IPS
INVENSYS PROCESS SYSTEMS

A Revolution in Performance

Pre-Submittal Meeting
Tricon Version 10

July 7, 2009

Brian Haynes – Program Manager

**Jeff Larson – Director, Nuclear Quality
Assurance**

Gary Hufton – Director of Engineering

Triconex History

- "Commercial Off The Shelf" (COTS) TMR PLC built from the "ground up" as a safety system.

- Version 9 Qualification via EPRI TR-107330, 102323 and TUV testing.

- Generic SER received from the NRC in December 2001 - Version 9.5.3.

- Qualification testing on Tricon Version 10.2.1 completed in 2007 via EPRI TR-107330, R.G. 1.180 R1 and TUV testing.

IPS INVENSYS PROCESS SYSTEMS — A Revolution in Performance

Scope of Submittal

- Tricon Version 10 Qualification

- IPS Position on DI&C-ISG-01, Cyber Security

- IPS Position on DI&C-ISG-02, Diversity and Defense-in-Depth Issues

- IPS Position on DI&C-ISG-04, Highly-Integrated Control Rooms – Communication Issues (HICRc)

IPS

A Revolution in Performance

INVENSYS PROCESS SYSTEMS

Nuclear Program specifics

- The product design and manufacture is maintained under a 10CFR50 Appendix B program.

- Commercial Grade Dedication processes in accordance with 10CFR21 and EPRI NP-5652, as endorsed by NRC

- Primary equipment manufacturing performed at IPS facilities

  - Direct access to design and testing requirements

  - Annual internal audits and commercial grade dedication surveys

- Hardware and pre-developed software is provided for system design & integration as a "Basic Component"

- System design, integration and testing under Invensys Corporate Nuclear Quality Assurance Program

IPS

INVENSYS PROCESS SYSTEMS

A Revolution in Performance

Nuclear Quality Assurance Program Improvements

- Issuance of the Invensys Corporate Nuclear Quality Assurance Manual

- Established Nuclear Quality Assurance Director position

- Product qualification responsibility transferred from Marketing to Engineering

IPS

INVENSYS PROCESS SYSTEMS

A Revolution in Performance

Procedural Improvements

- New administrative controls for unique engineering identification of nuclear components

  - "N" model/part numbers

- Formal procedures for nuclear qualification of new modules and evolutionary platform changes

  - Nuclear Qualified Equipment List

  - Change Impact Analysis

- Improved procedures for Commercial Grade Dedication of parts and services per 10CFR21

IPS INVENSYS PROCESS SYSTEMS | A Revolution in Performance

Commercial Grade Procurement & Dedication

- Defined and controlled Commercial Grade Dedication process

  - Product Design Control

  - Determination of Safety Function

  - Identified and linked Critical Characteristics

  - Use of NP-5652 Acceptance Methods - Primarily Methods 1 and 2

- Establishment and Maintenance of Commercial Grade Dedication records

  - Technical Evaluations

  - Acceptance Tests & Inspections

  - Supplier Controls

- Implementation of 10CFR21 evaluation and reporting requirements

Counterfeit or Fraudulent Material Prevention

- Addressed through IPS Corporate-level Supply Chain Policy

- Controls in Procurement and Receipt Inspection procedures

  – Graded approach based on material source

  – Inspection of physical condition, packaging, markings

  – May include sample testing/verification

A Revolution in Performance

Program Oversight & Assessment

- IPS Internal Audit process

- Multi-location NUPIC audits

- Individual nuclear utility customer audits

- NRC Inspection – May 2008

INVENSYS PROCESS SYSTEMS

A Revolution in Performance

Differences from Version 9 to Version 10

- Programmatic

- Hardware

- Software

Programmatic Differences

- Used IEC 61508 Functional Safety Standards and development processes for additional rigor and programmatic robustness.

    - SIL 3 per IEC 61508 for V10 versus AK5-AK6 per DIN V 19250 and DIN V VDE 0801

- Improved V10 Qualification Program processes

V9 Versus V10 Qualification Differences

- **Version 9**

  - IEEE 323-1983

  - Low Humidity, limited due to test equipment

  - Radiation qualification by analysis

  - EMC testing to TR-102323

  - Seismic envelop – 10G's

  - No Electrostatic Discharge Testing

- **Version 10**

  - IEEE 323-2003

  - Low Humidity tested to TR-107330 requirements

  - Radiation qualification by test

  - EMC testing to R.G. 1.180 R1

  - Seismic envelop – 14 G's

  - Electrostatic Discharge testing performed to IEC 61000-4-2

IPS INVENSYS PROCESS SYSTEMS   A Revolution in Performance

V10 Hardware

- Same System Architecture as previously qualified Tricon V9.5.3 System

- New Main Processor - 3008N

- New Communications Module - TCM

- New I/O Modules and Termination Assemblies

- Alternate Power Modules - VICOR

IPS
INVENSYS PROCESS SYSTEMS

A Revolution in Performance

V10 Hardware Improvements

- Improved processor speeds and memory

- Improved communications capabilities including MODBUS TCP protocol

- Improved I/O capabilities

- Surface Mount Technology versus "thru-hole"

- Improved signal conditioning capabilities

- Improved equipment performance

V10 Software

- Same Application Programming Model, TriStation V4.1.437 versus V4.1.419, as previously qualified

- New Main Processor Module Firmware

- New Communication Module Firmware

- New Remote Extender Module Firmware

- New I/O Module Firmware

V10 Software Changes

- All V10 Triconex software and firmware has been developed in accordance with approved IPS processes and procedures.

- IPS processes and procedures are the same as those that were reviewed and approved as part of the V9 SER issuance, but have been strengthened based upon Continuous Process Improvement principles and best practices.

IPS

INVENSYS PROCESS SYSTEMS

A Revolution in Performance

Expected Package Submittals
V10 Qualification Documents (versus V9 Submittal)

	V10	**V9**
• **TRICON Manufacturer Documents**		
– TRICON Hardware Manuals:		
– - Planning & Installation Guide	X	X
– - Users Manual for Field Term.	X	X
– - TRICON Communication Guide	X	X
– Developers Guide, TriStation 1131	X	X
– TRICON Libraries	X	X
– Triconex Training Manual	X	X
– TRICON Product Guide	X	X
– Hardware C of C		X

IPS
A Revolution in Performance
INVENSYS PROCESS SYSTEMS

Expected Package Submittals
V10 Qualification Documents (versus V9 Submittal)

	V10	V9
● Program Documents		
– Nuclear Qualification Quality Plan	X	X
– Master Test Plan	X	X
– Supplemental Test Plan (IEC 4-16 test)	X	
– Master Configuration List	X	X
– Software Quality Assurance Plan	X	X
– System Description	X	X
● Test System Drawings		
– System Arrangement/Wiring Diagrams & Schedule	X	X
– Functional Diagrams	X	X
– Loop Diagrams		X

Expected Package Submittals
V10 Qualification Documents (versus V9 Submittal)

- **Test Procedures**

	V10	V9
– System Setup & Checkout Procedure	X	X
– Operability Test Procedure	X	X
– Prudency Test Procedure	X	X
– Environmental Test Procedure	X	X
– Seismic Test Procedure	X	X
– Surge Withstand Test Procedure	X	X
– Class 1E Isolation Test Procedure	X	X
– EMI/RFI Test Procedure	X	X
– EFT Test Procedure	X	
– ESD Test Procedure	X	
– Radiation Exposure Test Procedure	X	

A Revolution in Performance

IPS
INVENSYS PROCESS SYSTEMS

Expected Package Submittals
V10 Qualification Documents (versus V9 Submittal)

- **Test Reports**

	V10	**V9**
Setup & Checkout Test Report, Initial Test	X	
Pre-Qualification Test - Setup & Checkout Test Report	X	X
Pre-Qualification Test - Operability Test Report,	X	X
Pre-Qualification Test - Prudency Test Report	X	X
Environmental Test Report	X	X
Seismic Test Report	X	X
EMI/RFI Test Report	X	X
Surge Withstand Test Report	X	X
Class 1E Isolation Test Report	X	X
Performance Proof - Setup & Checkout Test Report	X	X
Performance Proof - Operability Test Report	X	X
Performance Proof - Prudency Test Report	X	X
Seven Day Elev DC Voltage St/Checkout Test Report	X	
Radiation Exposure Test Report	X	
EFT Test Report	X	
ESD Test Report	X	

Expected Package Submittals
V10 Qualification Documents (versus V9 Submittal)

- **TSAP Application Software**

	V10	V9
– TSAP Software Requirements Specification	X	X
– TSAP Software Design Description	X	X
– TSAP Software Verification and Validation Plan	X	
– TSAP Software Validation Test (SVT) Procedure	X	X
– TSAP Software Validation Test Report	X	
– TSAP Final V&V Report	X	X
– TSAP Configuration Files/Program Listing	X	X

Expected Package Submittals
V10 Qualification Documents (versus V9 Submittal)

- **Technical Reports/Analyses**

	V10	V9
– Reliability/Availability Study	X	X
– Failure Modes and Effects Analysis	X	X
– System Accuracy Specification	X	X
– Software Qualification Report	X	X
– Critical Digital Review	X	X
– Radiation Hardness Evaluation		X
– Equipment Qualification (EQ) Summary Report	X	X
– Independent Assessment of Qualification Program	X	

A Revolution in Performance

IPS

INVENSYS PROCESS SYSTEMS

Expected Package Submittals
V10 Qualification Documents (versus V9 Submittal)

Other Misc Documents

	V10	V9
Triconex QA Manual	X	X
Maximum Response Time Calculations	X	X
TUV Type Approval Report and Certificate	X	X
Component Aging Analysis	X	X
ESD Design Guidelines		X
Scan Time Description		X
DIN/IEC Standards Comparison		X
Analog Input/Output Machine Count Calculations	X	
Ext Term Panel Interface Cable Similarity Analysis	X	
Change Impact Analysis	X	
Communication Application Safety Layer Specification	X	

A Revolution in Performance

IPS

INVENSYS PROCESS SYSTEMS

Expected Package Submittals

- **POSITION PAPERS**

  - DI&C-ISG-01, Cyber Security

  - DI&C-ISG-02, Diversity and Defense-in-Depth Issues

  - DI&C-ISG-04, Highly-Integrated Control Rooms – Communication Issues

Version 10 Package Submittal

- Expected Submittal Date – July 31, 2009

- Questions and Clarifications

IPS
INVENSYS PROCESS SYSTEMS

A Revolution in Performance