generate an alarm and be specifically identified upon request.	Clarify	The MTP displays provide screens to aid in the determination of the fault	SyRS R2.6.3.1-1 general requirement SRS table 7.1-2
344		E. On-line real time diagnostics shall be performed to verify the proper operation of I/O, CPU, Memory, overall system operability, process variable inputs and outputs.	Comply	CQ performs diagnostics which status are displayed on the MTP and OM	SyRS R2.9-1, R2.9.1-1, R2.9.2-1, R2.9.2-2, R2.9.2-3 and SRS 6.1
345		F. All OMs and MTPs graphic displays shall conform to the conventions as given in Section 3.4.4 of this spec to assure similarity to the new Integrated Computer System (ICS) displays.	NIC	See comments on Section 3.4.4 Needs to be consistent with CERPI display scheme WEC following CERPI display scheme	
346		G. All OMs and MTPs shall provide for verification of on-line control system changes via the feature. For example, to bypass an Input signal for maintenance, it would be necessary to select an area label "Bypass T/C", and also an area labeled "Confirm Bypass T/C".	Clarify	Standard CQ display shows point as Cyan color as per SyRS Table 2.6-5.	general non specific requirement, SRS R7.2.21-2
347		H. Software configuration management shall be implemented, documentation, and maintained for all development and control software. The software development system shall be self documenting and should have a revision history function that documents the specific changes that were implemented. Configurable parameters are covered by the management system.	Clarify	The CQ SPM describes the process WEC employees for software configuration management. WEC to provide SW Program Manual	SyRS R2.4-1
		I. The following system graphics, at a minimum, shall be supplied. The Offerer shall list and describe the number and type of graphics that are proposed. Offerer should provide cost of additional screens.			
		1. System and Process Alarms			
348		A screen or screens displaying at a minimum system and process alarms, along with time and date of initiation, and acknowledged status shall be provided. It shall be possible to acknowledge alarms from this graphic.	Clarify	The standard CQ displays include alarm list and system event list displays. The alarm list allows the user to acknowledge the alarms.	SyRS R2.6.2.1-1, SRS R7.2.2-1 WBT-D-2348
		2. Trends			
349		Provide graphics capable of bar graphs and trends for the Monitoring System. Trending parameters and scaling shall be selectable by the Operator and shall initialize with a predefined amount of data history displayed.	Clarify	The standard CQ trend displays allow the user to select trend variable. Historical data trending is not available.	SyRS R2.6.2.1-1 WBT-D-2348, SRS R7.2.2-1
		3. Maintenance Bypass			

Rqt #	Section	Wording	Comply, OOS (Not in WEC scope), Clarify, NIC (Not in compliance with Purchase Spec)	Response	Proof req. Met
350		A graphic shall be provided to allow bypass of process variable inputs and the associated alarms as required for maintenance. Indication of bypass permissive (without affecting system operation) shall be provided on the Maintenance and Test Panel only.	Clarify	The CQ MTP and OM allow process variables to be bypassed. Alarm bypassing is not provided.	SyRS R4.4-1 SyRS R2.6.3.1-1 WBT-D-2348, SRS R7.2.2-1
		4. Loop Tuning Parameters			
351		A graphic shall be provided to display and allow online adjustment of tunable values. This screen(s) shall allow for tuning of all tunable values. Tuning values that are updated on-line shall be bumpless and take effect without system reboot or process step change/upset and shall be provided on the Maintenance and Test Panel only.	Clarify	The CQ displays do allow for the online adjustment of addressable constants and alarm setpoint without reboot.	SyRS R2.6.2.2.20-11, SRS R7.2.2-1
		5. Interlock and Permissive Status			
352		A graphic depicting the status of all Interlocks and Permissives defined in this spec.	NIC	CQ PAMS does not contain control elements and thus interlocks and permissives are not applicable	N/A
		6. Reports			
353		A graphic allowing the generation of reports for Operations, Maintenance, and Engineering shall be provided. The number, contents, and format of these reports will be defined by TVA/Bechtel after award of Contract. To allow for equitable evaluation of proposals, each Offerer should allow for a total of nine reports, with approximately twenty to thirty parameters per report, with the report output being directable either to a printer, to a file on both hard drive, a removable storage drive, and to ICS.	NIC	All CQ displays can be printed.	SyRS R2.5.2.1-1, R2.5.2.1.3-3, R2.6.2-6, SRS R7.2.57-1
		7. Layouts			
354		All graphics that are developed shall be arranged in a logical progression	Comply		general non specific requirement
355		J. The proposed system shall have two levels of access. The level shall be readily identifiable by the user. These environments are:	Comply		
		1. MCR Display (Read Only) - Operations			
356		This shall be the default boot-up environment. No password or security measures are applicable to this environment. The minimum available displays shall include the System Mimic, Process Overview, System and Process Alarms, Trends, Loop Tuning Parameters, Interlocks and Permissives Status screens. No system parameters shall be alterable from these screens in this environment. It shall be possible to enter all other environments from this level, with an appropriate password.	Clarify	The CQ displays control access to the user adjustable features through a function enable keyswitch.	SyRS R2.5.2.1-1, R2.5.2.1-4, R2.5.2.1-5
357		2. AIR Display (Full Functional with Password) - Maintenance and Engineering	Clarify	Keyswitch protected only.	SyRS R2.5.2.1-1, R2.5.2.1-4, R2.5.2.1-5

Rqt #	Section	Wording	Comply, OOS (Not in WEC scope), Clarify, NIC (Not in compliance with Purchase Spec)	Response	Proof req. Met
358		The maintenance/test environment shall consist of the same displays as the Display Only environment. Loop tuning parameters shall be alterable from this environment, and input parameter bypasses shall be operational only with a password.	Clarify	The CQ displays control access to the user adjustable features through a function enable keyswitch.	SyRS R2.5.2.1-1, R2.5.2.1-4, R2.5.2.1-5
359		The Offerer shall meet the requirements of TVA Standard Specification SS-E18.15.01, Appendix B. The standard spec classification for this system application is "Other Safety-Related (SR) Systems" implements the requirements of TVA SPP 2.6.	NIC	CQ PAMS software is developed using the WEC Software Program Manual Approved by the NRC	SyRS R2.4-1
374	**3.5.5 Coding Standards and Conventions**	The Offerer software shall be generated consistent with documented software coding standards and conventions as outlined in SS-E18.15.01 section 5.1.4.	Clarify	Software developed in accordance with SW Program Manual	SyRS R2.4-1
386	**3.5.12 Security**	Security is addressed in the Security section of this specification.	Comply		administrative
		3.6 Interface Requirements			
388	**3.6.1 Interface with Other Systems**	Any system inputs that are received from safety systems shall be isolated from non-safety related.	Comply	Only non-safety interface is to the plant computer.	SyRS section 4 front matter, last bullet, SyRS R4.3.3-1
389		To eliminate the potential for mid scale failures, analog inputs and outputs shall not represent bipolar voltage combinations, where the signal passes through zero. Signals with live zeros are recommended.	Comply	all analog inputs are 4-20mA, T/C voltages, or RTDs - in compliance	SyRS section 4.2.1, SDS Table R4.4.1.2-4, -5 -7 and -10
391		The system will receive analog inputs from pressure and temperature sensors as from various non-safety devices. Signal conditioning hardware shall be included in the system to accept a variety of input types.	Comply	ABB S600 I/O Manuals	SyRS R2.5.3.1-1, R4.2.1-1, -2 & -3
392		Digital interfaces shall be provided for monitoring the system inputs and outputs by the plant ICS, transient monitors, etc. Signals supplied to the ICS, indicators, and recorders shall be buffered or isolated to prevent degradation of the system by any of the following events:	Clarify	note this is for digital interfaces only - not relevant to panel meters with analog outputs CQ PAMS provides a 100FX fiber optic output to the ICS.	SyRS R4.3.3-1, R4.3.3-3. R4.3.3-4
393		A. Broadcast Storm from ICS network	Comply		WNA-TP-02993-WBT
394		B. Failure of the digital interface component directly connected to the control system	Clarify	Assume this means failure of the communication link to the ICS.	SyRS R4.3.3-1
395		C. Other credible failures identified in the Hazard Analysis (section 3.2.2.E).	Comply		
396	**3.6.2 I/O Capacity**	The system shall be designed to adequately manage the minimum quantity of inputs and outputs.	Comply		general non specific requirement

Rqt #	Section	Wording	Comply, OOS (Not in WEC scope), Clarify, NIC (Not in compliance with Purchase Spec)	Response	Proof req. Met
397	**3.6.3 Field Terminations**	The Offerer's system shall have provisions for field terminations (e.g. Termination Assemblies) for all field I/O signals. These terminations shall be provided as either hardwired, screw terminal, or plug type connections (user selectable). Field terminal points shall be designed to accommodate up to #12 AWG wiring (specific terminal point wire sizes to be determined following contract award). All thermocouple (TC) cold junction compensation shall be provided directly at the field termination area where the TC wire terminates to a non match TC metal and the Offerer should limit the number of connections. The existing terminations of the present system should be utilized to prevent rewiring of devices external to the system.	Comply	Field terminations are to Phoenix Contact Combicon connectors that use compression terminals. 24-12AWG wire is accepted. TC wires can be routed to the cabinet for termination or an external junction box. RJT RTDs will be mounted near the termination to compensate for the Type K to copper junction.	TVA agrees with the clarification regarding the terminal screws SDS SDS4.4.2.3-1, R4.4.2.3-2 SyRSR3.1.1-8
398	**3.7 Maintenance**	The equipment shall use standardized, modular, plug in construction so that any component may be easily removed from the system and replaced without breaking or making soldering connections. The number of types, kinds, categories, etc., of components shall be kept to a minimum in order to reduce the spare parts cost. The Offerer shall provide a recommended periodic replacement frequency for all provided components. Any component with electrolytic capacitors shall specifically identify along with operating and shelf life cycles.	Comply		10047E63 – cabinet assembly drawing
399	**3.7.1 Troubleshooting**	Each component should contain both a red and green status LED (these colors are preferred but not required). Green indicates when a module is functioning properly and red indicates failure. The failed module location, module type, and its unique identifier shall be displayed on the Interface modules. A description of the problem shall be provided so that the User can easily determine the problem and take corrective action.	Comply	The AC160 modules contain both a red and green status LED. Green indicates when a module is functioning properly and red indicates failure. The failed module location and module type are displayed on the MTP. The AC160 error buffer will contain the description of the problem.	The Technical Manual to be provided to TVA will contain the S600 I/O Hardware Advant® Controller 160 Version 1.3; WNA-SD-00277-WBT, Section 2.31; CQ TR WCAP-16097-P-A, Section 6.4.1.1
400	**3.7.2 Testing, Calibration, and Verification**	Capability shall be provided for online tuning, testing, and calibration of the channels and the devices used to derive the various channel output signals. Capability to perform online self tuning shall also be provided.	Comply		SyRS R2.3.3-1, R2.5.2.1-1 to 5, R2.6.1-4, R2.6.2.2.19-1, R2.6.2.2.19-8, R2.6.2.2.19-11, R2.6.3.3-1, R2.6.3.3-7, R3.3.1-1
401		The system shall permit the administrative control (password and/or keylock) of access to all setpoint adjustments, module calibration adjustments, and tuning values. The system shall have a method to ensure configuration control verification to a specific revision level.	Comply		SyRS R2.5.2.1-1 Software revision and CRC info (for configuration control) is provided per SRS 7.2.18
402	**3.7.3 Channel Bypass or Removal from Operation**	The system shall be designed to permit any input or output to be removed from operation or bypassed for maintenance or testing during power operation. The design shall provide for administrative control of the means for manually bypassing the channels. Channel bypassing shall be inhibited where bypassing would place the output of a redundant handling scheme into BAD quality (i.e.., one signal already in bad quality).	Clarify	All inputs can be bypassed. The capability to bypass the outputs is OOS.	SyRS R2.5.2.1-1, 2.5.2.1.1-1, 2.5.2.1.2, 2.6.2.2.18, and R4.4-1
403		If a channel has been bypassed or deliberately rendered inoperable, this condition shall be alarmed within the control system.	Clarify	Standard QC system provides visual indication of a bypass signal	SyRS R2.6.2.4-1

Rqt #	Section	Wording	Comply, OOS (Not in WEC scope), Clarify, NIC (Not in compliance with Purchase Spec)	Response	Proof req. Met
404		Channel bypass and calibration activities shall be performed from maintenance graphics screens in AIR.	Comply	The MTP provides the capability to bypass any input.	SyRS R2.3.3-1, R2.5.2.1-1, R2.6.1-4, R2.6.2.2.19-1, R2.6.2.2.19-8, R2.6.2.2.19-11, R2.6.3.3-1, R2.6.3.3-7, R3.3.1-1, R4.4-1, 2.5.2.1.1-1, 2.5.2.1.2, 2.6.2.2.18, and R4.4-1 WBT-D-2348, SRS 7.2.20
405	**3.8 Equipment Cabinets**	The systems shall be housed in cabinets and mounted for seismic Cat I application. The equipment cabinets are fully enclosed with hinged access doors in the front and rear.	Comply		seismic - SyRS 3.1.7-2, SDS4.2.1-1 enclosed - no specific statement - see 10047E63 hinged - 2E10022 series
406		Offerer shall perform walkdown to determine details such as dimensions, mounting, cable entry, etc. Cabinet drawing shall be submitted for TVA/Bechtel approval for Seismic Cat I application.	Comply		Offerer never performed walkdown, but the cabinet dimensions have been deemed acceptable. 2E10022 10044E60 2E10019
407		A system shall not need forced ventilation to ensure reliability. If the system requires a ventilation system, it shall be fully 100% redundant complete with blower, inlet filter, and controls to enhance the reliability of the equipment. However, it is deemed as not being desirable and will be viewed as an exception to the specification. Temperature sensors with associated system alarms within each cabinet shall be provided.	Clarify	Cabinet temperature sensors are provided and displayed on the OM and MTP. There are blowers used on the cabinet, power supply, and AC160 racks.	sensors - SyRS R2.9.5-1 through 6 cabinet blower - SDS R6.2-1 R6.2-2 power supply blower - SDS SDS4.2.1.1-3 AC160 blower - SDS R4.2.1.1-4; SDS R4.2.1.4-3
		Racks Cleaning and Painting:			
408		After fabrication, all manufacturers' waste shall be removed from the equipment. All external and internal cast iron carbon steel and low alloy steel surfaces shall, as a minimum, be protected by applying one coat of primer and two coats of finish paint. All surfaces to be coated shall be prepared for priming by blast cleaning in accordance with the application Steel Structures Paint Council Specification.	Comply		WBT-D-0846 WBT-D-1057
409		Primer shall be applied within eight (8) hours after blast cleaning and before rusting occurs. Application of primer shall be in accordance with Federal Specification TT-T-664. After air dried, a first and second coat of alkyd enamel shall be applied per Federal Specification TT-E-508. The enamel shall be in accordance with Federal Standard No. 596a, Color No. 34410, light green.	Clarify	WEC to paint specified color	WBT-D-0846 WBT-D-1057

Rqt #	Section	Wording	Comply, OOS (Not in WEC scope), Clarify, NIC (Not in compliance with Purchase Spec)	Response		Proof req. Met
	3.9 Accuracies	Channel accuracy is defined to include the accuracy of the primary element, transmitter, rack modules and any process or environmental effects on field mounted hardware. The accuracy does not include errors for the time in which the system is in a non-steady state condition.				
410		A. Digital processing effects (where applicable) such as analog-to-digital conversion should not contribute any additional inaccuracies greater than 0.03% of channel span to the uncertainties specified in the above requirements of this section.	NIC	The AI card accuracy is ±0.05% span (includes linearity, hysteresis, noise, accuracy) as defined in the manufacturer's reference manual.		Suitability Evaluation
411	**3.9.1 System Processing Accuracies**	The Digital processing effects (where applicable) such as analog-to-digital conversion, software round-off error, and digital-to-analog conversion should not contribute any additional inaccuracies greater than a total of 0.03% of channel span to the uncertainties.	NIC	The AI card accuracy is ±0.05% span (includes linearity, hysteresis, noise, accuracy) as defined in the manufacturer's reference manual.		Suitability Evaluation
412	**3.9.2 System Accuracy Requirements**	**The overall control system's inaccuracies plus process inaccuracies shall be equal to or less than the existing Unit 1 Westinghouse supplied ICCM-86 system.**	Comply	**REQUIREMENTS FROM UNIT 1 ICCM-86 DESIGN SPECIFICATIONS #956080** Note that there are inconsistencies in this document, for example section 5.2.1 states different accuracies than section 6.2. For example wide range pressure states 0.5% in the former and 0.35% in the later (which U2 does not meet). It is possible this is referencing different physical portions of the system, but it does not appear to (reference 5D92409). Note - 5.1.4 should apply to all.		
				RVLIS RTDs	0	U1 - 0.625Ω U2 - 0.625Ω - SyRS R3.2.1-2 in compliance
				Analog inputs (LT's, delta T)		U1 - 0.03% A/D and 0.5% full span LT electronic U2 - ICE 30156 - 3.2.1 in compliance
				Analog inputs (Thot, WR P)		U1 - 0.03% A/D and 0.5% for AI signal conditioning board U2 - ICE 30156 - 3.2.1 in compliance
				CET'S		U1 - 0.03% A/D and (0.235% <10mv/1.0% > 10 mV for TC AI signal conditioning board U2 - ICE 30156 - 3.2.1
				ref junction RTD		U1 - 0.03% A/D and 0.5% full span U2 - 0.5% full span in compliance

Rqt #	Section	Wording	Comply, OOS (Not in WEC scope), Clarify, NIC (Not in compliance with Purchase Spec)	Response	Proof req. Met
				5.1.4.1.1 A/D - 12 bits, +/- 0.03% full scale	Suitability Evaluation
				5.1.4.2.1 D/A - 12 bits, +/- 0.07% full scale	Suitability Evaluation
				5.2.1.1.2 - analog input board +/- 0.5% full scale	Suitability Evaluation
				5.2.1.2.2 - RTD input +/- 0.625Ω	SyRS 3.2.1-2
				5.2.1.3.2 - T/C input 0.235% full span for inputs range 0-10mV and +/-1.0% of full span >10mV	Gen SyRS 3.2.1
				5.2.2.1.2 - voltage output +/-0.35% full span	Clarify: SyRS R3.2.1-3, AO650 accuracy is ±0.1% span
				5.2.2.2.2 - current loop output +/-0.35% full span	Clarify: SyRS R3.2.1-3, AO650 accuracy is ±0.1% span
				5.3.1 - power supply +/- (0.1% + 5mV)	00000-ICE-35478, Rev. 11 – Production Test Procedure for the Common Q Power Supply System
				6.2.1.4 - level transmitter (not include AI board) - 0.5% full scale	RVLIS Scope to determine accuracy of the transmitter.
				6.2.2.4 - RVLIS RTD - 0.5% full scale	AI687 Accuracy is ±0.1°C (±0.0238% span)
				6.2.5.4 - Thot - 0.35% full span	AI688 card accuracy for 4-20mA is 0.1% span
				6.2.6.4 - WR pressure - 0.35% full span	AI688 card accuracy for 4-20mA is 0.1% span
				6.2.7.4 - T/C - 200F - 1000F - 0.3% of full 60mV span 1000 - 2300F - linearly increasing from 0.235% to 1.0% of full 60mV span	AI687 Accuracy is ±0.5°C (±0.0385% span)
				6.2.8.4 - IRJ RTD - 0.5% full span	AI687 Accuracy is ±0.1°C (±0.1% span)
				6.2.9.4 - delta T - 0.5% full span	AI688 card accuracy for 4-20mA is 0.1% span
				6.3.1.4 - analog output - 0.35% output span	AO650 accuracy is ±0.1% span
				6.4.1 - calculated densities (function of T) +/- 0.5% span of absolute density in the range of 50F to 670F	SyRS R2.5.3.4.1-4

Rqt #	Section	Wording	Comply, OOS (Not In WEC scope), Clarify, NIC (Not In compliance with Purchase Spec)	Response	Proof req. Met
				6.4.1 - calculated densities (function of P) +/- 0.5% span of absolute+ density in the range of 150psig to 250psig	SyRS R2.5.3.4.1-5
413	**3.10 Response Time Requirements**	**The response time requirements for the Control and Monitoring System shall be equal to or better than the existing Unit 1 Westinghouse supplied ICCM-86 system.**	Comply	**REQUIREMENTS FROM UNIT 1 ICCM-86 DESIGN SPECIFICATIONS #956080**	
				There are no response times requirements as dictated by W in the applicable reference.	N/A
414	**3.10.1 Anti-Aliasing Filtering**	The Offerer shall address anti-aliasing for all input signals of the Monitoring System. This requirement includes all input process channels.	Comply	The AI card is designed with an anti-aliasing filter.	Suitability Evaluation
415	**3.10.2 Processors Response Time**	The processor response time (from the system's input module/s to output module/s including system processing time) for all input signals of the System shall not exceed 250 milli-seconds. This requirement includes all input process channels utilized for interlocks and permissives within the noted system(s), and also applies to interlock and permissive signals calculated outside of but utilized within System. This requirement includes bistable logic (on/off) control signals, and mode signals. The signals to the main control board (indication, status, recording, and alarm/annunciators) should have a minimum update rate of 1 second unless other wised specified.	Clarify	The CQ PAMS controller is running on a 256 ms cycle time. The response time requirement is currently for a 550 ms response time from input to output. The processor cycle time vs. processor loading shall be balanced during the implementation phase and the actual response time achieved will be defined. Data is provided to the MTP and OM on a 256 ms interval.	550ms - SyRS R3.2.2-2 SyRS R3.2.2-1 Overall response SRS 5.2.3-3, SRS 7.1.6-1, 2, 3 WNA-AP-00188-WBT (Westinghouse Timing analysis performed to verify response time).
416	**3.11 System Acceptance Test Requirements**	The purpose of the system acceptance tests is to determine, and the underlying standard for system acceptance shall be, compliance in every respect with this Requirements Specification. All materials furnished and all work performed under this specification shall be subject to four acceptance tests - a Factory Acceptance Test (FAT) at the Offerer's facility prior to delivery, an EMI/RFI Test prior to delivery, a Site Acceptance Test (SAT) after delivery at a staging location, and a Post Modification Test (PMT) after installation of the system. The FAT will be conducted, directed, and performed by the Offerer with TVA/Bechtel representatives as witnesses. The SAT and PMT will be conducted, directed, and performed by TVA/Bechtel representatives with full cooperation and assistance of Offerer's representatives. All tests will be of the entire system in its final configuration including the specific equipment and software to be delivered; no substitute equipment, cables, or software will be used unless approved by the Lead Electrical Engineer.	Clarify	No EMI/RFI test will be performed for TVA. Existing Common Q qualification summary reports will be provided defining the EMI/RFI results.	SyRS R3.1.7-3, 4 and 5
421	**3.11.1 Electro Magnetic (EMI) and Radio Frequency Interference (RFI)**	EMI and RFI tests are required in accordance with TVA Standard Specification SS E18.14.01. However, the Offerer may substitute his standard EMI/RFI test if approved by TVA/Bechtel.	Clarify	WEC shall provide the CQ qualification summary report defining the EMI/RFI, environmental, and seismic results.	SyRS R3.1.7-5

Rqt #	Section	Wording	Comply, OOS (Not in WEC scope), Clarify, NIC (Not in compliance with Purchase Spec)	Response	Proof req. Met
458	**3.13 Spare Parts**	The bidder shall submit a recommended spare parts list with the formal proposal. One spare part for each component of the system is recommended. Spare parts for the simulator modification should be procured with the system (see the Simulator section).	Clarify	Simulator is OOS	N/A
459	**3.14 Miscellaneous System Requirements**	A. All switches and fuses must be identified with unique labels.	Clarify	WEC has no control over labeling in the VENDOR SUPPLIED EQUIPMENT	N/A
460		B. All terminals and terminal blocks shall be labeled and have screw terminal connections suitable for use with ring type lugs (see exception in section 3.6.3 for TCs).	NIC	Phoenix Combicon compression terminals are used.	TVA agrees with the use of compression terminals SDS R4.4.2.3-2
461		C. All mechanical relay contacts shall be enclosed to prevent contamination.	Comply	Phoenix Contacts PLC-RSC-24DC/21-21 relays used	Drawing 10047D63 - cabinet assembly
462		D. Set screw connections of stranded wire less than #14 AWG are not acceptable anywhere in the equipment. Acceptable set screw connections are limited to ac power and system ground cables.	NIC	Phoenix Combicon compression terminals are used. Set screws not used in the CQ PAMS	TVA agrees with the use of compression terminals. SDS R4.4.2.3-2
463		E. All materials used shall have inherent flame retardant characteristics.	Comply		SDS R4.4.3-1
464		F. Aluminum conductors may be used only with the TVA's/Bechtel's written approval.	Comply		N/A
465		G. All bidder supplied wiring and cable shall be abrasion resistant and have non-PVC insulation and flame retardant certification.	Clarify	All WEC manufactured wiring is halogen free and flame retardant. Subvendor supplied equipment may contain PVC wiring.	SDS R4.4.3-1 - Flame retardancy SyRS R3.1.1-4
466		H. Terminal lugs shall be ring tongue nylon insulated or a TVA approved equal.	NIC	Phoenix Combicon compression terminals are used.	TVA agrees with the use of compression terminals. SDS R4.4.2.3-2
467		I. Separate terminal blocks shall be provided for power connectors and I/O connections.	Comply		10047E66, 10047E67 series, 10047E63
468		J. Internal power cabling/wiring shall be separated from I/O cabling/wiring.	Comply		10047E66, 10047E67 series
469		K. Terminals for I/O connections shall accommodate TVA's #12 to 16 AWG conductors.	Comply		SyRS R3.1.1-8
470		L. Terminals for power connections shall accommodate the wire size appropriate for the appropriate load, but not less than #12 AWG.	Comply		SDS SDS4.4.2.3-1

Rqt #	Section	Wording	Comply, OOS (Not in WEC scope), Clarify, NIC (Not in compliance with Purchase Spec)	Response	Proof req. Met
471		M. All internal wiring for I/O shall be twisted pair and shielded to the extent feasible.	Comply		SDS R4.4.3-9 and R4.4.3-10
472		N. Equipment layout shall be such as to minimize the amount of inter-panel wiring required.	Comply	There is no inter-panel wiring (e.g. wires between cabinets) in the CQ PAMS design.	N/A
	3.15 References	A. Standard Specification SS-E18.14.01 R3 - "Electromagnetic Interference (EMI) Testing Requirements for Electronic Devices"			
		B. Standard Specification SS-E18.15.01 R2 - "Software Requirements for Real-Time Data Acquisition and Control Computer Systems"			
		C. Electrical Design Guide DS-E18.1.24 - "Human Factor Engineering Design Standard"			
		D. Underwriters Laboratory UL1418-87 - "UL Standard for Safety, Implosion-Protected Cathode-Ray Tubes for Television-Type Appliances" (See Section 4.3.30)			
		E. WBN Design Criteria for Seismic Qualification, WB-DC-40-31.2 R8, "Seismic Qualification of Category 1 Fluid System Components and Electrical or Mechanical Equipment"			
		F. ISA Standard Practice 67.04			
		G. TVA GENERAL ENGINEERING SPECIFICATION G-38, FOR "INSTALLATION MODIFICATION, AND MAINTENANCE OF INSULATED CABLES RATED UP TO 15,000 VOLTS"			
		H. WATTS BAR NUCLEAR PLANT, DYNAMIC EARTHQUAKE ANALYSIS OF THE AUXILIARY-CONTROL BUILDING AND RESPONSE SPECTRA FOR ATTACHED EQUIPMENT - CEB-80-27 Revision 5			
		I. TVA ELECTRICAL ENGINEERING, STANDARD SPECIFICATION, SS-E12.7.01, SWITCHBOARD WIRE WITH FLAM-RETARDANT CROSS-LINKED POLYETHYLENE INSULATION			
		J. TVA STANDARD SPECIFICATION, CEB-SS-5.10, FOR SEISMIC QUALIFICATION OF ELECTRICAL, MECHANICAL, AND I&C DEVICES			
	3.16 Applicable Criteria & Standards	The following criteria apply to this system.			
473		Institute of Electrical & Electronics Engineers (IEEE) Standards: IEEE Std.603 -1991 & Std 7-4.3.2 - 1998	Comply		Licensing Technical Report Codes and Standard Section
474		WBN Design Criteria, WB-DC-40.31.2 (Seismic)	Clarify	Westinghouse providing qualification to the generic Common Q Platform qualification program.	SyRS R3.1.7-9

Rqt #	Section	Wording	Comply, OOS (Not in WEC scope), Clarify, NIC (Not in compliance with Purchase Spec)	Response	Proof req. Met
	3.17 Indicators and Recorders (PAMS - Safety Related)	The system should interface with the following (4-20 mA) signals - One per Train:	Comply		
475		A. Provide Main Control Board Indication 1. Saturation Margin	Comply		The list of dedicated analog outputs is provided in SyRS R4.3.1-5. The list of user selectable analog outputs is provided in SyRS R4.3.1-4.
476		B. Provide Main Control Board Recorder inputs 1. Incore Thermocouple Temperature for each channel (3 Pens each)	Clarify	The Common Q PAMS provides various outputs for pen recorders based on the Common Q Algorithm	The list of dedicated analog outputs is provided in SyRS R4.3.1-5. The list of user selectable analog outputs is provided in SyRS R4.3.1-4.
477		Pen 1 - Auctioneered High Quadrant Average Temperature	Clarify	WEC will provide list of available outputs	N/A - project is not utilizing any recorders (and if it did, it would use the existing 4-20mA outputs). The list of dedicated analog outputs is provided in SyRS R4.3.1-5. The list of user selectable analog outputs is provided in SyRS R4.3.1-4.
478		Pen 2 - Hottest Thermocouple (T/C) Temperature			
479		Pen 3 - Software Selectable (T/C TEMP, SAT MARGIN, RVLIS, or HOT LEG TEMP)			
	3.18 Alarms and Annunciators (dry contacts)	The following should actuate an alarm and annunciator for each Train:	Comply		
480		A. System Malfunction (MCR)	Comply		SyRS R4.3.2-7 (System Trouble is equivalent)
481		B. Opening any cabinet door	Comply		SyRS R4.2.2-6
482		C. High Incore Thermocouple Temperature	Comply		SyRS R4.3.2-5
483		D. Low Subcooling Margin	Comply		SyRS R4.3.2-3

Rqt #	Section	Wording	Comply, OOS (Not in WEC scope), Clarify, NIC (Not in compliance with Purchase Spec)	Response	Proof req. Met
484	**3.19 RS-422 Data Links to Plasma Display (MCR) (Safety Related)**	Train A - MCR Panel 2-M-4:	NA	There are no RS422 Data links and there is no Plasma Display in the Common Q PAMS. Therefore does not apply. For the compliance answers that follow, it is assumed that the AF100 network from the AC160 controller is the providing information for display on the MTP and OM FPDS'.	
485		1 - Wide Range THOT 1 (Loop 1)	Comply		SyRS R2.6.3.1-9
486		1 - Wide Range THOT 2 (Loop 2)	Comply		SyRS R2.6.3.1-9
487		1 - Wide Range Pressure (Hot leg 1)	Comply		SyRS R2.6.3.1-9
488		1 - Delta Temperature (ΔT from Cold Leg Loop 1)	Comply		SyRS R2.6.3.1-9
489		1 - RVLIS Dynamic Head (Wide Range Level ΔP)	Comply		SyRS R2.6.3.1-9
490		1 - Seal Table Capillary RTD (Reactor Level Temperature Compensation)	Comply		SyRS R2.6.3.1-9
491		1 - Reactor to Seal Table Capillary RTD (Reactor Level Temperature Compensation)	Comply		SyRS R2.6.3.1-9
492		1 - RVLIS Lower Range (Lower Range Level ΔP)	Comply		SyRS R2.6.3.1-9
493		1 - Hot Leg Capillary RTD (Reactor Level Temperature Compensation)	Comply		SyRS R2.6.3.1-9
494		1 - RVLIS Upper Range (Upper Plenum Level ΔP)	Comply		SyRS R2.6.3.1-9
495		2 - Head Capillary RTD (Reactor Level Temperature Compensation)	Comply		SyRS R2.6.3.1-9
496		1 - RVLIS Level Voids (calculated between Dynamic Head, Lower Range, and Upper Range) Both Static and Dynamic	Comply		SyRS R2.5.3.4.13-2
497		1- RVLIS Inaccurate (RCP S/U or Coast Down)	Comply		SyRS 2.5.3.4.14-3
498		1 - T/C Core Average (Average of 33 Core Exit Thermocouples)	Clarify	Representative CET Temperature provided in place of the average.	SyRS R2.6.2.2-4
499		1 - T/C Core Quad Average	NIC	Highest Quad Temperature (4) T/C Core Quadrant Average is not provided.	SyRS R2.6.3.1-9,
500		1 - T/C Core Quad Minimum	NIC	Next Highest Quad Temp (4) T/C Core Quadrant Minimum is not provided.	SyRS R2.6.3.1-9
501		33 - Core Exit T/C Values	Clarify	The number of CETs may be reduced to 29 based on other proposals before TVA	SyRS R2.6.3.1-9
502		1 - Core Quad Maximum T/C	Comply		SyRS R2.6.3.1-9
503		3 - Reference Junction Box RTDs (Curve Fit and Quality)	Comply		SyRS R2.6.3.1-9

Rqt #	Section	Wording	Comply, OOS (Not in WEC scope), Clarify, NIC (Not in compliance with Purchase Spec)	Response	Proof req. Met
504		1 - Representative CET Temperature	Comply		SyRS R2.6.2.2-4, R2.6.2.2-5,
505		1 - Highest CET Temperature	Comply		SyRS R2.6.2.2-5,
506		1 - RC Pump Status (Any one of four - derived from RCP undervoltage coil	Comply		SyRS R2.6.3.1-9 SyRS R2.6.2.2-5 SyRS R2.5.3.4.14-1 and R2.5.3.4.14-2
507		1 - Sub-cooling Margin (SUBCOOL Calculation from Temp Select (> T/C Quad Average vs. Auctioneered THOT) and Saturation Temp)	Clarify	Four sub-cooling margin calculations are provided (temperature and pressure margins based on each of the RCS temperature and the CET temperature).	SyRS R2.6.2.2-4
508		1 - Hydraulic Isolator Status (Any one of three)	Comply		SyRS R2.6.3.1-9 SyRS R2.6.2.2.8-1
509		1 - Malfunction Alarm (Diagnostic Errors or Hydraulic Isolator Status or	Comply		SyRS R2.6.2.2.11-1, R2.6.2.2.14-1 SRS 5.3
510		Requirement Withdrawn ~~(1 - Heat Up Cool Down Rate (Auctioneered THot Loop 1 & 2))~~	N/A	Requirement withdrawn by TVA	N/A
		System will supply the following analog outputs as a minimum			
511		Representative CET Temperature	Comply		SyRS R4.3.1-5 SDS R4.4.1.2-4 and -5
512		Both CET based SMM and RCS based SMM	Comply		SyRS R4.3.1-5 SDS R4.4.1.2-4 and -5
513		RVLIS Level	Comply		SyRS R4.3.1-5 SDS R4.4.1.2-4 and -5
		Train B - MCR Panel 2-M-6:			
514		1 - Wide Range THOT 3 (Loop 3)	Comply		See Train A
515		1 - Wide Range THOT 4 (Loop 4)	Comply		
516		1 - Wide Range Pressure (Hot Leg 3)	Comply		
517		1 - Delta Temperature (ΔT from Cold Leg Loop 2)	Comply		
518		1 - RVLIS Dynamic Head (Wide Range Level ΔP)	Comply		
519		1 - Seal Table Capillary RTD (Reactor Level Temperature Compensation)	Comply		

Rqt #	Section	Wording	Comply, OOS (Not in WEC scope), Clarify, NIC (Not in compliance with Purchase Spec)	Response	Proof req. Met
520		1 - Reactor to Seal Table Capillary RTD (Reactor Level Temperature	Comply		
521		1 - RVLIS Lower Range (Narrow Range Level ΔP)	Comply		
522		1 - Hot Leg Capillary RTD (Reactor Level Temperature Compensation)	Comply		
523		1 - RVLIS Upper Range (Upper Plenum Level ΔP)	Comply		
524		2 - Head Capillary RTD (Reactor Level Temperature Compensation)	Comply		
525		1 - RVLIS Level (calculated between Dynamic Head, Lower Range, and Upper Range)	Comply		
526		1- RVLIS Inaccurate (RCP S/U or Coast Down)	Comply		
527		1 - T/C Core Average (Average of 32 Core Exit Thermocouples)	Clarify	Representative CET Temperature provided The number of CETs may be reduced to 29 based on other proposals before TVA	
528		1 - T/C Core Quad Average	NIC	Highest Quad Temperature (4)	
529		1 - T/C Core Quad Minimum	NIC	Next Highest Quad Temp (4)	
530		32 - Core Exit T/C Values	Clarify	The number of CETs may be reduced to 29 based on other proposals before TVA	
531		1 - Core Quad Maximum T/C	Comply		
532		3 - Reference Junction Box RTDs (Curve Fit and Quality)	Comply		
533		1 - Representative CET Temperature	Comply		
534		1 - Highest CET Temperature	Comply		
535		1 - RC Pump Status	Comply		
536		1 - Sub-cooling Margin	Clarify	Lowest SMM of the RCS Temps and CET Temps.	
537		1 - Hydraulic Isolator Status	Comply		
538		1 - Malfunction Alarm	Comply		
		System will supply the following analog outputs as a minimum			
540		Representative CET Temperature	Comply		
541		Both CET based SMM and RCS based SMM	Comply		
542		RVLIS Level	Comply		
543	**3.20 Data Links to ICS**	A. Train A - InCore Exit Thermocouples values 1 - 33	Clarify	The data link is a 100FX Ethernet link containing significantly more information than listed here.	SyRS R4.3.3-2
544		B. Train B - InCore Exit Thermocouples values 34 - 65	Comply		SyRS table 4.3-2

Rqt #	Section	Wording	Comply, OOS (Not in WEC scope), Clarify, NIC (Not in compliance with Purchase Spec)	Response	Proof req. Met
545		C. Train A - Reactor Vessel Level	Comply		SyRS R4.3.3-2
546		D. Train B - Reactor Vessel Level	Comply		SyRS R4.3.3-2
547		E. Train A - Saturation Temperature Margin	Comply		SyRS R4.3.3-2
548		F. Train B - Saturation Temperature Margin	Comply		SyRS R4.3.3-2
549	**3.21 Specific Requirements**	A. Monitor safety related inputs and provide outputs to support PAMS monitoring functions.	Comply		general non specific requirement
550		B. The system hardware must be designed with sufficient redundancy such that a single failure of a power supply will not result in the loss of automatic functions.	OOS	Standard CQ Train design meets requirement	
	3.22 Inputs	TRAIN A:			
551		33 - Core Exit Thermocouples (May differ with WINCISE)	Comply	May be reduced to 29 based on other proposals submitted to TVA. CETs are not part of WINCISE.	SyRS R4.2.1-2
552		3 - Reference Junction Box RTDs (May differ with WINCISE)	Comply		SyRS R2.5.2.5-3
553		1 - Wide Range THOT 1, from Eagle 21 (4-20 ma)	Comply		SyRS R2.6.3.1-9
554		1 - Wide Range THOT 2, from Eagle 21 (4-20 ma)	Comply		SyRS R2.6.3.1-9
555		1 - Wide Range Pressure, from Eagle 21 (4-20 ma)	Comply		SyRS R2.6.3.1-9
556		1 - Delta Temperature, from Eagle 21 (4-20 ma)	Comply		SyRS R2.6.3.1-9
557		1 - RVLIS Dynamic Head (Wide Range Level ΔP)	Comply		SyRS R2.6.3.1-9
558		1 - RVLIS Lower Range (Lower Range Level ΔP)	Comply		SyRS R2.6.3.1-9
559		1 - RVLIS Upper Range (Upper Plenum Level ΔP)	Comply		SyRS R2.6.3.1-9
560		1 - Seal Table Capillary RTD (Reactor Level Temperature Compensation)	Comply		SyRS R2.6.3.1-9
561		1 - Reactor to Seal Table Capillary RTD (Reactor Level Temperature Compensation)	Comply		SyRS R2.6.3.1-9
562		1 - Hot Leg Capillary RTD (Reactor Level Temperature Compensation)	Comply		SyRS R2.6.3.1-9
563		2 - Head Capillary RTD (Reactor Level Temperature Compensation)	Comply		SyRS R2.6.3.1-9
564		4 - RCP Status Contacts from Under Voltage Relays (1 per RCP)	Comply		SyRS R2.6.3.1-9
565		1 - RVLIS Hydraulic Isolator Contact (Seal Table)	Comply		SyRS R2.6.3.1-9
566		1 - RVLIS Hydraulic Isolator Contact (Head)	Comply		SyRS R2.6.3.1-9
567		1 - RVLIS Hydraulic Isolator Contact (Hot Leg)	Comply		SyRS R2.6.3.1-9
		TRAIN B:			
568		32 - Core Exit Thermocouples (May differ with WINCISE)	Clarify	May be reduced to 29 based on other proposals submitted to TVA. CETs are not part of WINCISE.	same as train A

Rqt #	Section	Wording	Comply, OOS (Not in WEC scope), Clarify, NIC (Not in compliance with Purchase Spec)	Response	Proof req. Met
569		3 - Reference Junction Box RTDs (May differ with WINCISE)	Clarify		
570		1 - Wide Range THOT 1, from Eagle 21 (4-20 ma)	Comply		
571		1 - Wide Range THOT 2, from Eagle 21 (4-20 ma)	Comply		
572		1 - Wide Range Pressure, from Eagle 21 (4-20 ma)	Comply		
573		1 - Delta Temperature, from Eagle 21 (4-20 ma)	Comply		
574		1 - RVLIS Dynamic Head (Wide Range Level ΔP)	Comply		
575		1 - RVLIS Lower Range (Lower Range Level ΔP)	Comply		
576		1 - RVLIS Upper Range (Upper Plenum Level ΔP)	Comply		
577		1 - Seal Table Capillary RTD (Reactor Level Temperature Compensation)	Comply		
578		1 - Reactor to Seal Table Capillary RTD (Reactor Level Temperature Compensation)	Comply		
579		1 - Hot Leg Capillary RTD (Reactor Level Temperature Compensation)	Comply		
580		2 - Head Capillary RTD (Reactor Level Temperature Compensation)	Comply		
581		4 - RCP Status Contacts from Under Voltage Relays (1 per RCP)	Comply		
582		1 - RVLIS Hydraulic Isolator Contact (Seal Table)	Comply		
583		1 - RVLIS Hydraulic Isolator Contact (Head)	Comply		
584		1 - RVLIS Hydraulic Isolator Contact (Hot Leg)	Comply		
585	**3.23 Noise Levels**	The root mean square noise should be limited to 1.2% of output span in all channels. The noise limitation does not apply to process signal noise, e.g., fluctuations in applicable process variables, but should apply to all noise generated from detecting the signal onward. Where applicable, the requirement should be met with all lead, lag, and filter time constants set to 0.0 and module gains set to 1.	Comply	AI cards have 50hz or 5 Hz filters to reduce input signal noise.	Suitability Evaluation
586	**3.24 Programmed Functions**	All settings with the exception of time constants shall be continuously adjustable within their range and all time constants shall be continuously adjustable.	Clarify	The Common Q PAMS provides various operator adjustable variables necessary for operation.	alarms - SyRS R2.5.2.1.2-4 numerous items are adjustable mentioned throughout the SyRS
587	**3.25 Applicable Criteria & Standards**	The following design criteria contained in the AEC General Design Criteria (GDC) (7/10/67) document or as revised in the Atomic Industrial forum Comments of the forum Committee on Reactor Safety (10/2/67) are met by the Reactor Control System:	Clarify	The Common Q Topical report contains a list of standards that the system meets including the GDC criteria.	N/A
588		Criterion 11: Control Room	Comply		ML003740165 - PAMS SER
589		Criterion 12: Instrumentation and Control Systems	Comply		OM Meet Control Room Criteria: WB2 EQ Summary Report
590		Institute of Electrical & Electronics Engineers (IEEE) Standards: IEEE Std. 279-1971 (Section 4.7)	Comply		Attachment 4 of Reference 40

Rqt #	Section	Wording	Comply, OOS (Not in WEC scope), Clarify, NIC (Not in compliance with Purchase Spec)	Response	Proof req. Met
591	**3.26 WBN System Description**	N3-94-4003 R4 - TVAN System Description Document - INCORE INSTRUMENTATION SYSTEM	NA	WEC is proposing a Common Q PAMS system.	

SECTION 13
ORIGIN TRACING OF WBN2 PAMS SYSTEM REQUIREMENTS SPECIFICATION

The following table shows the tracing to the source requirements for the WBN2 PAMS System Requirements Specification (Reference 10).

[

]^{a,c}

For those origins designated as "Engineering Judgment", in most cases the requirement from Reference 10 is repeated (in italics) for context for the explanation for the engineering judgment.

SyRS Requirement	Page	Origin*
R2.1-1	2-1	WNA-DS-01070-GEN (No requirement # identified)
R2.2-1	2-1	3
R2.3.1-1	2-1	4, 6, 7, 8, 9, 10, 12, 13, 173, 174, 177
R2.3.3-1	2-4	400, 404
R2.4-1	2-4	64, 347, 359, 374
R2.5.1-1	2-5	Reference 53, subsection 2.5.1
R2.5.2.1-1	2-5	240, 272, 350, 353, 356, 357, 358, 400, 401, 402, 404
R2.5.2.1-2	2-5	272, 400, 402, 404
R2.5.2.1-3	2-5	272, 400
R2.5.2.1-4	2-5	272, 356, 357, 358, 400
R2.5.2.1-5	2-5	272, 356, 357, 358, 400
R2.5.2.1.1-1	2-6	272, 402, 404
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R2.5.2.1.3-1	2-6	272
R2.5.2.1.3-2	2-6	272

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R2.5.2.1.3-4	2-7	272
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R2.5.2.2-2	2-7	272
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R2.5.3.2-5	2-9	Reference 53, subsection 2.5.3.2
R2.5.3.2-6	2-9	19
R2.5.3.2-7	2-9	Reference 53, subsection 2.5.3.2
R2.5.3.2-8	2-10	Reference 53, subsection 2.5.3.2
R2.5.3.2-9	2-10	Reference 53, subsection 2.5.3.2
R2.5.3.2-10	2-10	Reference 53, subsection 2.5.3.2
R2.5.3.2-11	2-10	Reference 53, subsection 2.5.3.2
R2.5.3.2-12	2-10	245
R2.5.3.2-13	2-10	A1.1.2.2.10.3
R2.5.3.2-14	2-11	**Engineering judgment:** [ ]^{a,c}
R2.5.3.2-15	2-11	A1.1.2.2.10 & A1.1.2.2.10.3
R2.5.3.2-16	2-11	586

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R2.5.3.2-17	2-11	**Engineering Judgment** [ ]a,c
R2.5.3.2-18	2-11	**Engineering Judgment** [ ]a,c
R2.5.3.2-19	2-12	586
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R2.5.3.2-21	2-12	Reference 55, Section 2.2
R2.5.3.3-1	2-12	14, 15, Reference 54, subsection 6.2.1.1
R2.5.3.3-2	2-12	14, 15, Reference 54, subsection 6.2.1.1
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R2.5.3.3-13	2-14	WCAP-16097-P-A, subsection 6.2.1.1.3
R2.5.3.3-14	2-14	Reference 54, subsection 6.2.1.5
R2.5.3.3-15	2-14	586, Reference 54, subsection 6.2.1.5
R2.5.3.3-16	2-15	Reference 54, subsection 6.2.1.5

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R2.5.3.4.18-2	2-37	Reference 56, subsection 3.1.1.2
R2.5.3.4.18-3	2-37	Reference 56, subsections 3.1.1.1, 3.1.1.2 **Engineering Judgment:** [ ]^{a,c}
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R2.5.3.4.18-5	2-37	Reference 56, subsections 3.1.1.1, 3.1.1.2
R2.5.3.4.18-6	2-37	Reference 56, subsections 3.1.1.1, 3.1.1.2 **Engineering Judgment** [ ]^{a,c}
R2.5.3.4.18-7	2-37	Reference 56, subsections 3.1.1.1, 3.1.1.2 **Engineering Judgment** [ ]^{a,c}

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SECTION 14
SUITABILITY EVALUATION OF WBN2 REQUIREMENTS

14.1 HARDWARE SUITABILITY EVALUATION

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14.2 SOFTWARE SUITABILITY EVALUATION

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SECTION 15
CODES AND STANDARDS APPLICABLE TO THE COMMON Q PAMS

The applicable NRC regulatory guides, IEEE and EPRI industry standards for the Common Q PAMS are shown below. Compliance to these codes and standards are stated in Section 4 of Reference 1, or Attachment 4 of Reference 40.

When the Common Q Topical Report (Reference 1) was submitted to the NRC for review and approval, IEEE 384-1992 was referenced. At this time, RG 1.75, September 1978, had not been updated to endorse IEEE 384-1992. This same situation is found with IEEE 830-1998 and RG 1.172-1997, IEEE 379-1994 and RG 1.53-1973, and IEEE 323-1983 and RG 1.89-1984. This is also reflected in the Watts Bar Unit 2 PAMS documentation where these standards are referenced.

1. Regulatory Guide 1.22, "Periodic Testing of Protection System Actuation Functions," U.S. Nuclear Regulatory Commission, February 1972.

2. Regulatory Guide 1.29, "Seismic Design Classification," U.S. Nuclear Regulatory Commission, September 1978.

3. Regulatory Guide 1.53, "Application of the Single Failure Criterion to Nuclear Power Plant Protection Systems," U.S. Nuclear Regulatory Commission, June 1973.

4. Regulatory Guide 1.75, "Physical Independence of Electric Systems," U.S. Nuclear Regulatory Commission, September 1978.

5. Regulatory Guide 1.89, "Environmental Qualification of Certain Electrical Equipment Important to Safety for Nuclear Power Plants," U.S. Nuclear Regulatory Commission, June 1984.

6. Regulatory Guide 1.97, "Instrumentation for Light-Water Cooled Nuclear Power Plants to Assess Plant Conditions During and Following an Accident," U.S. Nuclear Regulatory Commission, December 1980.

7. Regulatory Guide 1.100, "Seismic Qualification of Electrical and Mechanical Equipment for Nuclear Power Plants," U.S. Nuclear Regulatory Commission, June 1988.

8. Regulatory Guide 1.118, "Periodic Testing of Electric Power and Protection Systems," U.S. Nuclear Regulatory Commission, April 1995.

9. Regulatory Guide 1.153, "Criteria For Safety Systems," U.S. Nuclear Regulatory Commission, June 1996.

10. ANSI/IEEE-ANS-7-4.3.2-1, "IEEE Standard Criteria for Digital Computer in Safety Systems of Nuclear Power Generating Stations," American National Standards Institute/Institute of Electrical and Electronics Engineers, Inc., 1993.

11. Regulatory Guide 1.152, "Criteria for Digital Computers in Safety Systems of Nuclear Power Plants," U.S. Nuclear Regulatory Commission, January 1996.

12. Regulatory Guide 1.168, "Verification, Validation, Reviews, and Audits for Digital Computer Software used in Safety Systems of Nuclear Power Plants," U.S. Nuclear Regulatory Commission, February 2004.

13. IEEE Standard 1012, "IEEE Standard for Software Verification and Validation," Institute of Electrical and Electronics Engineers, Inc., 1998.

14. IEEE Standard 1028, "IEEE Standard for Software Reviews and Audits," Institute of Electrical and Electronics Engineers, Inc., 1997.

15. IEEE Standard 279, "Protection Systems for Nuclear Power Generating Stations," Institute of Electrical and Electronics Engineers, Inc., 1971.

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

17. IEEE Standard 338, "IEEE Standard Criteria for the Periodic Testing of Nuclear Power Generating Station Safety Systems," Institute of Electrical and Electronics Engineers, Inc., 1987.

18. IEEE Standard 344, "IEEE Recommended Practices for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations," Institute of Electrical and Electronics Engineers, Inc., 1987.

19. IEEE Standard 379, "IEEE Standard Application of the Single-Failure Criterion to Nuclear Power Generating Station Safety Systems," Institute of Electrical and Electronics Engineers, Inc., 1994.

20. IEEE Standard 384, "IEEE Standard Criteria for Independence of Class 1E Equipment and Circuits," Institute of Electrical and Electronics Engineers, Inc., 1992.

21. IEEE Standard 603, "IEEE Standard Criteria for Safety Systems for Nuclear Power Generating Stations," Institute of Electrical and Electronics Engineers, Inc., 1991.

22. TR-102323, Rev. 1, "Guidelines for Electromagnetic Interference Testing in Power Plants," Electric Power Research Institute.

23. TR-106439, "Guidelines on Evaluation and Acceptance of Commercial Grade Digital Equipment for Nuclear Safety Applications," Electric Power Research Institute, October 1996.

24. TR-107330, "Generic Requirements Specification for Qualifying a Commercially Available PLC for Safety-Related Applications in Nuclear Power Plants," Electric Power Research Institute, December 1996.

25. IEEE Standard 830, "IEEE Recommended Practice for Software Requirements Specifications," Institute of Electrical and Electronics Engineers, Inc., 1993.

26. IEEE Standard 830, "IEEE Recommended Practice for Software Requirements Specifications," Institute of Electrical and Electronics Engineers, Inc., 1998.

27. Regulatory Guide 1.172, "Software Requirements Specifications for Digital Computer Software Used in Safety Systems of Nuclear Power Plants," U.S. Nuclear Regulatory Commission, September 1997.

28. Regulatory Guide 1.180, "Guidelines for Evaluating Electromagnetic And Radio-Frequency Interference in Safety-Related Instrumentation and Control Systems," U.S. Nuclear Regulatory Commission, January 2000.

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

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Attachment 4
TVA Letter Dated March 31, 2011
Responses to Licensee Open Items to be Resolved for SER Approval

Westinghouse Electric Company CAW-11-3131,
Application for Withholding Proprietary Information from Public Disclosure,
WNA-LI-00058-WBT-P, Revision 3, "Post-Accident Monitoring System (PAMS) Licensing Technical Report (Proprietary)," Dated March 14, 2011

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

U.S. Nuclear Regulatory Commission
Document Control Desk
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Proj letter: WBT-D-2991

CAW-11-3131

March 14, 2011

APPLICATION FOR WITHHOLDING PROPRIETARY INFORMATION FROM PUBLIC DISCLOSURE

Subject: WNA-LI-00058-WBT-P, Rev. 3, "Post-Accident Monitoring System (PAMS) Licensing Technical Report" (Proprietary)

The proprietary information for which withholding is being requested in the above-referenced report is further identified in Affidavit CAW-11-3131 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-11-3131, 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-11-3131

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 14th day of March 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-LI-00058-P, Rev. 3, "Post-Accident Monitoring System (PAMS) Licensing Technical Report" (Proprietary), dated March 2011, for submittal to the Commission, being transmitted by Tennessee Valley Authority 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 Post-Accident Monitoring System (PAMS) licensing and may be used only for that purpose.

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

(a) Provide Post-Accident Monitoring System licensing support for Westinghouse-designed system.

(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 the purpose of licensing Westinghouse-designed Post-Accident Monitoring Systems.

(b) Westinghouse can sell support and defense of licensing services.

(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 analysis reports 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. __ copies of WNA-LI-00058-WBT-P, Rev. 3, "Post-Accident Monitoring System (PAMS) Licensing Technical Report" (Proprietary)

2. __ copies of WNA-LI-00058-WBT-NP, Rev. 3, "Post-Accident Monitoring System (PAMS) Licensing Technical Report" (Non-Proprietary)

Also enclosed is the Westinghouse Application for Withholding Proprietary Information from Public Disclosure CAW-11-3131, 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-11-3131 and should be addressed to J. A. Gresham, Manager, Regulatory Compliance, Westinghouse Electric Company LLC, Suite 428, 1000 Westinghouse Drive, Cranberry Township, Pennsylvania 16066.