



Product Qualification Maintenance

The Triconex program for continuous product qualification.

18 November 2004



Invensys™
 TRICONEX™

Why are we here?

- **To discuss:**
 - **Who we are**
 - **What we do**
 - **12/2001 SER issuance**
 - **Post SER items**
 - **Our planned path forward in equipment qualification**

Triconex Background

- **Founded in 1983 with headquarters in Irvine, CA**
 - Designed to support the need for single train high reliability emergency shutdown safety systems.
 - Developed the high reliability, high availability Triple Modular Redundant (TMR) Fault Tolerant Controller based on the NASA concept.
 - Designed with high percentage of internal diagnostic coverage and no single point of failure.
 - Definition of Triconex Fault Tolerance:
 - Identifies and Compensates for Failed Control System Elements and Allows On-Line Repair while Continuing its Assigned Task Without Process Interruption
 - Designed for life cycle concerns with full backward compatibility of all new upgrades.

Triconex Background

- **Shipped first system in 1986**
 - Still in Service
- **Presently more than 5500 systems placed in service**
- **250,000,000 hours of cumulative service without a failure to perform on demand**
- **Number 1 supplier of safety systems worldwide**

Certification-Compliant

- **These are examples of the standards with which we comply:**
- **IEC 61508**
 - Functional Safety of Electrical/ Electronic/ Programmable Electronic Safety Related Systems
- **IEC 61131-2/2000**
 - Programmable Controllers, Equipment Requirements and Tests (Includes all sub test for EMI/RFI and Environmental)
- **DIN V 19250**
 - Fundamental Safety Aspects to be Considered for Measurement and Control Protective Equipment
- **DIN V VDE 0801**
 - Principles for Computers in Safety Related Systems
- **DIN VDE 0116**
 - Electrical Equipment of Furnaces
- **EN 54**
 - Fire Protection and Fire Alarm Systems

Certification-Compliant

- **National Fire Protection Association**
 - NFPA 72/96
 - National Fire Alarm Code
 - NFPA 8501
 - Standard for Single Burner Boiler Operation
 - NFPA 8502
 - Standard for the Prevention of Furnace Explosions/Implosions in Multiple Burner Boilers
- **SEMI 2**
 - Environmental, Health, and Safety Applications in Semiconductor Manufacturing Facilities
- **EPRI TR-107330 [1996]**
 - “Generic Requirements Specification for Qualifying A Commercially Available PLC for Safety-Related Applications in Nuclear Power Plants”
- **EPRI report 1000799 [2001]**
 - “Generic Qualification of the Triconex Corporation TRICON Triple Modular Redundant Programmable Logic Controller system for Safety-Related Applications in Nuclear Power Plants”

Certification-Approvals

- **Factory Mutual Research (FM)**
 - Report 3010681 – “Hazardous (Class 1, Division 2) Locations”
- **Canadian Standards Association (CSA)**
- **European Union - CE Mark**
- **TÜV Rheinland**
 - Report No. 968/EZ 105.03/01
 - AK1 – AK6 (DIN V 19250, DIN V VDE 0801)
 - SIL 1 – 3 (IEC 61508)
- **NRC Safety Evaluation Report**
 - ADAMS Accession Number ML013470433

Qualification Project Bases

- **EPRI TR-107330 - “Generic Requirements Specification for Qualifying a Commercially Available PLC for Safety-Related Applications in Nuclear Power Plants”**
 - Quality Assurance
 - Detailed Testing Requirements
 - Engineering Analyses
 - Documentation
- **Project Planning**
 - Quality Assurance Plan
 - Master Test Plan
 - Software Quality Plan

SER

- **SER issued in 2001**

- Accepts suitability of Triconex App. B program
- Acknowledges future software upgrades
 - *“It should be noted, however, that acceptance of the Tricon PLC system is based to a large degree on the TÜV-Rheinland independent review, and any future version of the Tricon PLC system will require an equivalent level of independent V&V in order to be considered acceptable for safety-related use in nuclear power plants.”*
- This tie to TÜV-Rheinland helps unite our U.S. nuclear program with our international safety systems program.
- SER does not explicitly acknowledge future hardware upgrades.
- SER lists specific H/W & S/W included in the qualification effort.

SER

- **Outstanding software issues in SER**
 - none
- **Outstanding hardware issues in SER**
 - Seismic
 - 10G, instead of 14G per EPRI TR-107330
 - EMI/RFI
 - Per EPRI TR-102323, Rev. 1
 - Specific equipment did not meet minimum levels
 - Requires Plant Specific Actions, such as surveys

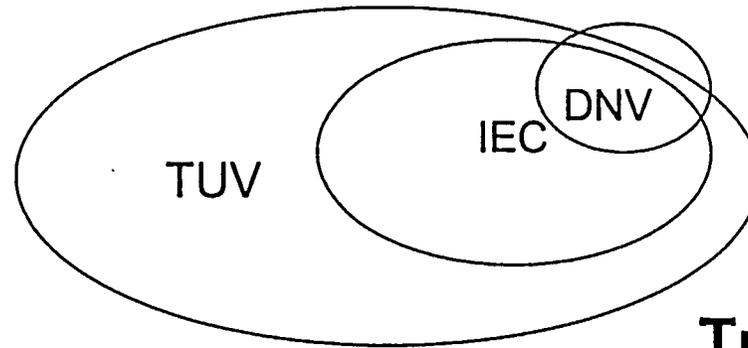
Triconex since SER issuance

- **Appendix B supplier**
 - Numerous client audits; H/W & S/W R&D, manufacturing, projects.
 - NUPIC/NIAC based Audits, for which other utilities are taking credit
- **Continual TÜV testing & certification**
 - Also a part of our continuous qualification process of software upgrades (per SER)
- **S/W upgrades for 1E service**
 - Complete V&V
 - Added layer of V&V independence through TÜV
 - All changes per approved proceduralized process
 - All changes include full change analysis prior to inclusion on NQEL (Nuclear Qualified Equipment List)
- **H/W upgrades for 1E service**
 - Small grouping by analysis
 - Specific function testing

Internal Testing Concerns

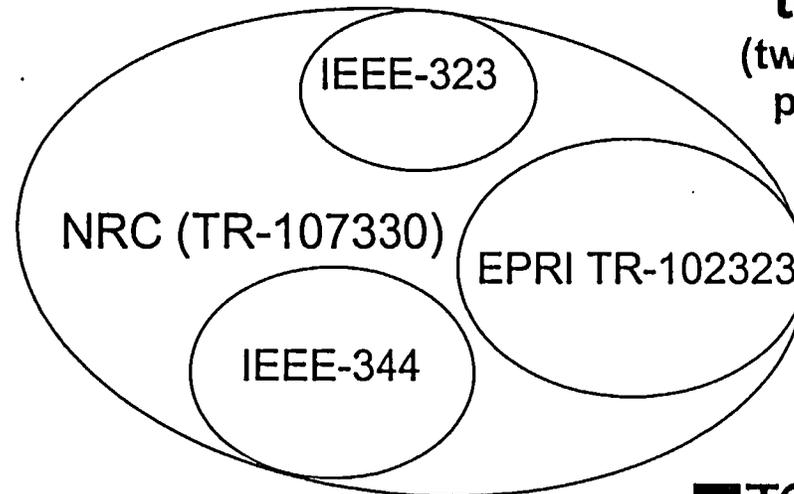
- Numerous testing standards to meet

- TUV
 - IEC
- FM
- NRC
 - EPRI
 - IEEE
- DNV



Triconex testing
(two separate programs)

- **Becoming Onerous!**

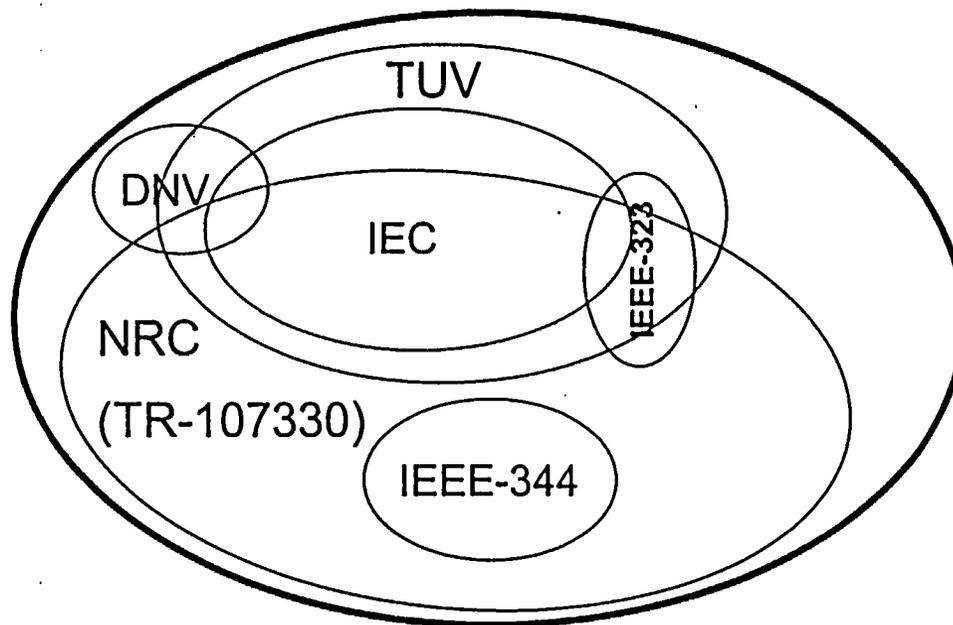


Triconex Direction

- **Triconex is committed to remain in the nuclear business, and continue to produce qualified product**
- **Milestone in forming future qualification testing plans was the issuance of RG 1.180, Rev. 1, October, 2003, EMI/RFI guidelines**
 - Allows for the use of IEC standards
 - Same standards used in our recurring TUV testing.
- **Triconex will embrace RG 1.180, Rev 1 for all future testing in place of EPRI TR-102323 and will continue testing IAW EPRI-TR-107330 as endorsed and performed in the Triconex SER.**

Triconex Recurring Test Plan

- **Cover all governing bodies in one recurring test**
 - Allows continuous adding of product to NQEL, and increases cost-benefits, enhancing future viability in all Safety markets.
- **Allows for a simplified testing regimen**



**Triconex
combined
testing**

Future NRC interface

- **Triconex does not envision future submittals for SER update**
- **Triconex expects docketed licensing submittals for safety related applications from utilities within the next few years.**

Summary

- **Triconex Tricon is designed and built to meet numerous domestic and international safety standards.**
- **Triconex is committed to long term support of the nuclear industry by providing continuously qualified upgrades to resolve obsolescence issues**
- **Triconex plans to combine our varied testing programs to one all encompassing test on a recurring basis based on the merging U.S. and IEC standards.**
- **Any NRC concerns with our presented approach?**