Project:	TRICON v10 NUCLEAR QUALIFICATION PROJECT

Evaluation of IEEE Std. 323-2003 as Endorsed by USNRC Regulatory Guide 1.209

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Appendix C

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1.0 PURPOSE

The Triconex V10 Nuclear Qualification Project was based upon the standards provided in IEEE 323-1974 and IEEE 323-1983. Subsequent to the implementation of the project to these earlier standards, the USNRC provided endorsement to IEEE 323-2003. The purpose of this analysis is to provide an evaluation of the standards provided in IEEE 323-2003 as endorsed by USNRC Regulatory Guide 1.209, and determine the degree of conformance by the Triconex V10 Nuclear Qualification Project.

2.0 SUMMARY

Until recently, the US Nuclear Regulatory Commission had provided endorsement to IEEE Std. 323-1974 as described in Regulatory Guide 1.89. The U.S. Nuclear Regulatory Commission (NRC) issues regulatory guides to describe and make available to the public methods that the NRC staff considers acceptable for use in implementing specific parts of the agency's regulations, techniques that the staff uses in evaluating specific problems or postulated accidents, and data that the staff need in reviewing applications for permits and licenses. The Triconex V10 Nuclear Qualification Project was based on the USNRC's endorsement of IEEE 323-1974. The evaluation contained herein indicates that the Triconex V10 Nuclear Qualification complies with the standards provided in IEEE 323-2003, as endorsed by Regulatory Guide 1.209, dated March 2007.

3.0 EVALUATION

The primary focus of IEEE Std. 323 - 1974, "IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations" (Reference 5.2), is the reliable operation of safety-related equipment under normal, abnormal, design-basis accident, post-design-basis accident, and containment test conditions. Traditionally, computer-based instrumentation and control (I&C) systems are primarily implemented in nuclear power plant locations that are characterized as mild environments that are not affected by design-basis accident conditions. Thus, the design-basis accident element of type testing for qualification does not apply to computer-based I&C systems in mild environments.

Regulatory Guide 1.89 is focused on the environmental qualification of equipment intended for use in harsh environments that are subject to design-basis accidents. Because the NRC has limited the scope of Regulatory Guide 1.89 to equipment intended for application in harsh environments, they had determined that additional guidance was warranted to address qualification for mild environmental conditions, as needed for computer-based technologies.

IEEE revised IEEE Std. 323, in 2003. The main impetus of this revision is to incorporate current practices and lessons learned from the implementation of previous versions of the standard by the nuclear industry. A particular distinction between IEEE Std. 323-2003, "IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations" (Reference 5.3), and IEEE Std. 323-1974 (Reference 5.2), is that the 2003 version acknowledges qualification of equipment in

mild environments and does not require age conditioning to an end-of-installed-life condition for equipment in mild environments, where significant aging mechanisms are not present. Additionally, it recognizes that digital systems and new advanced analog systems may require susceptibility testing for EMI/RFI and power surges, if the environments are significant to the equipment being qualified.

The revision also provides the following: 1) a better definition of harsh environment accident terms, 2) harsh environment test margins have been updated to better identify the parameters that achieve test margin on accident profiles, and 3) recognition that the condition of the equipment for which acceptable performance was demonstrated is the qualified condition, applicable to new license renewal and life extension options. These differences do not affect the Tricon v10 Qualification. Provided in Table 3-1 is a compliance matrix of the provisions of the standard and the V10 Nuclear Qualification Project.

The USNRC has endorsed IEEE Std. 323-2003 in USNRC Regulatory Guide 1.209. The USNRC has acknowledged that the practices in IEEE Std. 323-2003 are sufficient to address qualification for the mild environmental conditions of typical plant locations where safety-related computer-based I&C systems are generally located. However, they have also re-emphasized that commercial MOS devices are very sensitive to ionizing radiation doses, and that radiation hardness levels are on the order of 1E3 Rads.

USNRC Regulatory Guides are comprised of four sections: A. Introduction, B. Discussion, C. Regulatory Position, and D. Implementation. Sections A and B are self explanatory. Section C, Regulatory Position, provides the conditions acceptable to the NRC staff for satisfying the applicable regulations. Section D, Implementation, provides information to applicants and licensees regarding the NRC staff's plans for using the regulatory guide (e.g. applicability to construction permits, standardized designs, etc.). The pertinent section for this evaluation is Section C, Regulatory Position. Provided in Table 3-2 is a compliance matrix of the provisions of the Regulatory Guide and the V10 Nuclear Qualification Project.

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4.0 CONCLUSIONS

A review of IEEE 323-2003 and the regulatory positions contained in Regulatory Guide 1.209 was performed and compared to the Tricon V10 Nuclear Qualification. The evaluation contained herein documents that the Tricon V10 Nuclear Qualification complies with the standards provided in IEEE 323-2003, as endorsed by Regulatory Guide 1.209, dated March 2007.

5.0 REFERENCES

5.1 EPRI TR-107330, Generic Requirements Specification for Qualifying a Commercially Available PLC for Safety-Related Applications in Nuclear Power Plants

5.2 IEEE 323-1974, IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations

5.3 IEEE 323-2003, IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations

5.4 USNRC Regulatory Guide 1.180, Revision 1 - Guidelines for Evaluating Electromagnetic and Radio-Frequency Interference in Safety-Related Instrumentation and Control Systems

5.5 USNRC Regulatory Guide 1.209, Dated March 2007- Guidelines for Environmental Qualification of Safety-Related Computer-Based Instrumentation and Control Systems in Nuclear Power Plants