Project:	TRICON v10 NUCLEAR QUALIFICATION PROJECT

TEST SPECIMEN APPLICATION PROGRAM V10_TSAP_REV_0.PT2

FINAL V&V REPORT

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Revision History

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1.0 VERIFICATION

1.1 ACTIVITIES

Verification activities associated with the Tricon v10 Nuclear Qualification Project Test Specimen Application Program (TSAP) consisted of the following Verification and Validation (V&V) life cycle phases:

1. Requirements Phase;
2. Design Phase; and
3. Implementation Phase.

The Requirements, Design and Implementation Phases were implemented in accordance with the Nuclear Qualification Quality Plan (NQQP) (Reference 5.2) and the TSAP Software Verification and Validation Plan (Reference 5.3). In addition to these documents, the Implementation Phase was also implemented in accordance with the TSAP Verification Specification & Plan (Reference 5.4).

Each V&V phase included those verification activities associated with the TSAP's stage of development during that phase. That is, during the Requirements Phase, the TSAP requirements document was design verified; during the Design Phase, the TSAP design description was design verified; and during the Implementation Phase the TSAP, itself was verified. In addition, each V&V phase included the development of its associated Phase Summary Report and a Software Traceability Analysis (STA) in accordance with the requirements of the SVVP.

The specific details of each V&V life cycle phase activity associated with TSAP verification are provided in Section 1.2.

1.2 RESULTS

1.2.1 Requirements Phase

During the V&V Requirements Phase, the following results were achieved:

1. The TSAP Software Requirements Specification (SRS) (Reference 5.13) was satisfactorily design verified, approved and issued;
2. The Requirements Phase IEEE 1012 Software Traceability Analysis (STA) (Reference 5.12) was prepared as a draft; and
3. The V&V Requirements Phase Summary Report (Reference 5.6) was issued recommending that V&V Design Phase activities should begin.

1.2.2 Design Phase

During the V&V Design Phase, the following results were achieved:

1. The TSAP Software Design Description (SDD) (Reference 5.14) and the TSAP Function Diagrams (FD) (Reference 5.15) were satisfactorily design verified, approved and issued;
2. The TSAP Verification Specification & Plan (Reference 5.4) was approved and issued;
3. The TSAP Validation Test Specification & Plan (Reference 5.5) was approved and issued;
4. The TSAP Software Validation Test (SVT) Procedure (Reference 5.10) was prepared as a draft;
5. The Design Phase IEEE 1012 Software Traceability Analysis (STA) (Reference 5.12) was prepared as a draft by updating the Requirements Phase STA; and
6. The V&V Design Phase Summary Report (Reference 5.6) was issued recommending that V&V Implementation Phase activities should begin.

1.2.3 Implementation Phase

During the V&V Implementation Phase, the following results were achieved:

1. Test Specimen Application Program (TSAP) V10_TSAP_REV_0.PT2 was satisfactorily design verified in accordance with the requirements of the TSAP Verification Specification & Plan (Reference 5.4);
2. The TSAP Software Validation Test (SVT) Procedure (Reference 5.10) was approved and issued;
3. The Implementation Phase IEEE 1012 Software Traceability Analysis (STA) (Reference 5.12) was prepared as a draft by updating the Design Phase STA; and
4. The V&V Implementation Phase Summary Report (Reference 5.8) was issued recommending that V&V Test Phase activities should begin.

1.3 ANOMALIES

During the V&V Requirements Phase, it was determined that a requirement to change the state of an output once each cycle had been omitted from the TSAP SRS (Reference 5.13). In accordance with the NQQP, Paragraph 10.1.3, this design document discrepancy was documented and resolved on a Document Review Comment Sheet (DRCS). The TSAP SRS was corrected prior to completion of the Requirements Phase

and this activity was documented in the TSAP V&V Requirements Phase Summary Report (Reference 5.6).

During the V&V Design Phase, several discrepancies associated with the TSAP SDD (Reference 5.14) and the TSAP FDs (Reference 5.15) were identified. In accordance with the NQQP, Paragraph 10.1.3, these design document discrepancies were documented and resolved on a DRCS. The TSAP SDD and TSAP FDs were corrected prior to completion of the Design Phase and these activities were documented in the TSAP V&V Design Phase Summary Report (Reference 5.7).

No TSAP source code anomalies were identified during the V&V Implementation Phase as documented in the TSAP V&V Implementation Phase Summary Report (Reference 5.8).

2.0 VALIDATION

2.1 ACTIVITIES

Validation activities associated with the Tricon v10 Nuclear Qualification Project Test Specimen Application Program (TSAP) consisted of the V&V life cycle Test Phase.

The Test Phase was implemented in accordance with the Nuclear Qualification Quality Plan (NQQP) (Reference 5.2) and the TSAP Software Verification and Validation Plan (Reference 5.3). In addition to these documents, the Test Phase was also implemented in accordance with the TSAP Validation Test Specification & Plan (Reference 5.5) and the TSAP Software Validation Test (SVT) Procedure (Reference 5.10).

Test Phase validation activities included the validation of the TSAP, completion of the STA, development of the Test Phase Summary Report and development of the validation Test Report.

The specific details of all V&V Test Phase activities are provided in Section 2.2.

2.2 RESULTS

During the V&V Test Phase, the following results were achieved:

1. The TSAP Software Validation Test (SVT) Procedure (Reference 5.10) was successfully executed;
2. Test Specimen Application Program (TSAP) V10_TSAP_REV_0.PT2 was satisfactorily validated in accordance with the requirements of the TSAP Validation Test Specification & Plan (Reference 5.5);
3. The TSAP Software Validation Test Report (Reference 5.11) was approved and issued;

4. The IEEE 1012 Software Traceability Analysis (STA) (Reference 5.12) was prepared, by updating the Implementation Phase STA, approved and issued; and
5. The V&V Test Phase Summary Report (Reference 5.9) was issued recommending that V&V Installation and Checkout Phase activities should begin.

2.3 ANOMALIES

No TSAP anomalies where identified during the V&V Test Phase as documented in the TSAP V&V Test Phase Summary Report (Reference 5.9).

3.0 ASSESSMENT

All Tricon v10 Nuclear Qualification Project TSAP V&V requirements have been satisfied in accordance with the Nuclear Qualification Quality Plan (NQQP) (Reference 5.2) and the TSAP Software Verification and Validation Plan (Reference 5.3).

Based upon the results of all TSAP V&V life cycle activities (References 5.6, 5.7, 5.8 and 5.9), the TSAP satisfies the requirements of EPRI TR-107330 (Reference 5.16) and meets its functional and design requirements.

The TSAP is capable of performing its intended function during Tricon v10 Nuclear Qualification Project testing activities.

4.0 RECOMMENDATIONS

For future nuclear qualification projects, it is recommended that project planning require input from more sources during TSAP requirements and design phases. The TSAP, as designed, is significantly more complicated than required by EPRI TR-107330 (Reference 5.16) and this resulted in a significant amount of resources being expended during its design, implementation and testing. However, it should be noted that the requirements and design processes used during the development of the Tricon v10 Nuclear Qualification TSAP did result in a validated TSAP, with no major complications encountered, and is, therefore, considered satisfactory.

5.0 REFERENCES

5.1 IEEE Std 1012 - 1998, IEEE Standard for Software Verification and Validation

5.2 9600164-002, Nuclear Qualification Quality Plan (NQQP)

5.3 9600164-513, TSAP Software Verification and Validation Plan (SVVP)

5.4 9600164-714, TSAP Verification Specification & Plan

5.5 9600164-715, TSAP Validation Test Specification & Plan

5.6 9600164-710, TSAP V&V Requirements Phase Summary Report

5.7 9600164-711, TSAP V&V Design Phase Summary Report

5.8 9600164-712, TSAP Implementation Phase Summary Report

5.9 9600164-713, TSAP Test Phase Summary Report

5.10 9600164-716, TSAP Software Validation Test (SVT) Procedure

5.11 9600164-717, TSAP Software Validation Test Report

5.12 9600164-720, TSAP IEEE 1012 Software Traceability Analysis (STA)

5.13 9600164-517, TSAP Software Requirement Specification (SRS)

5.14 9600164-518, TSAP Software Design Description (SDD)

5.15 9600164-600 – 614, TSAP Function Diagrams (FD)

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