

**Project:** TRICON v10 NUCLEAR QUALIFICATION PROJECT

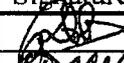
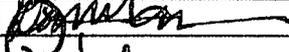
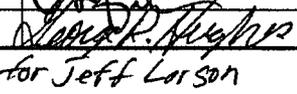
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**TEST SPECIMEN APPLICATION PROGRAM  
 SOFTWARE VERIFICATION AND VALIDATION PLAN**

**Document No: 9600164-513**

**Revision 2**

**December 1, 2006**

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### Revision History

<b>Revision</b>	<b>Date</b>	<b>Description</b>	<b>Author</b>
0	08/11/06	Initial issue.	Ravindar Baskaran
1	11/03/06	The SVVP was modified to allow for optional use of dynamic testing during the Implementation Phase of the TSAP.	Ravindar Baskaran
2	12/01/06	The SVVP was modified to delete the Final V&V Report as an output of the V&V Test Phase and, instead, require that a draft of be prepared during this phase.	Ravindar Baskaran



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## 1. INTRODUCTION

### 1.1 Purpose

The purpose of this Software Verification and Validation Plan (SVVP) is to define the verification and validation effort that will be applied to the Tricon v10 Nuclear Qualification Project Test Specimen Application Program (TSAP). This plan also establishes the requirements to track, monitor and report on various tasks performed during the life cycle phases of the TSAP. This will include participating in procedure, management and document reviews, as appropriate.

The main objective of this SVVP is to ensure that the TSAP developed for the Tricon v10 Nuclear Qualification Project meets all requirements of EPRI TR-107330 and the Master Test Plan (MTP). This SVVP clearly indicates the verification and validation tasks that will be accomplished during the various phases of the TSAP life cycle.

This SVVP also defines when, how and by whom specific Verification and Validation (V&V) activities will be performed and includes the V&V methodologies, options and alternatives. Methodologies identified in this Plan are used to verify and validate TSAP development during its requirements, design, development, implementation and operation and maintenance life cycle phases.

This TSAP SVVP is prepared in accordance with NQQP Section 10.2, Application Program Development, and follows the guidelines described in IEEE 1012-1998, IEEE Standard for Software Verification and Validation and IEEE 1074-1997, IEEE Standard for Developing Software Life Cycle Processes, including the guidance of associated NRC Regulatory Guides (RG). The associated RGs are as follows:

1. RG1.153 Rev 1, 1, Jun. 1996 - Criteria for Safety Systems
2. RG1.168, Feb. 2004 - Verification, Validation, Reviews and Audits for Digital Computer Software Used in Safety Systems of Nuclear Power Plants.
3. RG1.170, Aug. 1997 - Software Test Documentation for Digital Computer Software Used in Safety Systems of Nuclear Power Plants.
4. RG1.171, Aug. 1997 - Software Unit Testing for Digital Computer Software used in Safety Systems of Nuclear Power Plants.
5. RG1.172, Aug. 1997 - Software Requirements Specifications for Digital Computers Software Used in Safety Systems of Nuclear Power Plants.
6. RG1.173, Aug. 1997 - Developing Software Life Cycle Processes For Computer Software Used in Safety Systems of Nuclear Power Plants.

The Tricon v10 Nuclear Qualification Project TSAP will be developed using the Invensys Triconex TriStation 1131 software, which is solely designed for this purpose. TriStation 1131 is itself a fully validated software product, approved and independently certified for use in developing

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safety-critical application programs. Hence, the controls necessary for TSAP development are considerably simpler than what would be required for software developed from the ground up.

The TS1131 software allows the user to configure an application program using different programming techniques like Ladder Diagram (LD), Function Block Diagram (FBD), Structured Text (ST) and Cause and Effect Matrix Programming Language (CEMPL). Since the code and the detailed design are essentially the same when using FBD, the Tricon v10 Nuclear Qualification Project TSAP will be developed using this technique. Consistent with this design approach, V&V activities are simplified during the design and implementation life cycle phases of the TSAP.

## 1.2 Scope

This Plan specifies the reviews and tests to be executed, in whole or in part, during Tricon v10 Nuclear Qualification Project TSAP verification and validation. The Plan limits itself in specifying the activities required to verify and validate the TSAP for conformance to the requirements of EPRI TR-107330 and the MTP as implemented via the TSAP Software Requirements Specification (SRS).

This SVVP does not include V&V of the TriStation 1131 Developer’s Workbench, which is the tool used to develop the Tricon v10 Nuclear Qualification Project TSAP, or the TUT embedded operating system firmware; refer to the TSAP Software Quality Assurance Plan (SQAP) for further information. This SVVP addresses the attributes of all non-TSAP software only to the extent of verifying that inputs, outputs, and displays are correct as specified.

This Plan addresses the following activities:

- a) The conditions and requirements that must be met or completed prior to the start of formal V&V as per Section 9.8.5, Conduct Of Testing, of the NQQP;
- b) All personnel and processes required to conduct the V&V;
- c) Identification of the TSAP for testing the Tricon system and IO Modules as defined in the Software Design Description (SDD);
- d) The test deliverables to be generated during and after TSAP V&V; and
- e) The process to be followed in reporting test results, observations and discrepancies as per NQQP Section 10.4.3, Anomaly Reporting, and Section 10.4.4, Final V&V Report.

## 2. REFERENCE DOCUMENTS

The following documents were used as references during the development of this SVVP:

1. EDM – Engineering Department Manual
2. QAM - Triconex Quality Assurance Manual
3. EPRI TR-107330 - Generic Requirements Specifications for Qualifying a Commercially Available PLC Safety Related Applications in Nuclear Power Plant
4. IEEE 1012-1998 - IEEE Standard for Software Verification and Validation
5. IEEE 1074-1997 - IEEE Standard for Developing Software Life Cycle Processes
6. MTP – Master Test Plan (9600164-500)
7. NQA-1-1994, Sub Part 2.7 - Quality Assurance Requirements of Computer Software for Nuclear Facility Application
8. NQQP - Tricon v10 Nuclear Qualification Quality Plan (9600164-002)
9. SQAP – Software Quality Assurance Plan (9600164-537)

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### 3. DEFINITIONS

**Anomaly** – An anomaly is any condition that deviates from expectations based on requirements specifications, design documents, user documents, standards, etc. or from an individual’s perceptions or experiences.

**Baseline** - A work product that has been formally reviewed and agreed upon that there after serves as the basis for further development, and can be changed only through formal configuration management procedures.

**Component Testing** – Testing conducted to verify a TSAP function or a function block for which a separate specification is available and whether these functions or function blocks correctly implement the design.

**Deliverable** - Document or product submitted to satisfy a requirement.

**Detail Design** - This life cycle activity contains typical work packages used during the design stages of the project, such as prepare Software Requirements Specification, prepare Software Design Description, prepare Test Specimen description, develop design reports, etc.

**Implementation** - This life cycle activity contains typical work packages used during the hardware staging and software installation phase of the project. Typical work packages include review Master Test Plan, procure materials, review Master Configuration List, and prepare test procedures and cases.

**Inspection** - A static analysis technique that relies on visual examination of development or purchased products to detect errors, violations of development standards, specifications, and other problems.

**Integration** - This life cycle activity contains typical work packages used during the functional system testing that occurs per the approved test procedures. Typical work packages include: stage system, verify control strategies, and document verification and resolve discrepancies. The integration activities should demonstrate that all functions were integrated properly and subsystem tests required by this SVVP were successfully completed. A part of Validation testing (hardware integration) is performed during this activity. For the purposes of this SVVP, integration overlaps the Implementation and test (Validation) phase activities and is contained therein.

**Life Cycle** - A set of interrelated activities or processes that result in the development or assessment of software and hardware products. For V&V purposes, no life cycle is concluded until its development products are verified and validated according to the defined tasks in the SVVP.

**Management Activity** - This life cycle activity contains the generic activities and tasks, which may be employed by any party that manages its respective processes. Examples of tasks are: 1) prepare plans for execution; and 2) report on the results of plan execution. This activity is applicable to all TSAP development life cycles.

**Phase** - A period of TSAP development activity associated with a life cycle.

**Phase Summary Report** – This report serves to summarize and consolidate the results of V&V activities performed by the V&V Team for each life cycle of the TSAP.

**Regression Testing** – The retesting of the TSAP that has been modified to ensure that any bugs have been fixed and that no other previously working functions have failed as a result of the corrective action and that newly added features have not created problems with previous versions of the TSAP.

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**Traceability Matrix** - In a TSAP development process, the traceability matrix is a table that correlates the high-level requirements and detailed requirements of the TSAP to the matching parts of high-level design, detailed design, test plan and test case. It can also be used between any two documents that require a traceability relationship to determine completeness.

**Validation** - Confirmation by examination and provisions of objective evidence that the particular requirements for a specific intended use are fulfilled.

**Verification** - Confirmation by examination and provisions of objective evidence that specified requirements have been fulfilled.

#### 4. V & V OVERVIEW

The V&V approach as described in IEEE 1012-1998, Annex C, Section C.4.1 will be used for conducting Project V&V activities. These activities will be planned and scheduled in accordance with the Project schedule and the Nuclear Qualification Quality Plan (NQQP).

The V&V efforts are accomplished using a separate V&V organization not associated with the design organization as identified in the NQQP. This independent V&V process is consistent with the process described in Annex C.4.1 of IEEE 1012-1998.

This section of the plan covers in detail the Organization, resources, responsibilities, tools, techniques and methodologies necessary to perform the TSAP software V&V.

The Tricon v10 Nuclear Qualification Project TSAP is designed to continuously monitor and verify Tricon-Under-Test (TUT) component functionality during all phases of qualification testing. For the Tricon v10 Nuclear Qualification Project, one (1) TSAP will be developed to satisfy all the stated requirements of EPRI TR-107330. Consistent with this methodology, the TSAP is considered test software, which is not being qualified for a nuclear power plant application. The TSAP developed for the Tricon v10 Nuclear Qualification Project shall be classified as Software Integrity Level 4 in accordance with IEEE Std. 1012-1998, Section 4. However, as the TSAP is not being qualified for a nuclear power plant application, V&V Phase Criticality Analysis, Risk Analysis and Hazard Analysis are not required.

#### 4.1 Organization And Responsibilities

##### 4.1.1 Project V&V Organization

Refer to Section 3.0, Project Organization, of the NQQP for a detailed organization chart of the Tricon v10 Nuclear Qualification Project.

##### 4.1.2 V&V Responsibilities

Refer to Section 4.12, TSAP Verification & Validation (V&V) Team, of the NQQP for more details about the responsibility held by each individual involved in the verification and validation of the Tricon v10 Nuclear Qualification Project TSAP.

#### 4.2 Project Schedule

The Project Manager (PM) has developed a Project Schedule that includes the schedule for TSAP V&V activities and required milestone delivery dates.



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#### 4.4 Tools, Techniques And Methodologies

##### 4.4.1 General

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These analyses shall be prepared in the form of a matrix beginning with the requirements of EPRI TR-107330. These IEEE 1012 Software Traceability Analyses (STA) shall delineate and trace all technical requirements from the source document through Invensys Triconex design documents, e.g., Software Requirements Specifications and Test Specifications, to their method of implementation and/or satisfaction.

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The main purpose of this V&V activity is to ensure that all TSAP EPRI TR-107330 requirements related to the Main Processor (MP) module, Input/Output (I/O) module, Special modules, etc. are satisfied and their satisfaction is documented.

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**4.4.3 Features To Be Verified**

The developed TSAP shall be verified and validated with respect to the following standards and specifications:

- 1) EPRI TR-107330
- 2) TSAP Software Requirements Specification (SRS)
- 3) TSAP Software Design Description (SDD)
- 4) Master Test Plan (MTP)

The functionality of the TSAP shall be verified and validated with special emphasis on the following:

- 1) Main Processor (MP) modules
- 2) Input/Output modules
- 3) Tricon Communication module (TCM)
- 4) Support of the Prudency and Operability tests as established by the MTP

**4.5 V&V Deliverables**

The following are the list of deliverables as a part of the TSAP V&V effort.

1. TSAP Software Verification and Validation Plan
2. TSAP Test Plan/Specification
3. Executed TSAP Software Validation Procedure
4. TSAP life cycle phase Software Traceability Analyses
5. A verified and validated TSAP
6. TSAP Software Verification and Validation Reports, Phase Summary Reports and the Final V&V Report.

**4.6 TSAP Verification Tasks**

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TRICONEX PRODUCTS – INVENSYS PROCESS SYSTEMS

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## 5. LIFE CYCLE VERIFICATION AND VALIDATION

This Section of the Plan explains the V&V activities that shall be performed over the entire life cycle of the TSAP. Even though many tasks may cross different life cycle phases, the SVVP is written and V&V shall be managed with tasks assigned to a particular life cycle phase. The following are the life cycle phases applicable to development of the Tricon v10 Nuclear Qualification Project TSAP:

1. Management Phase of V&V
2. Requirement Phase of V&V
3. Design Phase of V&V
4. Implementation Phase of V&V
5. Test Phase (Validation Phase) of V&V
6. Installation and Checkout Phase
7. Operation and Maintenance Phase
8. Retirement Phase

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## 5.2 Requirements Phase V&V

The requirements phase is the period in the software life cycle during which the requirements, such as functional capabilities for the TSAP, are defined and documented. The main document of the requirements phase, the SRS should accurately state the intended purpose of the TSAP. The SRS should be traceable forward through successive development phases and into the design, code and test documentation. The requirement phase V&V shall include the following minimum tasks:

- 1) IEEE 1012 TSAP Software Requirements Traceability Analysis (STA)
- 2) TSAP Software Requirements Evaluation

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**5.2.1 TSAP Software Requirements Traceability Analysis**

The main goal of the IEEE 1012 Software Requirements Traceability Analysis (STA) is to establish that the SRS completely satisfies all of the capabilities and functionalities as specified in EPRI TR-107330. Apart from this goal, it is also necessary to establish that the SRS is structured so that the requirements may be traced through subsequent development stages.

Traceability analysis will be initiated concurrent with the SRS and shall be completed (Paragraph 5.5.1) prior to use of the TSAP in qualification testing to ensure that such testing is consistent with all applicable requirements. The NQQP provides the requirements for STA review, approval and control.

**Inputs:**

- a) EPRI TR-107330
- b) Tricon v10 Nuclear Qualification Project Master Test Plan (MTP)

**Task:**

The following are tasks associated with the Requirements Phase analysis activity:

- a) Confirm compliance with EPRI TR-103770 Standards
- b) Review the SRS against the EPRI Standard requirements
- c) Review the SRS against the MTP
- d) Develop a Software Traceability Analysis (STA)

**Verification Techniques:**

a, b

**Outputs:**

- a) Conformed TSAP Software Requirements Specification
- b) Draft Project Software Traceability Analysis (STA)
- c) A V&V Summary Report on the Requirements Phase Analysis activities, including any identified discrepancies and possible enhancements
- d) Documented follow-up that changes and corrections are incorporated into the requirements phase documents

**5.2.2 TSAP Software Requirements Evaluation**

The main goal of the requirements evaluation is to verify the correctness, consistency, completeness, readability and testability of the SRS. During the requirements evaluation, the requirements inputs shall be verified against the governing requirements.

**Inputs:**

- a) EPRI TR-107330 Standard
- b) Tricon v10 Nuclear Qualification Project Master Test Plan (MTP)

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**Task:**

The following are tasks associated with the Requirements Phase evaluation activity:

- a) Evaluate the adequacy of the allocation of system requirements to TSAP software
- b) Evaluate the feasibility of accomplishing TSAP objectives and goals with assigned requirements
- c) Ensure TSAP requirements are complete, accurate, testable, and unambiguous
- d) Verify the system architecture and composition, ensuring that the overall integrated system meets the TSAP needs and objectives

**Verification Techniques:**

a, b

**Outputs:**

- a) Software Traceability Analysis for the TSAP requirements life cycle phase
- b) Verified SRS
- c) Documented follow-up that changes and corrections are incorporated into the requirements phase documents
- d) A V&V Phase Summary Report on the Requirements Phase evaluation activities, including any reported deficiencies and possible enhancements

**5.3 Design Phase V&V**

The design phase is the period in the software life cycle during which the designs for architecture, software components and interfaces are created, documented and verified to satisfy requirements. Design phase V&V activity also provides an additional opportunity to locate faults not previously detected in the requirements. Design Phase V&V shall include the following minimum tasks:

- 1) Design Traceability Analysis
- 2) Software Design Evaluation
- 3) Develop Test Specifications and Plans

For details about connections between the TUT and test equipments, stimulation Tricon and host PC refer to TSAP SDD.

**5.3.1 TSAP Design Traceability Analysis**

The main goal of the Design Traceability Analysis is to establish the trace in both directions between the SDD to SRS and SRS to SDD in order to identify the relationship for correctness, consistency, completeness and accuracy.

**Inputs:**

- a) SRS
- b) STA (From the SRS Traceability Analysis)

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**Task:**

- a) Verify the SDD against the SRS
- b) Update Software Traceability Analysis for TSAP design specification

**Verification Techniques:**

a, b

**Outputs:**

- a) Draft Software Traceability Analysis updated for all completed Design Phase output documents
- b) A V&V Phase Summary Report on the Design Phase analysis activities and possible enhancements
- c) Documented follow-up that changes and corrections are incorporated into the design phase documents

**5.3.2 TSAP Software Design Evaluation**

The main goal of the software design evaluation is to evaluate the SDD for correctness, completeness, consistency, accuracy and testability.

**Inputs:**

- a) SRS
- b) Requirements Trace Table (From the SRS Traceability Analysis)

**Task:**

The following tasks are involved in this phase:

- a) Verify the SDD
- b) Draft SVT

**Verification Techniques:**

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**Outputs:**

- a) TSAP Test Specifications and Plans
- b) Draft TSAP Software Validation Test Procedure
- c) A V&V Summary Report on the Design Phase evaluation activities, including any reported deficiencies and possible enhancements.
- d) Verified SDD
- e) Documented follow-up that changes and corrections are incorporated into the design phase documents.

**5.3.3 TSAP Test Specifications and Plans**

Test Specifications and Plans are prepared in accordance with the requirements of the NQQP, Section 9.0.

**5.4 Implementation Phase V&V**

The implementation phase is the period in the software life cycle during which the TSAP is created from design documentation and then debugged. In the implementation phase, the V&V tasks are focused on the TSAP source code and the determination of how well it conforms to the design specifications and coding standards.

The following minimum tasks are included in the implementation phase of the V&V activity:

- 1) TSAP source code traceability analysis
- 2) Source code evaluation
- 3) Component test execution
- 4) Generate verification test cases and procedures, as applicable
- 5) Document TSAP source code anomalies

**5.4.1 TSAP Software Traceability Analysis**

**Inputs:**

- a) SDD
- b) Design Trace Table (From the SDD Traceability Analysis)

**Task:**

The following tasks are involved in this phase:

- a) Update Software Traceability Analysis for TSAP source code

**Verification Techniques:**

a, b

**Outputs:**

- a) Draft Software Traceability Analysis for all completed TSAP source code

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- b) A V&V Summary Report on the Implementation Phase analysis activities, including any reported deficiencies and possible enhancements.
- c) Documented follow-up that changes and corrections are incorporated into the TSAP source code

**5.4.2 TSAP Source Code Evaluation**

**Inputs:**

- a) TSAP Software Design Description
- b) Functional Diagrams
- c) Tricon v10 Nuclear Qualification Project Master Test Plan (MTP)

**Task:**

The following tasks are involved in this phase:

- a) Evaluate TSAP source code with SDD
- b) Ensure the TSAP source code is complete, accurate, testable and unambiguous
- c) Finalize SVT
- d) Identify and document source code anomalies in accordance with the requirements of the NQQP, Paragraph 10.4.3.

**Verification Techniques:**

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**Outputs:**

- a) Reviewed TSAP source code
- b) TSAP Software Validation Test procedure
- c) A V&V Summary Report on the Implementation Phase evaluation activities, including any reported deficiencies and possible enhancements
- d) Documented follow-up that changes and corrections are incorporated into the TSAP source code
- e) Anomaly Reports

**5.4.3 TSAP Component Test Execution**

**Inputs:**

- a) Reviewed TSAP source code

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**Task:**

The following tasks are involved in this phase:

- a) Develop and validate TSAP source code test drivers (a .pt2 file, i.e., application program, to drive the developed TSAP), as applicable.
- b) Conduct TSAP verification test cases, as applicable.

**Verification Techniques:**

a, b

**Outputs:**

- a) A .pt2 file for custom built function block testing
- b) A V&V Summary Report on the Component Test Execution activities, including any reported deficiencies and possible enhancements
- c) Documented follow-up that changes and corrections are incorporated into the TSAP source code
- d) Documented verification test results
- e) Verified TSAP
- f) Anomaly Reports

**5.5 Test Phase (Validation)**

The test phase is the period of time in the software life cycle during which TSAP is evaluated and integrated and the TSAP is evaluated to ensure that all functional requirements have been satisfied. This validation process will provide a reasonable degree of assurance that the design requirements were adequately and accurately translated through the requirements, design, and implementation phases.

The integrated system validation process is the method used to determine whether the TSAP meets its functional requirements; therefore, the fully integrated system with the actual system hardware and software are required.

**5.5.1 Test Execution**

**Inputs:**

- a) System design drawings (system architecture, chassis arrangement and cable schedules)
- b) Source code (.pt2 file)
- c) TSAP SVVP
- d) TSAP Software Validation Procedure
- e) Test Software Configuration

**Task:**

The following tasks are involved in this phase:

- a) Validation of TSAP software against design specification requirements shall include:

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- 1) TSAP software functional checkout
- 2) TSAP software performance testing
- b) The TSAP functional performance is validated using the “black box” method, i.e., validating the TSAP outputs by means of actuating prescribed inputs. Validation is performed using the limits and ranges designated in the TSAP functional requirements, which are included in the SDD. Major validation areas shall be:
  - 1) Functional operation.
  - 2) Demonstrates TSAP’s performance within the overall system.
  - 3) External and internal interfaces – demonstrates that critical software functions execute together as specified
  - 4) As necessary regression testing – demonstrates changes made to the software do not introduce conditions for new hazards or errors
- c) Validation procedures are updated, if required.
- d) Final documentation is:
  - 1) Complete and consistent with procedures
  - 2) Accurate and compatible with the delivered TSAP
  - 3) Complies with applicable standards
- e) Validation test results are:
  - 1) Complete and consistent with procedures
  - 2) Traceable to functional requirements
  - 3) Documented in a test report
  - 4) Final V&V Report preparation

**Validation Techniques:**

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**Outputs:**

The output documents for the Test Phase are:

- a) Completed Test procedures
- b) Test Report(s)

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- c) Approved and issued STA for all completed Test Phase output documents
- d) A V&V phase summary report on Test Phase review activities, including reported deficiencies and possible enhancements
- e) Documented follow-up that changes and corrections are incorporated into the test phase documents
- f) **Draft of the TSAP Final V&V Report**
- g) Anomaly Report(s)
- h) Validated TSAP

**5.6 Installation And Checkout Phase**

The verified and validated TSAP is installed into the Tricon-Under-Test (TUT); the TUT is then subjected to the Start-Up & Checkout Procedure. This life cycle phase is the responsibility of Invensys Triconex.

If revisions to the TSAP are required during this life cycle phase, they are documented and controlled in accordance with the NQQP. The revisions are subject to the V&V requirements of this SVVP, including the conduct of regression test, as required. The appropriate Phase Summary Report will be prepared and, as necessary, the Final V&V Report will be updated.

If revisions to the TSAP are not required during this life cycle phase, documents required by the SVVP will stand as issued and a Phase Summary Report will not be generated.

**5.7 Operations And Maintenance Phase**

Once installed into the TUT and after completion of the Start-Up & Checkout procedure, the TSAP is executed while the TUT is subjected to Prudency, Operability and other qualification tests. This life cycle phase is the responsibility of Invensys Triconex.

If revisions to the TSAP are required during this life cycle phase, they are documented and controlled in accordance with the NQQP. The revisions are subject to the V&V requirements of this SVVP, including the conduct of regression test, as required. The appropriate Phase Summary Report will be prepared and, as necessary, the Final V&V Report will be updated.

If revisions to the TSAP are not required during this life cycle phase, documents required by the SVVP will stand as issued and a Phase Summary Report will not be generated.

**5.8 Retirement Phase**

Upon completion of the Tricon v10 Nuclear Qualification Project, the TSAP (.pt2), all associated design documents and V&V reports shall be archived and subjected to configuration control as per NQQP. This life cycle phase is the responsibility of Invensys Triconex.

At this time, the TSAP is considered to be retired as it relates to the Project; however, the Tricon v10 Nuclear Qualification Project TSAP may be used for future Invensys Triconex nuclear qualification activities and, as such, it will be subject to all requirements of this SVVP.

**6. TSAP SOFTWARE VERIFICATION AND VALIDATION REPORTS**

This plan generates the following three types of reports for the Tricon v10 Nuclear Qualification Project:

- A. TSAP V&V Phase Summary Reports

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- B. TSAP Final V&V Report
- C. Software Traceability Analyses

### 6.1 TSAP V&V Phase Summary Report

This Section addresses V&V Phase Summary Reports for the TSAP life cycle phases. The TSAP life cycle considerations for which Phase Summary Reports will be generated are:

1. Requirements
2. Design
3. Implementation
4. Test

V&V Phase Summary Reports shall be prepared by the V&V Team within an appropriate amount of time after the end of each life cycle phase but no later than the beginning of the next phase. The reports shall contain:

1. A description of the activities performed;
2. A summary of the activity results;
3. The phase outputs;
4. A summary of anomalies and resolutions during the implementation and test phases;
5. An assessment of the software quality;
6. Identification and assessment of technical and management risks; and
7. Recommendations.

V&V Phase Summary Reports shall be reviewed, as a minimum, by a member of the V&V Team and the Project Quality Assurance Engineer (PQAE) and be approved by the IPS Nuclear Quality Director.

Upon approval, V&V Phase Summary Reports shall be processed in accordance with section 7.0, Configuration Management and Document Control, of the NQQP. Revisions to V&V Phase Summary Reports shall be prepared, reviewed and approved in the same manner as the initial issue.

The V&V Phase Summary Reports shall include, at a minimum, the following sections:

**PURPOSE**

Describe the purpose of the Phase Summary Report.

**SCOPE**

State the objective of the phase, i.e., what the phase was intended to accomplish.

**TASKS PERFORMED**

Describe what tasks were performed and what approach was taken to satisfy the requirements of the governing specifications. This includes identification of the phase input documents.

**TASK RESULTS**

Provide a summary of the task results and any relevant discussion of the results. This includes identification of the phase output documents.

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**ANOMALIES**

Provide a summary of the documented deficiencies identified during the performance of the phase tasks and the resolutions.

**SOFTWARE QUALITY**

Provide an assessment of the software quality at the conclusion of the life cycle.

**TECHNICAL AND MANAGEMENT RISKS**

Describe any risks associated with the continuation of the application development to the next phase.

**RECOMMENDATIONS**

Provide recommendations for procession to the next life cycle phase.

The V&V Phase Summary Reports may include any of the following sections, if applicable:

**REFERENCES**

List the documents that were used or referred to during the creation of the Phase Summary Report.

**APPENDICES**

Include the Appendices that are part of the Phase Summary Report.

**ATTACHMENTS**

Include the documents that are Attachments to the Phase Summary Report.

**6.2 TSAP Final V&V Report**

Upon successful completion of the verification and validation process **through the TSAP V&V Test Phase**, a Final V&V Report, which summarizes all TSAP verification and validation activities, shall be prepared. This report shall be prepared, reviewed and approved in accordance with NQQP.

**6.3 Software Traceability Analyses**

Software Traceability Analysis links together the TSAP design requirements, design specifications, and testing requirements. An explicit traceability among these activities and associated documentation shall be provided for review. The Traceability Analysis shall consist of a matrix with line items for requirements, specifications and tests.

A TSAP traceability analysis is an important tool to verify that all functions are linked to established specifications and established test procedures. The TSAP traceability analysis report shall consist of:

1. Conformance that each function described in SDD has been implemented in the source code and vice versa; and
2. Conformance that each function is testable and can be traced to a test case and vice versa.

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## 7. VERIFICATION AND VALIDATION ADMINISTRATIVE PROCEDURES

### 7.1 Anomaly Reporting And Resolution

For details on how TSAP anomalies are identified, dispositioned and tracked refer to Section 10.4.3 “Anomaly Reporting” of the NQQP. Deficiencies at any stage shall be addressed by the procedures defined in Section 9.9, Deficiencies Identified during Testing, of the NQQP.

For TSAP anomalies, testing may proceed as governed by the anomaly classification assigned in accordance with Section 10.4.3, Anomaly Reporting, of the NQQP. Upon completion of a nuclear qualification test, the TRB shall review the test results for completeness, accuracy and acceptability. This review shall be conducted in accordance with Section 9.5, Test Document Review and Approval, of the NQQP and include, as a minimum, the completed Test Procedure, Test Log, the associated Test Report and all related QPARs.

### 7.2 Suspension And Resumption Criteria

The actions to be taken in the event failures are detected during V&V validation testing activities will be handled on a case-by-case basis. The suspension and resumption criteria for TSAP validation testing are delineated in NQQP, Section 9.9, Deficiencies Identified During Testing.

### 7.3 Task Iteration Policy

This SVVP addresses two types of actions: Task and Activity. Project Tasks are procedure driven and are derived from the inherent quality system. Project Activities are requirements driven and are derived from the related specifications.

The V&V Team is responsible to determine the extent to which a V&V task will be repeated when its input or procedure is changed.

### 7.4 Deviation Policy

The basis of the V&V program is provided by the NQQP, SQAP and SVVP. Deviations from these documents are not expected and shall be dealt with on a case-by-case basis. As necessary, such deviations will be documented and evaluated using the ARR process in accordance with the QAM. In all cases, the PQAE or the IPS Nuclear Quality Director shall concur with the issuance of an ARR.

The Project V&V Team shall, based on the extent of a deviation:

1. Document the task or deviation, rationale and effect on the Project; and
2. Identify the plans, procedures, and processes affected.
3. As necessary, conduct retesting as prescribed by the ARR or an associated QPAR.

### 7.5 Control Procedures

Control procedures are required for effective control of the TSAP and the results of the TSAP V&V activity. The NQQP and SQAP provide the overall quality plan for the project and shall be effectively applied to the TSAP V&V efforts.



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#### 7.6 Standards, Practices, And Conventions

Standards, practices and conventions shall be applied as delineated in the NQQP, SQAP and this SVVP.

### 8. V&V DOCUMENTATION REQUIREMENTS

The NQQP and the SVVP shall define the purpose, format and contents of the following documents.

1. Test Plan (NQQP)
2. Test Design (NQQP)
3. Test Cases (SVVP)
4. Test Procedures (NQQP and SVVP)
5. Test Results (NQQP and SVVP)
6. Software Traceability Analyses (SVVP)