

Attachments 9-11 to the Enclosure contain Proprietary Information - Withhold Under 10 CFR 2.390

Enclosure
Attachment 5
PG&E Letter DCL-12-069

**Invensys Operations Management Document
“993754-1-802, Revision 2, Software Verification and Validation Plan”**

Attachments 9-11 to the Enclosure contain Proprietary Information
When separated from Attachments 9-11 to the Enclosure, this cover sheet is decontrolled.

Project:	PG&E PROCESS PROTECTION SYSTEM REPLACEMENT
Purchase Order No.:	3500897372
Project Sales Order:	993754

PACIFIC GAS & ELECTRIC COMPANY

NUCLEAR SAFETY-RELATED PROCESS PROTECTION SYSTEM REPLACEMENT DIABLO CANYON POWER PLANT

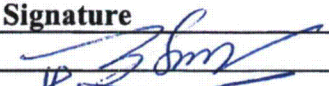
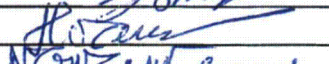
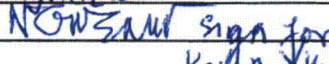
SOFTWARE VERIFICATION AND VALIDATION PLAN (SVVP)

Document No. 993754-1-802 (-NP)

Revision 2

June 7, 2012

Non -Proprietary copy per 10CFR2.390
- Areas of InvenSYS Operations Management proprietary
information, marked as [P], have been redacted based
on 10CFR2.390(a)(4).

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Document:	993754-1-802	Title:	Software Verification And Validation Plan		
Revision:	2	Page:	2 of 50	Date:	06/07/2012

Document Change History			
Revision	Date	Change	Author
0	08/17/11	Initial Release	S. Phan
1	10/13/11	Revise the Figure 3. PPS Replacement Project Organization Structure. Revise the Figure 2 Tricon Protection Set Architecture for the PPS Replacement System.	S. Phan
2	06/07/12	<p>Section 1.1: Add paragraph "Compliance with IEEE Standard 1012-1998 is demonstrated by the attached compliance matrix, 993754-1-802, Software Verification and Validation Plan Compliance to IEEE Standard 1012-1998 [Attachment 1]".</p> <p>Section 3.1: Revised the definition for "Acceptance Testing".</p> <p>Section 4.1.2: Added a listing of the documents independent review IV&V activities.</p> <p>Revised section 4.3:</p> <ul style="list-style-type: none"> Added discussion of mapping IV&V tasks to IEEE Standard 1012. Added Table 1 "Minimum V&V task assigned to SIL -4 PPS Replacement Project". <p>Section 4.4: Added discussion of resource summary for IV&V activities.</p> <p>Added Section 5.1.1 Management of V&V.</p> <p>Section 5.2: Revised the discussion of verification activities during project life cycle.</p> <p>Section 5.2: Added reference to IEEE Standard 829; added clarifying statements regarding component, integration, and system-level testing activities.</p> <p>Revised consistent with the use of "life cycle" entire document.</p> <p>Added section: 8.0</p> <p>Revised figure 2</p> <p>Revised some typos</p> <p>Added IV&V task generate and verify the Software Verification Test Report, 993754-1n2-853 at section 5.2.4.2.1, and 5.2.4.2.2.</p> <p>Deleted section 8. Attachment 1</p> <p>Added Appendix D - Compliance Matrix: Software Verification and Validation Plan Compliance to IEEE Standard 1012-1998</p>	S. Phan

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1. Introduction

1.1. Purpose

The purpose of this Software Verification and Validation Plan (SVVP) is to establish the requirements for the Verification and Validation (V&V) process to be applied to the TriStation Application Project (TSAP) software developed for the Process Protection System (PPS) Replacement Project, running on the Safety-Related V10 Tricon platform hardware. This SVVP is described in the Software Quality Assurance Plan (SQAP) [Ref 2.4.8]. This SVVP includes the TSAP software and V10 Tricon system hardware interface with Advanced Logic System (ALS) (but not the ALS functions themselves), and Maintenance Workstation (MWS).

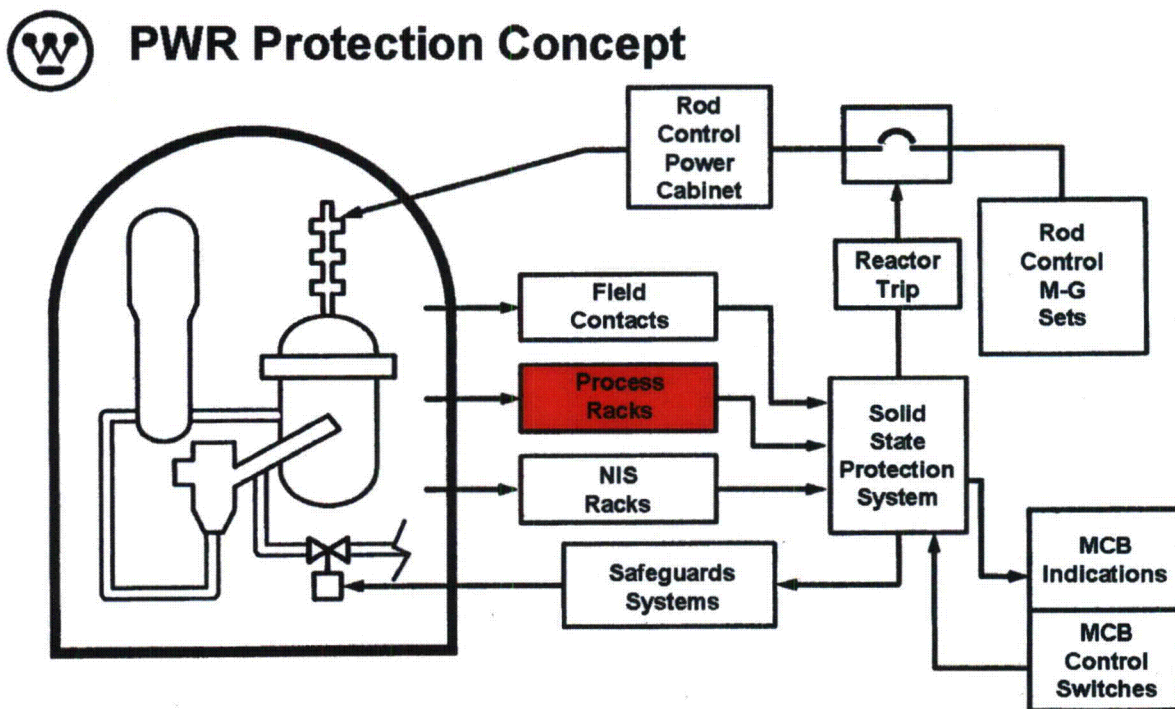


Figure 1. Westinghouse PWR Reactor Protection Concept.

This SVVP also defines when, how, and by whom specific V&V activities are to be performed, including options and alternatives as required, and description of the various V&V methodologies used. Various methods will be used to detect errors in the TSAP software and hardware interface during the system design, development, and implementation process.

The PPS is classified as Nuclear Safety-Related (Class 1E) and all project activities shall comply with the applicable requirements of the InvenSYS Operation Management Nuclear Quality

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Assurance Manual (IOM-Q2) [Ref 2.4.1] and any additional quality requirements specified in the Project Quality Plan (PQP) [Ref 2.4.7].

This SVVP is prepared in accordance with PPM 7.0 [Ref 2.4.4], Application Program Development, and follows the guidelines described in IEEE 1012-1998 "IEEE Standard for Software Verification and Validation" [Ref 2.1.6], IEEE 1074-1995, "IEEE Standard for Developing Software Life Cycle Processes" [Ref 2.1.9], and Branch Technical Position 7-14, "Guidance on Software Reviews for Digital Computer-Based Instrumentation and Control Systems", [Ref 2.2.6]. Compliance with IEEE Standard 1012-1998 is demonstrated by the attached Compliance Matrix: Software Verification and Validation Plan Compliance to IEEE Standard 1012-1998 [Appendix D].

The goals of this SVVP are to:

- 1) Provide an integrated solution that will improve V10 Tricon Protection Set reliability and availability.
- 2) Reduce costs by detecting system errors as early as possible.
- 3) Provide objective evidence for system performance evaluation.
- 4) Demonstrate compliance with customer requirements and the Invensys QA Program.
- 5) This SVVP describes the verification and validation requirements for the PPS Replacement Project.

1.2. Scope

The V&V activities described in this SVVP apply to V10 Tricon Protection Set software, documents, and other items that are produced during implementation of this project. The boundaries of the V&V activities include I/O inputs from ALS and data link inputs via the TCM for the MWS. These ALS inputs to the V10 Tricon will be simulated during the factory acceptance test, as discussed in Invensys document 993754-1-813, Validation Test Plan. This SVVP does not include V&V of the software running on ALS and the MWS as shown in Figure 2. This V&V process does not include operating systems, software, or firmware other than the TSAP generated by the TriStation 1131 (TS 1131). This SVVP does not include V&V of the TS1131 programming tool, which will be used to develop the TSAP software. Software generated by Vendors other than Invensys Operations Management are verified and validated by the originating organization under separate programs. This SVVP addresses the attributes of third-party software only to the extent of verifying that the inputs, outputs, and displays are correct as specified.

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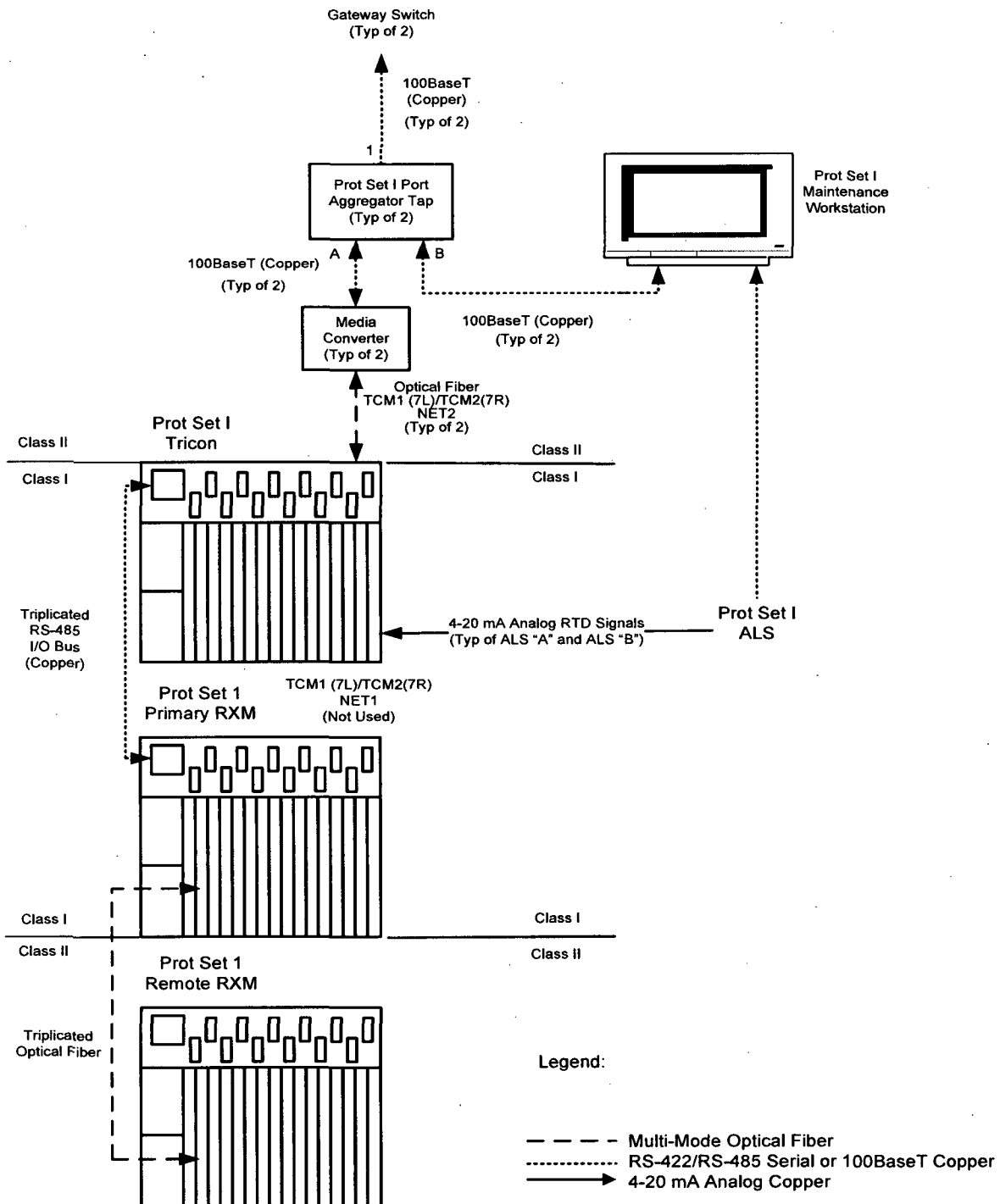


Figure 2. Tricon Protection Set Architecture for the PPS Replacement System.

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1.3. Verification and Validation Program Implementation

V&V activities are integrated into the project activities from beginning to end and include Planning, Requirements, Design, Implementation, and Test Phases of the system software life cycle. During the Planning Phase the SVVP is developed to describe Nuclear IV&V activities, and also define when, how and by whom specific IV&V activities that are to be performed, includes various V&V methodologies used. The Requirements Phase entails the review of the Software Requirements Specification (SRS) developed based on customer design inputs [Ref 2.3]. Verification of each of these documents is performed to ensure that the applicable customer requirements have been adequately and accurately translated. The Design Phase is development of the Software Design Description (SDD). Again, verification of the SDD is performed to ensure that the applicable customer requirements have been adequately and accurately translated. The Implementation Phase addresses the implementation of the SDD. The Implementation Phase activities are verified throughout the implementation process to ensure that the design has been correctly implemented. When all Implementation Phase activities have been completed, the system validation Test Phase activities are performed. These activities yield objective evidence that the operation of the system is consistent with the specified system requirements.

Traceability is critical to the success of the project. Traceability is achieved through the development of a Project Traceability Matrix (PTM). Traceability shall be determined sufficient if one is able to trace requirements from design inputs to design outputs and to trace requirement from design outputs back to design inputs (forward and backward traceability).

The PTM has shared responsibility. The Requirement and Design Phase PTM are prepared by Nuclear Delivery, where the Implementation and Test Phase PTM are prepared by Nuclear IV&V.

Refer to Appendix A of this SVVP for a typical V&V Flow Chart.

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2. References

2.1. Industry Documents

- 2.1.1 IEEE 7 – 4.3.2 – 2003, Standard Criteria for Digital Computers in Safety Systems of Nuclear Power Generating Stations.
- 2.1.2 IEEE 730 – 1998, Software Quality Assurance Plans.
- 2.1.3 IEEE 829 – 1983, Standard for Software Test Documentation.
- 2.1.4 IEEE 830 – 1998, Recommended Practice for Software Requirements Specifications.
- 2.1.5 IEEE 1008 – 1987, Standard for Software Unit Testing.
- 2.1.6 IEEE 1012 – 1998, Standard for Software Verification and Validation.
- 2.1.7 IEEE 1028 – 1997, Standard for Software Reviews and Audits.
- 2.1.8 IEEE 1059 – 1993, Guide for Software Verification and Validation Plans.
- 2.1.9 IEEE 1074 – 1995, Standard for Developing Software Life Cycle Processes.
- 2.1.10 IEEE 1228 – 1994, IEEE Standard for Software Safety Plans.
- 2.1.11 IEEE 828 – 1998, IEEE Standard for Software Configuration Management Plans.

2.2. NRC Documents

- 2.2.1 U.S. NRC Regulatory Guide (RG) 1.168, Rev. 1, Verification, Validation, Reviews, and Audits for Digital Computer Software Used in Safety Systems of Nuclear Power Plants.
- 2.2.2 U.S. NRC RG-1.169, Configuration Management Plans for Digital Computer Software Used in Safety Systems of Nuclear Power Plants.
- 2.2.3 U.S. NRC RG-1.172, Software Requirements Specifications for Digital Computer Software Used in Safety Systems of Nuclear Power Plants.
- 2.2.4 U.S. NRC Digital Instrumentation and Controls Interim Staff Guidance (ISG6), DI&C-ISG-06.
- 2.2.5 NUREG-0800, Standard Review Plan, Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition, Chapter 7 – Instrumentation and Controls, Revision 4, U.S. Nuclear Regulatory Commission, dated June 1997.
- 2.2.6 DI&C-ISG-01, Digital Instrumentation and Controls Task Working Group #1: Cyber Security Interim Staff Guidance, Revision 0, U.S. Nuclear Regulatory Commission, dated December 31, 2007.
- 2.2.6 Branch Technical Position 7-14, Guidance on Software Reviews for Digital Computer-Based Instrumentation and Control Systems, Revision 5, U.S. Nuclear Regulatory Commission, dated March 2007.
- 2.2.7 U.S. NUREG/CR-6430, Software Safety Hazard Analysis.
- 2.2.8 U.S. NRC RG-1.170, Software Test Documentation for Digital Computer Software Used in Safety Systems of Nuclear Power Plants.
- 2.2.9 U.S. NRC RG-1.171, Software Unit Testing for Digital Computer Software Used in Safety Systems of Nuclear Power Plants.

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2.3. PG&E Documents

- 2.3.1 PG&E Purchase Order # 3500897372.
- 2.3.2 Master Service Agreement # 4600016720.
- 2.3.3 PG&E 08-0015-SP-001, Function Requirements Specification (FRS).
- 2.3.4 PG&E Process Protection System (PPS) Replacement Conceptual Design Document.
- 2.3.5 PG&E Process Protection System (PPS) Replacement Interface Requirements Specification.
- 2.3.6 PG&E Process Protection System Controller Transfer Functions Design Input Specification, 10115-J-NPG.
- 2.3.7 PG&E Process Protection System (PPS) Function Block Diagram (FBD) 08-0015-D Series.

2.4. InvenSYS Triconex Documents

- 2.4.1 IOM-Q2, InvenSYS Operation Management Nuclear Quality Assurance Manual.
- 2.4.2 NSIPM, Nuclear Systems Integration Program Manual, NTX-SER-09-21.
- 2.4.3 Quality Procedure Manual (QPM).
- 2.4.4 InvenSYS Project Procedures Manual (PPMs).
- 2.4.5 InvenSYS 9100150-001, Tricon V10 Nuclear Qualified Equipment List (NQEL).
- 2.4.6 Project Management Plan (PMP), 993754-1-905.
- 2.4.7 Project Quality Plan (PQP), 993754-1-900.
- 2.4.8 Software Quality Assurance Plan (SQAP), 993754-1-801.
- 2.4.9 V10 Tricon Topical Report, 7286-1-545, Revision 4, InvenSYS Operations Management (ADAMS Accession Number ML110140443), dated December 20, 2010.
- 2.4.10 Tricon V10 Conformance to Regulatory Guide 1.152, NTX-SER-10-14.
- 2.4.11 RG1.152 Conformance Report, 993754-1-913.

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3. Definition and Acronyms

3.1. Definitions

Acceptance Testing: Testing conducted in an operational environment to determine whether a system satisfies its acceptance criteria (i.e., initial requirements and current needs of its user) and to enable the customer to determine whether to accept the system.

Anomaly: A condition observed in the documentation or operation of hardware and software that deviates from expectations based on previously verified hardware/software products or reference documents. A critical anomaly is one that must be resolved before the V&V effort proceeds to the next phase.

Baseline: A work product that has been formally reviewed and accepted by the involved parties as the revision level approved for the Implementation Phase of the project. A baseline should be changed only through formal configuration management procedures. Some baselines may be the project deliverables, while others provide the basis for further work.

Component Testing: Testing conducted to verify the implementation of the design for a system hardware/software element (e.g., unit, module, function block etc.).

Criticality: A subjective description of the intended use and application of the system. Software and hardware criticality properties may include: safety, security, complexity, reliability, performance, or other characteristics.

Criticality Analysis: A structured evaluation of the software characteristics (e.g., safety, security, complexity, performance) for severity of impact of system failure, system degradation, or failure to meet software requirements or system objectives.

Deliverable: Document or product submitted to satisfy a requirement of the contract.

Demonstration: This is the life cycle activity where customer Factory Acceptance Testing occurs.

Detailed Design: This life cycle activity contains typical work packages used during the design stages of the project, such as: review design input, prepare P&IDs, define design control strategies, develop design reports, etc.

Hazard Analysis: A systematic qualitative or quantitative evaluation of software for undesirable outcomes resulting from the development or operation of a system. These outcomes may include injury, illness, death, mission failure, economic loss, environmental loss, or adverse social impact. This evaluation may include screening or analysis methods to categorize, eliminate, reduce, or mitigate hazards.

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 detailed implementation input, procure materials, configure control strategies, 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.

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Integration Testing: An orderly progression of testing of incremental pieces of the software program in which software elements, hardware elements, or both are combined and tested until the entire system has been integrated to show compliance with the programs design, and capabilities and requirements of the system. Typical work packages include verification of control strategies, document verification and resolution of discrepancies. Verification is performed during this activity.

Integrity level: A denotation of a range of values of a property of an item necessary to maintain system risks within acceptable limits. For items that perform mitigating functions, the property is the reliability with which the item must perform the mitigating function. For items whose failure can lead to a threat, the property is the limit on the frequency of that failure.

Life Cycle Activity: A set of interrelated activities or processes that result in the development or assessment of software and hardware products. For V&V purposes, no process 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; 2) initiate the plans, etc. This activity is applicable to all life cycle phases.

Phase: Defined for this document as a step in life cycle activity.

Preliminary Design: This life cycle activity contains typical work packages used in the preliminary stages of a project, such as: contract review, define control strategies, develop Project Plans, and describe change management.

Project Traceability Matrix: A documented matrix indicating the origin of the requirements, their implementing design output documentation and the corresponding testing requirements.

Unit: An assembly of interconnected components that constitutes an identifiable device, instrument, or piece of equipment. A unit can be disconnected, removed as a single piece, and replaced by a spare. It has definable performance characteristics that permit it to be tested as a single assembly. Software functions that meet the requirements of this definition are also defined as a unit. By this definition, the words "unit" and "module" (hardware/software) are interchangeable.

Verification: The process of evaluating a system or component to determine whether the products of a given development phase satisfy the conditions imposed at the start of that phase.

Validation: The process of evaluating a system or component during or at the end of the development process to determine whether it satisfies specified requirements.

3.2. Acronyms

ALS	Advanced Logic System
DRCS	Document Review Comment Sheet
FAT	Factory Acceptance Test
FMEA	Failure Modes and Effects Analysis
HRS	Hardware Requirements Specification
HVT	Hardware Validation Test
IO	Input/Output

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IV&V	Independent Verification and Validation
M&TE	Measurement and Test Equipment
MWS	Maintenance Workstation
ND	Nuclear Delivery
NQA	Nuclear Quality Assurance
NRC	Nuclear Regulatory Commission
NIST	National Institute of Standards and Technology
PE	Project Engineer
PQAE	Project Quality Assurance Engineer
PQP	Project Quality Plan
PLC	Programmable Logic Controller
PM	Project Manager
PPM	Project Procedures Manual
PPS	Process Protect System
PS	Protection Set
PTM	Project Traceability Matrix
QA	Quality Assurance
QPM	Quality Procedures Manual
SDC	Software Development Checklist
SDD	Software Design Description
SIDR	System Integration Deficiency Report
SIL	Software Integrity Level
SQAP	System Quality Assurance Plan
SRS	Software Requirements Specification
SVVP	Software Verification and Validation Plan
Tricon	Programmable Logic Process Controller by Triconex
TS1131	TriStation 1131 Developer's Workbench
TSAP	TriStation Application Project
V&V	Verification and Validation

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4. V&V Overview

The V&V approach as described in IEEE 1012-1998 will be used for conducting project V&V activities. These activities will be planned and scheduled per the project schedule, the applicable PPMs [Ref 2.4.4], and the PQP.

The V&V efforts shall be accomplished using a Nuclear Independent Verification & Validation organization not associated with the Nuclear Delivery organization as identified in the PQP. This independent V&V process is consistent with the process described in Annex C.4.1 of IEEE 1012-1998.

4.1. Organization

4.1.1. V&V Organization

The V&V organization for the InvenSYS Operations Management V&V team is shown in Figure 3. The figure shows the organizations involved in the PPS Replacement Project: Nuclear Independent Verification and Validation (IV&V); Nuclear Delivery (ND); and Nuclear Quality Assurance (NQA).

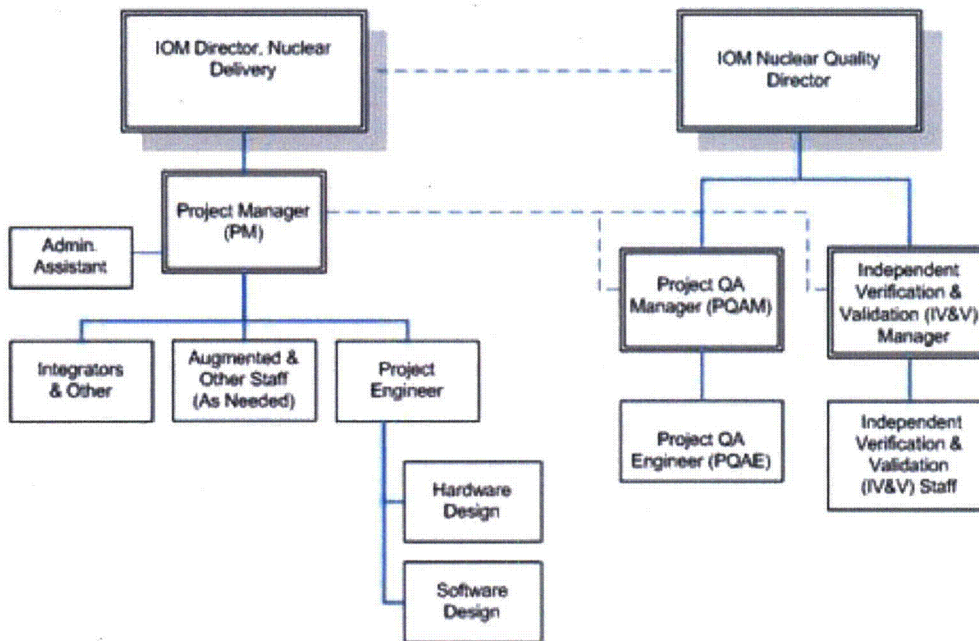


Figure 3. PPS Replacement Project Organization Structure

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The Nuclear IV&V group shall be responsible for performing independent design document review, software design verification, generating and verifying the V&V documents, and performing V&V test executions. The Nuclear IV&V group will define its own schedule for the V&V activities without any restrictions or influence from the Nuclear Delivery group.

The PPS Replacement Project team members from Nuclear IV&V include the IV&V Team Lead and three IV&V Engineers.

During day-to-day V&V execution, the Nuclear IV&V team will interface with ND engineers and the PQAE as needed. When anomalies have been identified during the project life cycle, cases may arise that require escalating the resolution to higher levels of management within InvenSYS Operations Management. In Figure 3, the lines of communication between the organizations at the Management and Director levels are shown by the dashed lines. As shown, issues requiring escalation can be escalated up separate and independent reporting chains up to the Director level. In those rare cases that the Director level is not sufficient, IOM-Q2 allows escalation to the Regional and Global Director levels and still maintain the necessary managerial, technical, and financial independence necessary for compliance with NRC requirements contained in, for example, Regulatory Guide 1.168 [Ref 2.2.1].

4.1.2. V&V Responsibilities

InvenSYS Operations Management will assign a core group of engineers and support staff to the PPS Replacement Project. As project needs change, assigned personnel will be added or removed. The following individuals will be involved in the PPS Replacement Project:

Director –

P

The Nuclear IV&V Director reports to the Global Director of Quality, and is responsible for providing resources and expertise to V&V operations.

Manager –

P

The Nuclear IV&V Manager reports to the Director, Nuclear IV&V, and is responsible for implementation of the nuclear IV&V activities conducted at the InvenSYS Operations Management Lake Forest Facility. The IV&V Manager has the authority and organizational freedom to ensure that V&V activities are managerially, technically, and financially independent of the development organization. The IV&V Manager approves Project IV&V documents, e.g., Software Verification and Validation Plan (SVVP), IV&V Phase Reports, etc.

Staff –

P

The Nuclear IV&V Staff reports to the Nuclear IV&V Manager. Some of the major functions and responsibilities for the IV&V Staff are listed below.

- Prepare the Software Verification and Validation Plan (SVVP).
- Prepare the Software Safety Plan (SSP).
- Prepare the Safety Analysis (Criticality/Hazards/Risk/Interface).
- Prepare the Validation and Verification Test Plans.

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- Perform independent review/verification of software design documents.
- Generate and execute Verification and Validation test procedures, and prepare reports on the test results.
- Perform independent review/verification of test documents.

Test Director/IV&V Lead

The Test Director, also the IV&V Lead is a member of the IV&V Staff and reports to the IV&V Manager. The Test Director is responsible for the overall conduct of assigned test activities and participates in Project Review Committee (PRC) activities.

P

The following is a listing of the documents generated as a result of PPS Replacement Project V&V activities. These documents shall be controlled per PPM 4.0 [Ref 2.4.4]. The specific documents shall be developed and processed in accordance with the controlling Project Procedures Manual. These documents shall be generated by the Nuclear IV&V staff, with the exception of the PTM¹ and will be verified by Nuclear IV&V staff and approved by Nuclear IV&V Manager.

- 1) Software Verification and Validation Plan, 993754-1-802.
- 2) Software Safety Plan, 993754-1-911.
- 3) Safety Analysis (Criticality/ Hazard/ Risk/ Interface), 993754-1-915.
- 4) Validation Test Plan, 993754-1-813.
- 5) Project Traceability Matrix, 993754-1-804¹
- 6) Phase Summary Report(s) (Requirements, Design, Implementation, and Test Phase)
- 7) Software Verification Test Plan, 993754-1-868.
- 8) Validation Test Specification, 993754-1-812.
- 9) Software Verification Test Specification, 993754-1-869.
- 10) Software Verification Test Procedure and Test Case, 993754-1n²-870-k³.
- 11) Software Verification Test Case Execution and Report, 993754-1n²-853.
- 12) Hardware Validation Test Procedure, 993754-1n²-902-0.
- 13) Factory Acceptance Test Procedure, 993754-1n²-902-1.
- 14) Validation Test Report.
 - a. Hardware Validation Test Report, 993754-1n²-854-0.
 - b. Factory Acceptance Test Report, 993754-1n²-854-1.
- 15) Project Traceability Matrix¹, 993754-1-804.
- 16) V&V Phase Summary Reports, 993754-1-856 to -863.

¹ The PTMs has shared responsibility. The Requirements and Design Phase PTM are prepared by Nuclear Delivery, where the Implementation and Test Phase PTMs are prepared by Nuclear IV&V.

² n = 1 through 4 to match the Protection Set. Project Plans are not required to have this additional number because the plans are at the project level and not specific to a particular Protection Set.

³ k = 1 through i, where i is the number of programs in the V10 Tricon Protection Set application program (PT2 file).

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17) System Response Time Confirmation Report, 993754-1-818.

18) V&V Final Report.

The following is a listing of the documents independent review as a result of PPS Replacement Project V&V activities.

- 1) Purchase Order Compliance Matrix
- 2) Software Configuration Management Plan
- 3) Software Integration Plan
- 4) Software Requirements Specification
- 5) Maximum TSAP Scan Time
- 6) Project Traceability Matrix
- 7) Software Design Description
- 8) Application Code (PT2 files)
- 9) Input / Output List
- 10) System Accuracy Report.

4.2. Project Schedule

The project schedule was developed based on the life cycle defined in the NSIPM [Ref 2.4.2] as implemented by the PPM. Adhering to the procedures will also assure the required project deliverables will satisfy PG&E technical and NRC regulatory requirements, and that the necessary supporting collateral will be generated to support the safety conclusions of both ND and Nuclear IV&V.

4.3. Software Integrity Level (SIL)

IEEE 1012-1998, Section 4, provides guidance on selection of criticality levels for software based on its intended use and application. Criticality levels are established by a subjective evaluation of attributes. IEEE 1012 uses Integrity Levels to quantify criticality. The assigned Software Integrity Levels may vary as the software evolves. However, the software and hardware developed for nuclear safety related portions of this project will be used in a safety-critical application and shall be classified as Software Integrity Level 4 (Criticality-High).

The V&V effort will perform the minimum V&V tasks as shown in Table 1 for the assigned Software Integrity Level.

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The project documents listed below identify the types of design outputs at the system level and will be assigned a Software Integrity Level 4 rating:

- 1) Project Plans, Software V&V Plan, Software Safety Plan.
- 2) Project Specifications/Reports
 - a. Hardware Requirements Specification (HRS)

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- b. Software Requirements Specification (SRS)
 - c. Software Design Description (SDD)
 - d. Validation Test Specification
 - e. Verification Test Specification
 - f. V&V Activity Summary Reports
- 3) System Design Integration Drawings.
 - 4) TriStation Application Project application program.
 - 5) Verification and Validation Test Produces, Test Reports, Final V&V Report.

4.4. Resource Summary

Staffing

Execution of Nuclear IV&V activities requires the following staff:

- Nuclear IV&V Lead
- Nuclear IV&V Engineer 1
- Nuclear IV&V Engineer 2
- Nuclear IV&V Engineer 3
- Nuclear IV&V Engineer 4

The PPS Replacement Project requires a Nuclear IV&V staff with combined knowledge and experience with the U.S. NRC regulations and processes, software engineering life cycle management, and verification and validation of nuclear safety-related hardware and software. Specific skills and knowledge are required in the following areas:

- Application of U.S. NRC Regulatory Guides relevant to safety-system software development.
- Application of U.S. NRC Regulatory Guides relevant to independent verification and validation of safety-system software.
- Application of relevant U.S. NRC staff guidance related to design and licensing of nuclear safety systems, such as DI&C-ISG -06 [Ref 2.2.4].
- Understanding of staff guidance contained in Chapter 7 of U.S. NRC NUREG-0800, Standard Review Plan [Ref 2.2.5].
- Application of Institute of Electrical and Electronics Engineers standards (e.g., those endorsed by U.S. NRC Regulatory Guides) relevant to independent verification and validation of software for nuclear safety-related applications.
- Implementation of the InvenSYS Operations Management NSIPM and PPM to nuclear safety-related projects.
- Knowledgeable in the use of the TS1131 Developer's Workbench, InvenSYS Emulator Test Driver (ETD) and Microsoft Excel.
- Knowledgeable of Tricon hardware.
- Knowledgeable of safety and protection systems.
- Experienced with reading and interpreting P&IDs, instrument diagrams, and function block diagrams.

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Tools

Tool required for IV&V activities are detailed in Section 4.5.1 of this plan.

Facilities

For system validation, the InvenSys test area will be required to be secured, configuration controlled, and otherwise suitable environment. The test area will support the deliverable Tricon hardware and associated test apparatus, to allow Nuclear IV&V personal to validate the combined hardware/software system, prior to delivery to the customer.

Finances

Aside from ordinary budget for personnel and tools, Nuclear IV&V has no financial resource needs.

Special Procedural Requirements

Several procedures unique to IV&V test activities will be employed. These procedures are described along with the specific activities in the IV&V test plans, specifications, and procedures.

4.5. Tools, Techniques, and Methods

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5. V&V Process

The following explains the correlation of the Invensys Operations Management NSIPM life cycle to IEEE 1012-1998 life cycle processes and activities.

Table 2 Life cycle Mapping

IEEE 1012 V&V Life cycle Processes	NSIPM V&V Life cycle Processes
Management	Throughout (Primary Planning)
Acquisition	Acquisition
Supply	Throughout (Planning)
Development <ul style="list-style-type: none"> • Concept • Requirements • Design • Implementation • Test 	Development <ul style="list-style-type: none"> • Planning • Requirements • Design • Implementation • Test
Operation	Delivery (scope of supply based on contract requirement.)
Maintenance	

1) Management

The Management process is applicable to all phases the Project. Invensys Operations Management shall meet the task performance requirements for management of V&V as stated in IEEE 1012-1998. All acquisition process tasks shall be performed as Management process activities. The supply process contract review task shall be performed as a Management process activity.

2) Acquisition

Prior to accepting a Purchase Order, Nuclear Delivery reviews it to identify any compliance issues. Until the review is completed, the Purchase Order is placed on Nuclear Hold until the Acceptance Review is completed. A compliance matrix is created to determine that the PG&E requirements can be satisfied. Nuclear IV&V reviews the compliance matrix in accordance with IEEE Standard 1012-1998. Any deviations and exceptions to PG&E requirements will be documented by Invensys Operations Management and approved by PG&E.

3) Supply

This process is applicable for purposes of contract review, because a purchase order has been offered and accepted. The supply process is initiated by either a decision to prepare a proposal to answer an acquirer's request for proposal, or by signing and entering into a contract with the acquirer to provide the system. This process also verifies that the request for proposal requirements and contract requirements are consistent.

4) Development

This process is applicable to the Project and incorporates the majority of the project activities. Invensys Operations Management shall meet the task performance requirements for Development process activities as outlined below:

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- a. Concept V&V – System architecture, allocation of system requirements to hardware, software, and user interface components, and a specific implementation are delineated in the system requirements and technical specifications provided to Invensys Operations Management. Therefore these activities are not applicable.
- b. Requirements V&V – Invensys Operations Management shall meet the task performance requirements for Requirements V&V as stated in IEEE 1012-1998.
- c. Design V&V – Invensys shall meet the task performance requirements for Design V&V as stated in IEEE 1012-1998.
- d. Implementation V&V – Invensys Operations Management shall meet the task performance requirements for Implementation V&V as stated in IEEE 1012-1998. Regression testing, as recommended by RG 1.168 [Ref 2.2.1], is accommodated in this phase by the identification of required retest in the Anomaly Report.
- e. Test V&V – Invensys Operations Management shall meet the task performance requirements for Test V&V as stated in IEEE 1012-1998.
- f. Installation and Checkout V&V – Invensys shall meet the task performance requirements for Installation and Checkout V&V as stated in IEEE 1012-1998 with the exception of the Final V&V Report which is produced in the Test phase.

During the development process, the following tasks shall be performed and the V&V task reports issued if any changes to design inputs occur.

- a. Evaluation of New Constraints
- b. Proposed Change Assessment

These tasks shall be performed as part of the Baseline Change Assessment task included in each life cycle activity.

5) Operation

This phase covers the operation of the software product and operational support to users after installation normal commissioning. It addresses operational testing, system operations, and user support with respect to the operating procedures.

This is not applicable to the PPS Replacement Project after delivery to the customer. Plant operating procedures are not within the Invensys Operations Management scope of work.

6) Maintenance

This applies to modifications to code and associated documentation caused by a problem or a need for improvement or adaptation of the product. It addresses modifications, migration, or retirement of the software during the operational process.

Contract requirements are defined by the Warranty terms. These requirements shall be maintained, along with processes for bug fixes (hardware and software), repairs, and available upgrades. However, these processes are controlled at a corporate level, and outside the scope of the PPS Replacement Project once the system is delivered.

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5.1. V&V Management – General

Project personnel resources are managed separately between the ND staff and the Nuclear IV&V staff. The Nuclear IV&V Manager ensures that the V&V process is not compromised due to schedule conflict causing a change in personnel, which may lead to a less rigorous level of technical review.

Good communication between the ND staff and the Nuclear IV&V staff is a significant contributor to a proper V&V process. One of the objectives of the V&V process is to verify the assumptions incorporated into the design solution. The V&V process must ensure that the basis for an assumption is correct and that the system requirements are met within the constraints of the assumptions.

5.1.1. Management of V&V

The V&V effort shall perform, the following V&V tasks for Management of V&V as appropriate for the SIL 4 PPS Replacement Project:

- Software Verification and Validation Plan (SVVP) Generation
- Baseline Change Assessment
- Management Review of V&V
- Management and Technical Review Support
- Interface With Organizational and Supporting Processes

5.2. Life Cycle Verification Activities

The V&V effort shall comply with the task descriptions, inputs, and outputs as described in Table 1 of IEEE Standard 1012-1998. The PPS Replacement Project uses the life cycle process defined in the NSIPM as implemented by the PPM. The minimum V&V tasks that are implemented during the project life cycle are as follows:

- Planning
- Requirements
- Design
- Implementation
- Test

This PPS Replacement Project will deliver a configured system that meets the requirements of the design defined by the customer. This will include translating the design requirements into the system, and will rely heavily on engineering documents to facilitate this translation.

Tricon system hardware and software were verified as part of the initial qualification program for Tricon hardware and software as identified in the Nuclear Qualified Equipment List (NQEL) [Ref 2.4.5]. The TS1131 programming tool is included in the set of software approved by the NRC. In accordance with PPM 7.0, Application Program Development, the TSAP software and

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system hardware life cycle activities or phases applicable to the verification and validation of the PPS Replacement Project are described above.

5.2.1. Planning Phase

The planning of V&V is applicable to all software life cycles. Software development is an iterative process. The V&V effort will usually identify the need to make certain software or document changes requiring subsequent new tasks to implement these changes. V&V tasks are re-performed if errors are discovered in the V&V inputs or outputs.

The Project will utilize the design review methodology to perform the design verification process as defined in PPM 2.0 [Ref 2.4.4].

Should baseline documents require modification, the changes shall be controlled in accordance with PPM 2.0 and PPM 3.0 as appropriate. The design review will use both an in-process project peer review and an independent review by an independent review engineer.

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5.2.2. Requirements Phase

The system requirements form the basis for all system design and verification activities, and are used throughout the rest of the system life cycle. They serve as the basis for the verification of design specifications, which are the basis of design implementation. The system requirements are the bases against which all validation activities are performed. The intent of verifying the system requirements is to ensure that the requirements are complete, correct, consistent, clear, traceable, and testable.

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5.2.3. Design Phase

The purpose of design verification is to ensure that the design documents are adequately and accurately translated from the design inputs prior to design implementation. The design specification documents define and provide the details of the system design structure, information flow, processing steps, and other aspects required to be implemented in order to satisfy the system design requirements. The intent of design verification is to ensure that the design documents are clear and understandable, accurate, correct, consistent, complete, implementable, testable, and traceable to the design requirements. The V&V tasks are conducted on an ongoing basis. Test planning and verifying the conformance of the design are major objectives of these V&V activities.

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5.2.4. Implementation Phase

The purpose of implementation verification is to ensure the implementation documents are clear, understandable, logically correct, and adequately and correctly translate the design specifications. The objectives of the implementation documents are to facilitate the effective production, testing, use, transfer, and conversion to a different environment with consideration of future modifications and traceability to design specifications. In general, the verification activities should answer the following questions:

- 1) Does the implementation satisfy design specifications?
- 2) Does implementation follow established design standards?
- 3) Does implementation follow established documentation standards?
- 4) Does the implementation serve production, test, use, transfer, and other needs of the customer?

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5.2.4.1 Implementation Phase required inputs

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5.2.5. Test Phase

The above verification process should provide a reasonable degree of assurance that the design requirements were adequately and accurately translated through the Requirements, Design, and Implementation Phases.

The system validation process determines whether the system meets its functional requirements (functional operations, system level performance, external interfaces, internal interfaces, testability, and other requirements stated during the requirements phase). System validation evaluates the system performance against simulated inputs at the factory test facility. The integrated system with the actual V10 Tricon Protection Set hardware and software is required.

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5.3. Post Test/Pre-Ship Checkout

Upon completion of the Test Phase activities, a system integration document package shall be assembled in accordance with PPM 8.0[Ref 2.4.4]. The package shall include all as-built drawings, completed test procedures, and customer-specified documents.

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6. V&V Reporting

V&V reporting shall occur throughout the entire life cycle and include the following reporting mechanisms.

6.1. V&V Activity Summary Report

Summary reports are required for the following phases:

- Requirements Phase
- Design Phase
- Implementation Phase
- Test Phase

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6.2. Test Reports

A Software Verification Test Report will be developed per PPM 7.01, Software Verification, to summarize the results of the verification test execution.

A Validation Test Report is required to be developed per PPM 6.0 to summarize the results of the tests performed. This Test Report may be either included the Test Phase summary reports or incorporated them as attachments.

6.3. Anomaly Reports

The guidelines for the SIDR and its associated form are defined in PPM 10.0 [Ref 2.4.4], Nonconformance and Corrective Action. Additional guidelines for SIDR generation can be found in PPM 6.0 and PPM 7.0.

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6.4. V&V Final Report

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7. V&V Administrative Requirements

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7.4. Control Procedures

The control procedures and plans applied to the V&V effort are:

- 1) Project Procedures Manual.
- 2) Project Management Plan.
- 3) Software Quality Assurance Plan.
- 4) Software Configuration Management Plan.
- 5) Software Verification and Validation Plan.

The above documents describe the quality assurance, configuration management, data management, security, and protection of V&V results from unauthorized alterations.

7.5. Software Standards, Practices, and Conventions

Replacement of the Diablo Canyon Power Plant Process Protection System requires NRC approval prior to installation of the V10 Tricon Protection Sets. PG&E intends to submit the License Amendment Request package in the middle of July 2011. There are a number of

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regulatory requirements that must be satisfied, such as 10 CFR 50.55a (h), which incorporates IEEE Standard 603-1991 by reference. There are also a number of regulatory guidance documents that will be followed by Invensys Operations Management during the V10 Tricon Process Protection System development. The regulatory guidance documents endorse consensus standards from the Institute of Electronics and Electrical Engineers (IEEE). The standards to which Invensys Operations Management conforms are also listed below.

The software standards, practices, and conventions that govern the performance of V&V tasks are defined in the Project Procedures Manual. Verification and validation activities shall be performed in accordance with Project Procedure Manual PPM 2.0, PPM 6.0, and PPM 7.0.

NRC Staff Review Guidance:

- NUREG-0800, Standard Review Plan, Chapter 7.
- Branch Technical Position 7-14, Guidance on Software Reviews for Digital Computer-Based Instrumentation and Control Systems.

Regulatory Guides:

- 1.152, Criteria for Use of Computers in Safety Systems of Nuclear Power Plants.
- 1.168, Verification, Validation, Reviews and Audits for Digital Computer Software Used in Safety Systems of Nuclear Power Plants.
- 1.169, Configuration Management Plans for Digital Computer Software Used in Safety Systems of Nuclear Power Plants.
- 1.170, Software Test Documentation for Digital Computer Software Used in Safety Systems of Nuclear Power Plants.
- 1.171, Software Unit Testing for Digital Computer Software Used in Safety Systems of Nuclear Power Plants.
- 1.172, Software Requirements Specifications for Digital Computer Software Used in Safety Systems of Nuclear Power Plants.
- 1.173, Developing Software Life Cycle Processes for Digital Computer Software Used in Safety Systems of Nuclear Power Plants.
- 1.180, Guidelines for Evaluating Electromagnetic and Radio-Frequency Interference in Safety-related Instrumentation and Control Systems.

IEEE standards:

- 603, IEEE Standard Criteria for Safety Systems for Nuclear Power Generating Stations.
- 7-4.3.2, IEEE Standard Criteria for Digital Computers in Safety Systems of Nuclear Power Generating Stations.
- 828, IEEE Standard for Configuration Management Plans.
- 829, IEEE Standard for Software Test Documentation.
- 830, IEEE Recommended Practice for Software Requirements Specifications.
- 1012, IEEE Standard for Software Verification and Validation.
- 1028, IEEE Standard for Software Reviews and Audits.
- 1059, IEEE Guide for Software Verification and Validation Plans.

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- 1074, IEEE Standard for Developing Software Life Cycle Processes.
- 1228, IEEE Standard for Software Safety Plans.

Other standards:

- ANSI/ASME NQA-1-1983, Quality Assurance Program Requirements for Nuclear Facilities.
- ANSI/ASME NQA-1a-1983 (Addenda), Addenda to ANSI/ASME NQA-1-1983, Quality Assurance Program Requirements for Nuclear Facilities.
- ANSI/ASME NQA-1-1994, the basis for the PPM.

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8. Appendices

Appendix A – Typical Verification and Validation Flow Chart

Appendix B – Task Report Log

Appendix C – Task Report Form

Appendix D – Compliance Matrix: SVVP Compliance to IEEE Standard 1012-1998.

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Figure A. Typical V&V Flow Chart

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Appendix B – Task Report Log

i n v e n s y sTM
Operations Management

i n v e n s y sTM
Triconex

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Appendix C – Task Report Form

i n v e n s y sTM
Operations Management

i n v e n s y sTM
Triconex

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Appendix D – Compliance Matrix: SVVP Compliance to IEEE Standard 1012-1998

Compliance Matrix
Software Verification Validation Plan Compliance to IEEE Standard 1012-1998

ID	Section	Description	Inputs	Outputs	COMPLIANCE STATUS CO (Comply) CL (Clarification) DE (Deviation) EX (Exception)	SVVP Correlation	Remarks
IEEE1012:1	TITLE	IEEE Standard for Software Verification and Validation			Title		
IEEE1012:2	1.	1. Overview			Title		
IEEE1012:3	1.	Software verification and validation (V&V) processes determine whether development products of a given activity conform to the requirement of that activity, and whether the software satisfies its intended use and user needs.			Info		
IEEE1012:4	1.	This determination may include analysis, evaluation, review, inspection, assessment, and testing of software products and processes.			Info		
IEEE1012:5	1.	V&V processes assess the software in the context of the system, including the operational environment, hardware, interfacing software, operators, and users.			Info		
IEEE1012:6	1.	This V&V standard is a process standard that addresses all software life cycle processes, including acquisition, supply, development, operation, and maintenance. This standard is compatible with all life cycle models. Not all life cycle models use all of the life cycle processes listed in this standard.			Info		
IEEE1012:7	1.	The user of this standard may invoke those software life cycle processes and the associated V&V processes that apply to the project. A description of the software life cycle processes may be found in ISO/IEC 12207 [B16]1, IEEE Std 1074-1997 [B12], and IEEE/EIA Std 12207.0-1996 [B13]. Annex A maps ISO/IEC 12207 (Tables A.1 and A.2) and IEEE Std 1074-1997 (Table A.3) to the V&V activities and tasks defined in this standard			Info		
IEEE1012:8	1.1	1.1 Purpose			Title		
IEEE1012:9	1.1	The purpose of this standard is to: 1) Establish a common framework for V&V processes, activities, and tasks in support of all software life cycle processes, including acquisition, supply, development, operation, and maintenance processes.			Info		
IEEE1012:10	1.1	2) Define the V&V tasks, required inputs, and required outputs.			Info		
IEEE1012:11	1.1	3) Identify the minimum V&V tasks corresponding to software integrity levels using a four-level scheme.			Info		
IEEE1012:12	1.1	4) Define the content of a Software V&V Plan (SVVP).			Info		
IEEE1012:13	1.2	1.2 Field of application			Title		
IEEE1012:14	1.2	This standard applies to software being developed, maintained, and reused (See Annex D for a description of V&V of reusable software). The term software also includes firmware, microcode, and documentation.			Info		
IEEE1012:15	1.2	Software is a key component that contributes to system behavior and performance. The relationship between software and system behavior requires that software V&V processes must take software interactions with all system components into consideration. The user of this standard should consider V&V as part of the software life cycle processes defined by industry standards such as ISO/IEC 12207 [B16], IEEE Std 1074-1997 [B12], or IEEE/EIA Std 12207.0-1996 [B13].			Info		
IEEE1012:16	1.3	1.3 V&V objectives			Title		
IEEE1012:17	1.3	V&V processes provide an objective assessment of software products and processes throughout the software life cycle. This assessment demonstrates whether the software requirements and system requirements (i.e., those allocated to software) are correct, complete, accurate, consistent, and testable.			Info		
IEEE1012:18	1.3	Other objectives of performing V&V are to 1) Facilitate early detection and correction of software errors;			Info		

Compliance Matrix
Software Verification Validation Plan Compliance to IEEE Standard 1012-1998

ID	Section	Description	Inputs	Outputs	COMPLIANCE STATUS CO (Comply) CL (Clarification) DE (Deviation) EX (Exception)	SVVP Correlation	Remarks
IEEE1012:19	1.3	2) Enhance management insight into process and product risk; and			Info		
IEEE1012:20	1.3	3) Support the software life cycle processes to ensure compliance with program performance, schedule, and budget requirements.			Info		
IEEE1012:21	1.3	The verification process provides supporting evidence that the software and its associated products 1) Comply with requirements (e.g., for correctness, completeness, consistency, accuracy) for all life cycle activities during each life cycle process (acquisition, supply, development, operation, and maintenance);			Info		
IEEE1012:22	1.3	2) Satisfy standards, practices, and conventions during life cycle processes; and			Info		
IEEE1012:23	1.3	3) Establish a basis for assessing the completion of each life cycle activity and for initiating other life cycle activities.			Info		
IEEE1012:24	1.3	The validation process provides supporting evidence that the software satisfies system requirements allocated to software, and solves the right problem (e.g., correctly models physical laws, or implements system business rules).			Info		
IEEE1012:25	1.3	V&V support primary life cycle processes.			Info		
IEEE1012:26	1.3	V&V processes are most effective when conducted in parallel with software development processes; otherwise, V&V objectives may not be realized.			Info		
IEEE1012:27	1.3	In this standard, V&V processes are discussed together because the V&V activities and tasks are interrelated and complementary. In some circumstances, the verification process may be viewed as a process separate from the validation process.			Info		
IEEE1012:28		The V&V task criteria described in Table 1 (starting on page 25) uniquely define the compliance requirements for V&V processes.			Info		
IEEE1012:29	1.4	1.4 Organization of the standard			Title		
IEEE1012:30	1.4	This standard is organized into clauses (Clauses 1 through 7), tables (Tables 1 through 3), figures (Figures 1 through 3), and annexes (Annexes A through I). Clause 1, Figures 1, 2, and 3, and Table 3 contain informative material that provides illustrations, examples, and process flow diagrams useful in understanding and using this standard. Clauses 2, 3, 4, 5, 6, and 7 and Tables 1 and 2 contain the mandatory V&V requirements for this standard. All annexes contain informative material except Annex I.			Info		
IEEE1012:31	1.4	Clause 2 lists normative references. Clause 3 provides a definition of terms, abbreviations, and conventions. Clause 4 explains the concept of using software integrity levels for determining the scope and rigor of V&V processes. Clause 5 describes each primary software life cycle process and lists the V&V activities and tasks associated with the life cycle process. Clause 6 describes the V&V reporting, administrative, and documentation requirements. Clause 7 outlines the content of a Software Verification and Validation Plan (SVVP).			Info		
IEEE1012:32	1.4	Tables 1, 2, and 3 are the focal point of this standard, containing detailed V&V process, activity, and task requirements. Table 1 provides V&V task descriptions, inputs, and outputs for each life cycle process. Table 2 lists minimum V&V tasks required for different software integrity levels. Table 3 provides a list of optional V&V tasks and their suggested applications in the life cycle. These optional V&V tasks may be added to the minimum V&V tasks to tailor the V&V effort to project needs and application specific characteristics.			Info		

Compliance Matrix
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ID	Section	Description	Inputs	Outputs	COMPLIANCE STATUS CO (Comply) CL (Clarification) DE (Deviation) EX (Exception)	SVVP Correlation	Remarks
IEEE1012:33	1.4	Figure 1 provides an example of an overview of the V&V inputs, outputs, and minimum V&V tasks for the highest software integrity level (Integrity Level 4). Figure 2 provides guidelines for scheduling V&V test planning, execution, and verification activities. An example of a phased life cycle model was used in Figures 1 and 2 to illustrate a mapping of the ISO/IEC 12207 life cycle processes to the V&V activities and tasks described in this standard.			Info		
IEEE1012:34	1.4	This standard implements the V&V framework using the terminology of process, activity, and task. Figure 3 illustrates how the V&V processes are subdivided into activities, which in turn have associated tasks. Hereafter, the term V&V effort is used to refer to the framework of the V&V processes, activities, and tasks.			Info		
IEEE1012:35	1.4	The annexes contain informative and normative information useful to implementing the requirements of this standard. Annex A (informative) describes the mapping of ISO/IEC 12207 and IEEE Std 1074-1997 V&V requirements to this standard's V&V activities and tasks. Annex B (informative) provides an example of a risk-based, four-level integrity scheme. Annex C (informative) provides a definition of independent verification and validation (IV&V). Annex D (informative) provides guidelines for conducting V&V of reusable software. Annex E (informative) describes V&V metrics for assessing V&V quality, V&V coverage, and software development processes and products. Such V&V metrics support process improvement tasks of project management. Annex F (informative) illustrates an example of the V&V organizational relationship to other project responsibilities. Annex G (informative) describes optional V&V tasks. Annex H (informative) lists standards and guides that may be useful in interpreting and implementing the V&V tasks identified in this standard. Annex I (normative) contains definitions from existing standards.			Info		
IEEE1012:36	1.5	1.5 Audience			Title		
IEEE1012:37	1.5	The audience for this standard is software suppliers, acquirers, developers, maintainers, V&V practitioners, operators, and managers in both the supplier and acquirer organizations.			Info		
IEEE1012:38	1.6	1.6 Compliance					
IEEE1012:39	1.6	The word shall identifies mandatory requirements to claim compliance with this standard. The words should or may indicate optional tasks that are not required to claim compliance to this standard.			Info		
IEEE1012:40	1.6	Any software integrity level scheme may be used with this standard. The software integrity level scheme used in this standard is not mandatory, but rather, establishes the minimum V&V tasks for the referenced software integrity scheme.			Info		
IEEE1012:41	1.6	To demonstrate compliance to this standard whenever different software integrity schemes are used, the user should map the project-specific software integrity scheme to the integrity scheme used in this standard. This mapping establishes the minimum V&V tasks that should be assigned to the project. Compliance with this standard requires that this mapping and the associated minimum V&V tasks be documented in the SVVP.			Info		

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IEEE1012:42	1.6	Not all V&V efforts are initiated at the start of the life cycle process of acquisition and continued through the maintenance process. If a project uses only selected life cycle processes, then compliance with this standard is achieved if the minimum V&V tasks are implemented for the associated life cycle processes selected for the project. As in all cases, the minimum V&V tasks are defined by the software integrity level assigned to the software. For life cycle processes that are not used by the project, the V&V requirements and tasks for those life cycle processes are optional V&V tasks invoked as needed at the discretion of the project. Specific software development methods and technologies (such as automated code generation from detailed design) may eliminate development steps or combine several development steps into one. Therefore, a corresponding adaptation of the minimum V&V tasks is permitted.			Info		
IEEE1012:43	1.6	When this standard is invoked for existing software and the required V&V inputs are not available, then V&V tasks may use other available project input sources or may reconstruct the needed inputs to achieve compliance with this standard.			Info		
IEEE1012:44	1.7	1.7 Disclaimer			Title		
IEEE1012:45	1.7	This standard establishes minimum criteria for V&V processes, activities, and tasks. The implementation of these criteria does not, however, automatically ensure compliance to system or mission objectives, or prevent adverse consequences (e.g., loss of life, mission failure, loss of system safety or security, financial or social loss). Compliance with this standard does not absolve any party from any social, moral, financial, or legal obligations.			Info		
IEEE1012:46	1.8	1.8 Limitations			Title		
IEEE1012:47	1.8	None.			Info		
IEEE1012:48	2.	2. Normative references			Title		
IEEE1012:49	2.	This standard does not require the use of any normative references. Other standards considered to be useful in the implementation and interpretation of this standard are listed in Annex H.			Info		
IEEE1012:50	3.	3. Definitions, abbreviations, and conventions			Title		
IEEE1012:51	3.	Not listed, as the entire section is only reference information.			Info		
IEEE1012:52	4.	4. V&V software integrity levels			Title		
IEEE1012:53	4.1	4.1 Software integrity levels			Title		
IEEE1012:54	4.1	Software exhibits different criticality based upon its intended use and application of the system to critical or noncritical uses. Some software systems affect critical, life-sustaining systems, while other software systems are noncritical, standalone research tools. Software criticality is a description of the intended use and application of a system.			Info		
IEEE1012:55	4.1	This standard uses a software integrity level approach to quantify software criticality. Software integrity levels denote a range of software criticality values necessary to maintain risks within acceptable limits. These software properties may include safety, security, software complexity, performance, reliability, or other characteristics. Critical, high-integrity software typically requires a larger set and more rigorous application of V&V tasks.			Info		
IEEE1012:56	4.1	For planning the V&V processes, software integrity levels are generally assigned early in the development process, preferably during the system requirements analysis and architecture design activities.			Info		

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IEEE1012:57	4.1	The software integrity level can be assigned to software requirements, functions, group of functions, or software components or subsystems.			Info																	
IEEE1012:58	4.1	The assigned software integrity levels may vary as the software evolves. Design, coding, procedural, and technology implementation features selected by the development organization can raise or lower the software criticality and the associated software integrity levels assigned to the software. Risk mitigation approaches acceptable to the acquirer also may be used to reduce software criticality, thus allowing the selection of a lower integrity level. The software integrity level assignment is continually updated and reviewed by conducting the V&V criticality analysis task throughout the software development process.			Info																	
IEEE1012:59	4.1	This standard does not mandate the use of the software integrity scheme referenced in this standard. The user of this standard may select any software integrity scheme (such as from existing standards) that defines the requirements for assigning software integrity levels.			Info																	
IEEE1012:60	4.1	The software integrity levels established for a project result from agreements among the acquirer, supplier, developer, and independent assurance authorities (e.g., a regulatory body or responsible agency). The V&V effort shall specify a software integrity scheme if one is not already defined.			CO	Sec 4.3																
IEEE1012:61	4.1	This standard shall use the specified four-level software integrity scheme as a method to define the minimum V&V tasks that are assigned to each software integrity level.			CO	Sec 4.3																
IEEE1012:62	4.1	<table><tr><th>Criticality</th><th>Description</th><th>Level</th></tr><tr><td>High</td><td>Selected function affects critical performance of the system.</td><td>4</td></tr><tr><td>Major</td><td>Selected function affects important system performance.</td><td>3</td></tr><tr><td>Moderate</td><td>Selected function affects system performance, but workaround strategies can be implemented to compensate for loss of performance.</td><td>2</td></tr><tr><td>Low</td><td>Selected function has noticeable effect on system performance but only creates inconvenience to the user if the function does not perform in accordance with requirements.</td><td>1</td></tr></table>			Criticality	Description	Level	High	Selected function affects critical performance of the system.	4	Major	Selected function affects important system performance.	3	Moderate	Selected function affects system performance, but workaround strategies can be implemented to compensate for loss of performance.	2	Low	Selected function has noticeable effect on system performance but only creates inconvenience to the user if the function does not perform in accordance with requirements.	1	Info		
Criticality	Description	Level																				
High	Selected function affects critical performance of the system.	4																				
Major	Selected function affects important system performance.	3																				
Moderate	Selected function affects system performance, but workaround strategies can be implemented to compensate for loss of performance.	2																				
Low	Selected function has noticeable effect on system performance but only creates inconvenience to the user if the function does not perform in accordance with requirements.	1																				
IEEE1012:63	4.1	To identify the minimum V&V tasks that apply to a different selected software integrity level scheme, the user of the standard shall map this standard’s software integrity scheme and associated minimum V&V tasks to their selected software integrity level scheme.	CO	Sec 5.2.1.2.1 Sec 5.2.2.2.1 Sec 5.2.3.2.1 Sec 5.2.4.2.1 Sec 5.2.5.2.1																		
IEEE1012:64	4.1	Figure 1—An example of software V&V overview	Info																			
IEEE1012:65	4.1	The mapping of the software integrity level scheme and the associated minimum V&V tasks shall be documented in the SVVP.	CO	Sec 4.3																		
IEEE1012:66	4.1	An example of a risk-based software integrity level scheme is illustrated in Annex B.																				

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IEEE1012:67	4.1	This standard does not apply to those portions of the software for which none of the software integrity criteria apply (i.e., those software portions below level 1).			Info		
IEEE1012:68	4.1	The basis for assigning software integrity levels to software components shall be documented in a V&V Task Report and V&V Final Report.			CO	Sec 4.3	
IEEE1012:69	4.1	The integrity level assigned to reusable software shall be in accordance with the integrity level scheme adopted for the project (see Annex D), and the reusable software shall be evaluated for use in the context of its application.			N/A	N/A	DCPP TSAP source code development does not include any reusable software (e.g. legacy software, COTS software).
IEEE1012:70	4.1	The V&V processes are tailored to specific system requirements and applications through the selection of a software integrity level with its corresponding minimum V&V tasks and the addition of optional V&V tasks. The addition of optional V&V tasks allows the V&V effort to address application specific characteristics of the software.			Info		
IEEE1012:71	5.	5. V&V processes			Title		
IEEE1012:72	5	V&V processes support the management process (5.1), acquisition process (5.2), supply process (5.3), development process (5.4), operation process (5.5), and maintenance process (5.6). The minimum V&V activities and tasks supporting the above processes are referenced in the following subclauses and defined in Table 1. This clause's subtitles are the same as subtitles in Table 1 to correlate the requirements of the following subclauses with Table 1 tasks.			Info		
IEEE1012:73	5.	The V&V effort shall comply with the task descriptions, inputs, and outputs as described in Table 1.			CO	Sec 5.2	
IEEE1012:74	5.	The V&V effort shall perform the minimum V&V tasks as specified in Table 2 for the assigned software integrity level.			CO	Sec 4.3	
IEEE1012:75	5.	If the user of this standard has selected a different software integrity level scheme, then the mapping of that integrity level scheme to Table 2 shall define the minimum V&V tasks for each of the user's software integrity levels.			NA	NA	This project selected the same the integrity level scheme as mentioned IEEE 1012
IEEE1012:76	5.	Not all software projects include each of the life cycle processes listed above.					
IEEE1012:77	5.	To be in compliance with this standard, the V&V processes shall address all those life cycle processes used by the software project.			CO	Sec 5.0	
IEEE1012:78	5.	Some V&V activities and tasks include analysis, evaluations, and tests that may be performed by multiple organizations (e.g., software development, project management, quality assurance, V&V). For example, risk analysis and hazard analysis are performed by project management, the development organization, and the V&V effort.			Info		

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IEEE1012:79	5.	The V&V effort performs these tasks to develop the supporting basis of evidence showing whether the software product satisfies its requirements. These V&V analyses are complementary to other analyses and do not eliminate or replace the analyses performed by other organizations.			Info		
IEEE1012:80	5.	The degree to which these analyses efforts are coordinated with other organizations shall be documented in the organizational responsibility section of the SVVP.			CO	Sec 4.1.1	
IEEE1012:81	5.	The user of this standard shall document the V&V processes in the SVVP and shall define the information and facilities necessary to manage and perform these processes, activities, and tasks, and to coordinate those V&V processes with other related aspects of the project.			CO	Sec 4.1	
IEEE1012:82	5.	The results of V&V activities and tasks shall be documented in task reports, activity summary reports, anomaly reports, V&V test documents, and the V&V Final Report.			CO	Sec 5.2.1 Sec 5.2.2 Sec 5.2.3 Sec 5.2.4 Sec 5.2.5 Sec 6.1; Sec 6.2 Sec 6.3; Sec 6.4	
IEEE1012:83	5.1	5.1 Process: Management			Title		
IEEE1012:84	5.1	The management process contains the generic activities and tasks, which may be employed by any party that manages its respective processes. The management tasks are to 1) prepare the plans for execution of the process, 2) initiate the implementation of the plan, 3) monitor the execution of the plan, 4) analyze problems discovered during the execution of the plan, 5) report progress of the processes, 6) ensure products satisfy requirements, 7) assess evaluation results, 8) determine whether a task is complete, 9) check the results for completeness.			Info		
IEEE1012:85	5.1.1	5.1.1 Activity: Management of V&V			Title		
IEEE1012:86	5.1.1	The Management of V&V activity is performed in all software life cycle processes and activities. This activity continuously reviews the V&V effort, revises the SVVP as necessary based upon updated project schedules and development status, and coordinates the V&V results with the developer and other supporting processes such as quality assurance, configuration management, and reviews and audits.			Info		
IEEE1012:87	5.1.1	The Management of V&V assesses each proposed change to the system and software, identifies the software requirements that are affected by the change, and plans the V&V tasks to address the change.			Info		
IEEE1012:88	5.1.1	For each proposed change, the Management of V&V assesses whether any new hazards or risks are introduced in the software, and identifies the impact of the change to the assigned software integrity levels.			Info		
IEEE1012:89	5.1.1	V&V task planning is revised by adding new V&V tasks or increasing the scope and intensity of existing V&V tasks if software integrity levels or hazards or risks are changed.			Info		
IEEE1012:90	5.1.1	The Management of V&V activity monitors and evaluates all V&V outputs.			Info		
IEEE1012:91	5.1.1	Through the use of V&V metrics and other qualitative and quantitative measures, this V&V activity develops program trend data and possible risk issues that are provided to the developer and acquirer to effect timely notification and resolution.			Info		

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IEEE1012:92	5.1.1	At key program milestones (e.g., requirements review, design review, test readiness), the Management of V&V consolidates the V&V results to establish supporting evidence whether to proceed to the next set of software development activities.			Info		
IEEE1012:93	5.1.1	Whenever necessary, the Management of V&V determines whether a V&V task needs to be re-performed as a result of developer changes in the software program.			Info		
IEEE1012:94	5.1.1	The V&V effort shall perform, as appropriate for the selected software integrity level, the minimum V&V tasks for Management of V&V from the following list: 1) Task: Software Verification and Validation Plan (SVVP) Generation			CO	Sec 5.2.1.2.1 -1)	
IEEE1012:95	5.1.1	2) Task: Baseline Change Assessment			CO	Sec 5.2.1.2.1 -2)	
IEEE1012:96	5.1.1	3) Task: Management Review of V&V			CO	Sec 5.2.2.2.1 -6) Sec 5.2.3.2.1 -8) Sec 5.2.4.2.1 -10) Sec 5.2.5.2.1 -6)	
IEEE1012:97	5.1.1	4) Task: Management and Technical Review Support			CO	Sec 5.2	
IEEE1012:98	5.1.1	5) Task: Interface With Organizational and Supporting Processes			CO	Sec 4.1	
IEEE1012:99	5.2	5.2 Process: Acquisition			Title		
IEEE1012:100	5.2	The acquisition process begins with the definition of the need (e.g., statement of need) to acquire a system, software product, or software service. The process continues with the preparation and issuance of a request for proposal (e.g., bid request, tender), selection of a supplier, and management of the acquisition process through to the acceptance of the system, software product, or software service.			Info		
IEEE1012:101	5.2	The V&V effort uses the acquisition process to scope the V&V effort, plan interfaces with the supplier and acquirer, and review the draft systems requirements contained in the request for proposal.			Info		
IEEE1012:102	5.2.1	5.2.1 Activity: Acquisition Support V&V			Title		
IEEE1012:103	5.2.1	The Acquisition Support V&V activity addresses project initiation, request for proposal, contract preparation, supplier monitoring, and acceptance and completion.			Info		
IEEE1012:104	5.2.1	The V&V effort shall perform, as appropriate for the selected software integrity level, the minimum V&V tasks for Acquisition Support V&V from the following list: 1) Task: Scoping the V&V Effort			CO	Sec 1.2 Sec 1.3	
IEEE1012:105	5.2.1	2) Task: Planning the Interface Between the V&V Effort and Supplier			N/A		This is not V&V scope of this project.
IEEE1012:106	5.2.1	3) Task: System Requirements Review			N/A		V&V does not perform this task because PG&E does not provide the System Requirements Specification.
IEEE1012:107	5.3	5.3 Process: Supply			Title		
IEEE1012:108	5.3	The supply process is initiated by either a decision to prepare a proposal to answer an acquirer's request for proposal or by signing and entering into a contract with the acquirer to provide the system, software product, or software service. The process continues with the determination of procedures and resources needed to manage the project, including development of project plans and execution of the plans through delivery of the system, software product, or software service to the acquirer.			Info		

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IEEE1012:109	5.3	The V&V effort uses the supply process products to verify that the request for proposal requirements and contract requirements are consistent and satisfy user needs. The V&V planning activity uses the contract requirements including program schedules to revise and update the interface planning between the supplier and acquirer.			Info		
IEEE1012:110	5.3.1	5.3.1 Activity: Planning V&V			Title		
IEEE1012:111	5.3.1	The Planning V&V activity addresses the initiation, preparation of response, contract, planning, execution and control, review and evaluation, and delivery and completion activities.			Info		
IEEE1012:112	5.3.1	The V&V effort shall perform, as appropriate for the selected software integrity level, the minimum V&V tasks for Planning V&V from the following list: 1) Task: Planning the Interface Between the V&V Effort and Supplier			N/A	N/A	During the planning phase, V&V does not plan interface between V&V effort and supplier. However, V&V performs POCCM review and contract verification.
IEEE1012:113	5.3.1	2) Task: Contract Verification			CO	Sec 5.0 -2)	
IEEE1012:114	5.4	5.4 Process: Development			Title		
IEEE1012:115	5.4	The development process contains the activities and tasks of the developer. The process contains the activities for requirements analysis, design, coding, integration, testing, and installation and acceptance related to software products. The V&V activities verify and validate these software products. The V&V activities are organized into Concept V&V, Requirements V&V, Design V&V, Implementation V&V, Test V&V, and Installation and Checkout V&V.			Info		
IEEE1012:116	5.4.1	5.4.1 Activity: Concept V&V			Title		
IEEE1012:117	5.4.1	The Concept V&V activity represents the delineation of a specific implementation solution to solve the user's problem. During the Concept V&V activity, the system architecture is selected, and system requirements are allocated to hardware, software, and user interface components. The Concept V&V activity addresses system architectural design and system requirements analysis. The objectives of V&V are to verify the allocation of system requirements, validate the selected solution, and ensure that no false assumptions have been incorporated in the solution.			Info		
IEEE1012:118	5.4.1	The V&V effort shall perform, as appropriate for the selected software integrity level, the minimum V&V tasks for Concept V&V from the following list: 1) Task: Concept Documentation Evaluation			N/A	N/A	V&V does not perform Concept Documentation Evaluation in Planning Phase.
IEEE1012:119	5.4.1	2) Task: Criticality Analysis			N/A	N/A	V&V does not perform Criticality Analysis in Planning Phase.
IEEE1012:120	5.4.1	3) Task: Hardware/Software/User Requirements Allocation Analysis			N/A	N/A	V&V does not perform Hardware/Software/User Requirement Allocation Analysis.
IEEE1012:121	5.4.1	4) Task: Traceability Analysis			N/A	N/A	V&V does not perform Traceability Analysis in Planning Phase.
IEEE1012:122	5.4.1	5) Task: Hazard Analysis			N/A	N/A	V&V does not perform Hazard Analysis in Planning Phase.
IEEE1012:123	5.4.1	6) Task: Risk Analysis			N/A	N/A	V&V does not perform Risk Analysis in Planning Phase.

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IEEE1012:124	5.4.2	5.4.2 Activity: Requirements V&V			Title		
IEEE1012:125	5.4.2	The Requirements V&V activity defines the functional and performance requirements, interfaces external to the software, qualification requirements, safety and security requirements, human factors engineering, data definitions, user documentation for the software, installation and acceptance requirements, user operation and execution requirements, and user maintenance requirements. The Requirements V&V activity addresses software requirements analysis. The objectives of V&V are to ensure the correctness, completeness, accuracy, testability, and consistency of the requirements.			Info		
IEEE1012:126	5.4.2	The V&V effort shall perform, as appropriate for the selected software integrity level, the minimum V&V tasks for Requirements V&V from the following list: 1) Task: Traceability Analysis			CO	Sec 5.2.2.2.1 -1)	
IEEE1012:127	5.4.2	2) Task: Software Requirements Evaluation			CO	Sec 5.2.2.2.1 -2)	
IEEE1012:128	5.4.2	3) Task: Interface Analysis			CO	Sec 5.2.2.2.1 -3)	
IEEE1012:129	5.4.2	4) Task: Criticality Analysis			CO	Sec 5.2.2.2.1 -3)	
IEEE1012:130	5.4.2	5) Task: System V&V Test Plan Generation and Verification			CO	Sec 5.2.2.2.1 -4)	System Test Plan is described in System Validation Test Plan.
IEEE1012:131	5.4.2	6) Task: Acceptance V&V Test Plan Generation and Verification			N/A	N/A	Acceptance V&V Test Plan Generation and Verification (Out of Scope).
IEEE1012:132	5.4.2	7) Task: Configuration Management Assessment			CO	Sec 5.2.2.2.1 -5)	
IEEE1012:133	5.4.2	8) Task: Hazard Analysis			CO	Sec 5.2.2.2.1 -3)	
IEEE1012:134	5.4.2	9) Task: Risk Analysis			CO	Sec 5.2.2.2.1 -3)	
IEEE1012:135	5.4.3	5.4.3 Activity: Design V&V			Title		
IEEE1012:136	5.4.3	In the Design V&V activity, software requirements are transformed into an architecture and detailed design for each software component. The design includes databases and interfaces (external to the software, between the software components, and between software units). The Design V&V activity addresses software architectural design and software detailed design. The objectives of V&V are to demonstrate that the design is a correct, accurate, and complete transformation of the software requirements and that no unintended features are introduced.			Info		
IEEE1012:137	5.4.3	The V&V effort shall perform, as appropriate for the selected software integrity level, the minimum V&V tasks for Design V&V from the following list: 1) Task: Traceability Analysis			CO	Sec 5.2.3.2.1 -1)	
IEEE1012:138	5.4.3	2) Task: Software Design Evaluation			CO	Sec 5.2.3.2.1 -2)	
IEEE1012:139	5.4.3	3) Task: Interface Analysis			CO	Sec 5.2.3.2.1 -7)	
IEEE1012:140	5.4.3	4) Task: Criticality Analysis			CO	Sec 5.2.3.2.1 -7)	
IEEE1012:141	5.4.3	5) Task: Component V&V Test Plan Generation and Verification			CO	Sec 5.2.3.2.1 -4)	Component V&V Test Plan is described in Software Verification Test Plan.
IEEE1012:142	5.4.3	6) Task: Integration V&V Test Plan Generation and Verification			CO	Sec 5.2.3.2.1 -4)	Integration V&V Test Plan is described in Software Verification Test Plan.

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IEEE1012:143	5.4.3	7) Task: V&V Test Design Generation and Verification			CO	Sec 5.2.3.2.1 -5) Sec 5.2.3.2.1 -6)	Test Design Generation and Verification is addressed in two documents: 1) Software Verification Test Specification. 2) System Validation Test Specification.
IEEE1012:144	5.4.3	8) Task: Hazard Analysis			CO	Sec 5.2.3.2.1 -7)	
IEEE1012:145	5.4.3	9) Task: Risk Analysis			CO	Sec 5.2.3.2.1 -7)	
IEEE1012:146	5.4.4	5.4.4 Activity: Implementation V&V			Title		
IEEE1012:147	5.4.4	The Implementation V&V activity transforms the design into code, database structures, and related machine executable representations. The Implementation V&V activity addresses software coding and testing. The objectives of V&V are to verify and validate that these transformations are correct, accurate, and complete.			Info		
IEEE1012:148	5.4.4	The V&V effort shall perform, as appropriate for the selected software integrity level, the minimum V&V tasks for Implementation V&V from the following list: 1) Task: Traceability Analysis			CO	Sec 5.2.4.2.1 -1)	
IEEE1012:149	5.4.4	2) Task: Source Code and Source Code Documentation Evaluation			CO	Sec 5.2.4.2.1 -4)	
IEEE1012:150	5.4.4	3) Task: Interface Analysis			CO	Sec 5.2.4.2.1 -6)	
IEEE1012:151	5.4.4	4) Task: Criticality Analysis			CO	Sec 5.2.4.2.1 -6)	
IEEE1012:152	5.4.4	5) Task: V&V Test Case Generation and Verification			CO	Sec 5.2.4.2.1 -5)	Software Verification Test Case Generation and Verification.
IEEE1012:153	5.4.4	6) Task: V&V Test Procedure Generation and Verification			CO	Sec 5.2.4.2.1 -5)	Software Verification Test Procedure Generation and Verification.
						Sec 5.2.5.2.1 -2)	System Validation Test Procedure Generation and Verification (Done in Invensys Test Phase).
IEEE1012:154	5.4.4	7) Task: Component V&V Test Execution and Verification			CO	Sec 5.2.4.2.1 -5)	Software Verification Test Procedure Execution and Verification.
IEEE1012:155	5.4.4	8) Task: Hazard Analysis			CO	Sec 5.2.4.2.1 -6)	
IEEE1012:156	5.4.4	9) Task: Risk Analysis			CO	Sec 5.2.4.2.1 -6)	
IEEE1012:157	5.4.5	5.4.5 Activity: Test V&V			Title		
IEEE1012:158	5.4.5	The Test V&V activity covers software testing, software integration, software qualification testing, system integration, and system qualification testing. The Test V&V activity and its relationship to the software life cycle is shown in Figure 2. The objectives of V&V are to ensure that the software requirements and system requirements allocated to software are satisfied by execution of integration, system, and acceptance tests.			Info		

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IEEE1012:159	5.4.5	For software integrity levels 3 and 4, the V&V effort shall generate its own V&V software and system test products (e.g., plans, designs, cases, procedures), execute and record its own tests, and verify those plans, designs, cases, procedures, and test results against software requirements.			CO	All	
IEEE1012:160	5.4.5	For software integrity levels 1 and 2, the V&V effort shall verify the development process test activities and products (e.g., test plans, designs, cases, procedures, and test execution results).			N/A	N/A	This is not within scope.
IEEE1012:161	5.4.5	The V&V effort shall perform, as appropriate for the selected software integrity level, the minimum V&V tasks for Test V&V from the following list: 1) Task: Traceability Analysis			CO	Sec 5.2.5.2.1 -1)	
IEEE1012:162	5.4.5	2) Task: Acceptance V&V Test Procedure Generation and Verification			N/A	N/A	Acceptance V&V Test Procedure Generation and Verification (Out of Scope).
IEEE1012:163	5.4.5	3) Task: Integration V&V Test Execution and Verification			CO	Sec 5.2.4.2.1 -5)	Software Verification Test Procedure Execution and Verification (Done in Invensys Implementation Phase).
IEEE1012:164	5.4.5	4) Task: System V&V Test Execution and Verification			CO	Sec 5.2.5.2.1 -3)	System Validation Test Procedure Execution and Verification.
IEEE1012:165	5.4.5	5) Task: Acceptance V&V Test Execution and Verification			N/A	N/A	Acceptance V&V Test Execution and Verification (Out of Scope).
IEEE1012:166	5.4.5	6) Task: Hazard Analysis			CO	Sec 5.2.5.2.1 -5)	
IEEE1012:167	5.4.5	7) Task: Risk Analysis			CO	Sec 5.2.5.2.1 -5)	
IEEE1012:168	5.4.6	5.4.6 Activity: Installation and Checkout V&V			Title		
IEEE1012:169	5.4.6	The Installation and Checkout V&V activity is the installation of the software product in the target environment and the acquirer's acceptance review and testing of the software product. The Installation and Checkout V&V activity addresses software installation and software acceptance support. The objectives of V&V are to verify and validate the correctness of the software installation in the target environment.			Info		
IEEE1012:170	5.4.6	The V&V effort shall perform, as appropriate for the selected software integrity level, the minimum V&V tasks for Installation and Checkout V&V from the following list: 1) Task: Installation Configuration Audit			N/A	N/A	Phase is out-of-scope per contract.
IEEE1012:171	5.4.6	2) Task: Installation Checkout			N/A	N/A	Phase is out-of-scope per contract.
IEEE1012:172	5.4.6	3) Task: Hazard Analysis			N/A	N/A	Phase is out-of-scope per contract.
IEEE1012:173	5.4.6	4) Task: Risk Analysis			N/A	N/A	Phase is out-of-scope per contract.
IEEE1012:174	5.4.6	5) Task: V&V Final Report Generation			N/A	N/A	Phase is out-of-scope per contract.
IEEE1012:175	5.4.6	Figure 2-An example of timephasing ofV&V test products and test execution tasks			Info		
IEEE1012:176	5.5	5.5 Process: Operation			Title		

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IEEE1012:177	5.5	The operation process covers the operation of the software product and operational support to users. The Operation V&V activity evaluates the impact of any changes in the intended operating environment, assesses the effect on the system of any proposed changes, evaluates operating procedures for compliance with the intended use, and analyzes risks affecting the user and the system.			Info		
IEEE1012:178	5.5.1	5.5.1 Activity: Operation V&V			Title		
IEEE1012:179	5.5.1	The Operation V&V activity is the use of the software by the end user in an operational environment. The Operation V&V activity addresses operational testing, system operation, and user support. The objectives of V&V are to evaluate new constraints in the system, assess proposed changes and their impact on the software, and evaluate operating procedures for correctness and usability.			Info		
IEEE1012:180	5.5.1	The V&V effort shall perform, as appropriate for the selected software integrity level, the minimum V&V tasks for Operation V&V from the following list: 1) Task: Evaluation of New Constraints			N/A	N/A	Phase is out-of-scope per contract.
IEEE1012:181	5.5.1	2) Task: Proposed Change Assessment			N/A	N/A	Phase is out-of-scope per contract.
IEEE1012:182	5.5.1	3) Task: Operating Procedures Evaluation			N/A	N/A	Phase is out-of-scope per contract.
IEEE1012:183	5.5.1	4) Task: Hazard Analysis			N/A	N/A	Phase is out-of-scope per contract.
IEEE1012:184	5.5.1	5) Task: Risk Analysis			N/A	N/A	Phase is out-of-scope per contract.
IEEE1012:185	5.6	5.6 Process: Maintenance			Title		
IEEE1012:186	5.6	The maintenance process is activated when the software product undergoes modifications to code and associated documentation caused by a problem or a need for improvement or adaptation. The Maintenance V&V activity addresses modifications (e.g., enhancements, additions, deletions), migration, or retirement of the software during the operation process.			Info		
IEEE1012:187	5.6	Modifications of the software shall be treated as development processes and shall be verified and validated as described in 5.1 (management process), and 5.4 (development process) of this standard.			N/A	N/A	Phase is out-of-scope per contract.
IEEE1012:188	5.6	Software integrity level assignments shall be assessed during the maintenance process. The software integrity level assignments shall be revised as appropriate to reflect the requirements of the maintenance process. These modifications may be derived from requirements specified to correct software errors (e.g., corrective), to adapt to a changed operating environment (e.g., adaptive), or to respond to additional user requests or enhancements (e.g., perfective).			N/A	N/A	Phase is out-of-scope per contract.
IEEE1012:189	5.6.1	5.6.1 Activity: Maintenance V&V			Title		
IEEE1012:190	5.6.1	The Maintenance V&V activity covers modifications (e.g., corrective, adaptive, and perfective), migration, and retirement of software. Migration of software is the movement of software to a new operational environment. For migrating software, the V&V effort shall verify that the migrated software meets the requirements of 5.4 through 5.5. The retirement of software is the withdrawal of active support by the operation and maintenance organization, partial or total replacement by a new system, or installation of an upgraded system.			Info		
IEEE1012:191	5.6.1	If the software was verified under this standard, the standard shall continue to be followed in the maintenance process. If the software was not verified under this standard and appropriate documentation is not available or adequate, the V&V effort shall determine whether the missing or incomplete documentation should be generated. In making this determination of whether to generate missing documentation, the minimum V&V requirements of the assigned software integrity level should be taken into consideration.			N/A	N/A	Phase is out-of-scope per contract.

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IEEE1012:192	5.6.1	The Maintenance V&V activity addresses problem and modification analysis, modification implementation, maintenance review/acceptance, migration, and software retirement. The objectives of V&V are to assess proposed changes and their impact on the software, evaluate anomalies that are discovered during operation, assess migration requirements, assess retirement requirements, and re-perform V&V tasks.			Info		
IEEE1012:193	5.6.1	The V&V effort shall perform, as appropriate for the selected software integrity level, the minimum V&V tasks for Maintenance V&V from the following list: 1) Task: SVVP Revision 2) Task: Proposed Change Assessment 3) Task: Anomaly Evaluation 4) Task: Criticality Analysis 5) Task: Migration Assessment 6) Task: Retirement Assessment 7) Task: Hazard Analysis 8) Task: Risk Analysis 9) Task: Task Iteration			N/A	N/A	Phase is out-of-scope per contract.
IEEE1012:194	6.	6. Software V&V reporting, administrative, and documentation requirements			Title		
IEEE1012:195	6.1	6.1 V&V reporting requirements			Title		
IEEE1012:196	6.1	V&V reporting occurs throughout the software life cycle. The SVVP shall specify the content, format, and timing of all V&V reports.			CO	Sec 5.2.1; 5.2.2; 5.2.3; 5.2.4; 5.2.5; 6.1; 6.2; 6.3; 6.4	V&V reporting occurs in four phases (Requirements, Design, Implementation and Test) software life cycle.
IEEE1012:197	6.1	The V&V reports shall constitute the Software Verification and Validation Report (SVVR). The V&V reports shall consist of required V&V reports (i.e., V&V Task Reports, V&V Activity Summary Reports, V&V Anomaly Reports, and V&V Final Report). The V&V reports may also include optional reports. Reporting requirements are described in 7.6 of this standard.			CO	Sec 6.0 Sec 5.2.2.2 Sec 5.2.2.3 Sec 5.2.2.4 Sec 5.2.2.5	
IEEE1012:198	6.2	6.2 V&V administrative requirements			Title		
IEEE1012:199	6.2	The SVVP describes the V&V administrative requirements that support the V&V effort. These V&V administrative requirements shall consist of the following: 1) Anomaly Resolution and Reporting			CO	Sec 7.1	
IEEE1012:200	6.2	2) Task Iteration Policy			CO	Sec 7.2	
IEEE1012:201	6.2	3) Deviation Policy			CO	Sec 7.3	
IEEE1012:202	6.2	4) Control Procedures			CO	Sec 7.4	
IEEE1012:203	6.2	5) Standards, Practices, and Conventions			CO	Sec 7.5	
IEEE1012:204	6.2	V&V administrative requirements are described in 7.7 of this standard.			Info		
IEEE1012:205	6.3.	6.3 V&V documentation requirements			Title		
IEEE1012:206	6.3.1	6.3.1 V&V Test documentation			Title		

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IEEE1012:207	6.3.1	V&V Test documentation requirements shall include the test plans, designs, cases, procedures, and results for component, integration, system, and acceptance testing. The V&V test documentation shall comply with project defined test document purpose, format, and content (e.g., see IEEE Std 829-1983 [B5]). The V&V task descriptions for component, integration, system, and acceptance testing are described in Table 1.			CO	Sec 5.2.2.2.1 -4) Sec 5.2.3.2.1 -4) Sec 5.2.3.2.1 -5) Sec 5.2.3.2.1 -6) Sec 5.2.4.2.1 -5) Sec 5.2.5.2.1 -2) Sec 5.2.5.2.1 -3)	
IEEE1012:208	6.3.2	6.3.2 SVVP documentation			Title		
IEEE1012:209	6.3.2	The V&V effort shall generate an SVVP that addresses the topics described in Clause 7 of this standard. If there is no information pertinent to a topic, the SVVP shall contain the phrase, "This topic is not applicable to this plan.", with an appropriate reason for the exclusion. Additional topics may be added to the plan. If some SVVP material appears in other documents, the SVVP may repeat the material or make reference to the material. The SVVP shall be maintained throughout the life of the software			CO	All	
IEEE1012:210	6.3.2	The SVVP shall include the V&V documentation requirements defined in 6.1, 6.2, and 6.3.1.			CO	Sec 6.0	
IEEE1012:211	7.	7. SVVP outline			Title		
IEEE1012:212	7.	The SVVP shall contain the content as described in 7.1 through 7.8 of this standard. The user of this standard may adopt any format and section numbering system for the SVVP. The SVVP section numbers listed in this standard are provided to assist the readability of this standard and are not mandatory to be in compliance with this standard.			CO	All	

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ID	Section	Description	Inputs	Outputs	COMPLIANCE STATUS CO (Comply) CL (Clarification) DE (Deviation) EX (Exception)	SVVP Correlation	Remarks
IEEE1012:213	7.	An example SVVP outline is shown in the boxed text. Software V&V plan outline (example) 1. Purpose 2. Referenced Documents 3. Definitions 4. V&V Overview 4.1 Organization 4.2 Master Schedule 4.3 Software Integrity Level Scheme 4.4 Resources Summary 4.5 Responsibilities 4.6 Tools, Techniques, and Methods 5. V&V Processes 5.1 Process: Management 5.1.1 Activity: Management of V&V 5.2 Process: Acquisition 5.2.1 Activity: Acquisition Support V&V 5.3 Process: Supply 5.3.1 Activity: Planning V&V 5.4 Process: Development 5.4.1 Activity: Concept V&V 5.4.2 Activity: Requirements V&V 5.4.3 Activity: Design V&V 5.4.4 Activity: Implementation V&V 5.4.5 Activity: Test V&V 5.4.6 Activity: Installation and Checkout V&V 5.5 Process: Operation 5.5.1 Activity: Operation V&V			Info		
IEEE1012:214	7.	5.6 Process: Maintenance 5.6.1 Activity: Maintenance V&V 6. V&V Reporting Requirements 7. V&V Administrative Requirements 7.1 Anomaly Resolution and Reporting 7.2 Task Iteration Policy 7.3 Deviation Policy 7.4 Control Procedures 7.5 Standards, Practices, and Conventions 8. V&V Documentation Requirements			Info		
IEEE1012:215	7.1	7.1 (SVVP Section 1) Purpose			Title		
IEEE1012:216	7.1	The SVVP shall describe the purpose, goals, and scope of the software V&V effort, including waivers from this standard. The software project for which the Plan is being written and the specific software processes and products covered by the software V&V effort shall be identified.			CO	Sec 1.1 Sec 1.2 Sec 1.3	
IEEE1012:217	7.2	7.2 (SVVP Section 2) Referenced documents			Title		
IEEE1012:218	7.2	The SVVP shall identify the compliance documents, documents referenced by the SVVP, and any supporting documents supplementing or implementing the SVVP.			CO	Sec 2.1 Sec 2.2 Sec 2.3 Sec 2.4	

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IEEE1012:219	7.3	7.3 (SVVP Section 3) Definitions			Title		
IEEE1012:220	7.3	The SVVP shall define or reference all terms used in the SVVP, including the criteria for classifying an anomaly as a critical anomaly. All abbreviations and notations used in the SVVP shall be described.			CO	Sec 3.1 Sec 3.2	
IEEE1012:221	7.4	7.4 (SVVP Section 4) V&V overview			Title		
IEEE1012:222	7.4	The SVVP shall describe the organization, schedule, software integrity level scheme, resources, responsibilities, tools, techniques, and methods necessary to perform the software V&V.			CO	Sec 4.0	
IEEE1012:223	7.4.1	7.4.1 (SVVP Section 4.1) Organization			Title		
IEEE1012:224	7.4.1	The SVVP shall describe the organization of the V&V effort, including the degree of independence required (See Annex C of this standard). The SVVP shall describe the relationship of the V&V processes to other processes such as development, project management, quality assurance, and configuration management. The SVVP shall describe the lines of communication within the V&V effort, the authority for resolving issues raised by V&V tasks, and the authority for approving V&V products. Annex F provides an example organizational relationship chart.			CO	Sec 4.1.1	
IEEE1012:225	7.4.2	7.4.2 (SVVP Section 4.2) Master Schedule			Title		
IEEE1012:226	7.4.2	The SVVP shall describe the project life cycle and milestones. It shall summarize the schedule of V&V tasks and task results as feedback to the development, organizational, and supporting processes (e.g., quality assurance and configuration management). V&V tasks shall be scheduled to be re-performed according to the task iteration policy.			CO	Sec 4.2	
IEEE1012:227	7.4.2	If the life cycle used in the SVVP differs from the life cycle model in this standard, this section shall describe how all requirements of the standard are satisfied (e.g., by cross-referencing to this standard).			CO	Sec 5.0	
IEEE1012:228	7.4.3	7.4.3 (SVVP Section 4.3) Software integrity level scheme			Title		
IEEE1012:229	7.4.3	The SVVP shall describe the agreed upon software integrity level scheme established for the system and the mapping of the selected scheme to the model used in this standard.			CO	Sec 4.3	
IEEE1012:230	7.4.3	The SVVP shall document the assignment of software integrity levels to individual components (e.g., requirements, detailed functions, software modules, subsystems, or other software partitions), where there are differing software integrity levels assigned within the program.			CO	Sec 4.3	Per contractual agreement, SIL is assigned to system level, not individual component.
IEEE1012:231	7.4.3	For each SVVP update, the assignment of software integrity levels shall be reassessed to reflect changes that may occur in the integrity levels as a result of architecture selection, detailed design choices, code construction usage, or other development activities.			CO	Sec 4.3	
IEEE1012:232	7.4.4	7.4.4 (SVVP Section 4.4) Resources summary			Title		
IEEE1012:233	7.4.4	The SVVP shall summarize the V&V resources, including staffing, facilities, tools, finances, and special procedural requirements (e.g., security, access rights, and documentation control).			CO	Sec 4.4	
IEEE1012:234	7.4.5	7.4.5 (SVVP Section 4.5) Responsibilities			Title		
IEEE1012:235	7.4.5	The SVVP shall identify an overview of the organizational element(s) and responsibilities for V&V tasks.			CO	Sec 4.1.2	
IEEE1012:236	7.4.6	7.4.6 (SVVP Section 4.6) Tools, techniques, and methods			Title		
IEEE1012:237	7.4.6	The SVVP shall describe documents, hardware and software V&V tools, techniques, methods, and operating and test environment to be used in the V&V process. Acquisition, training, support, and qualification information for each tool, technology, and method shall be included.			CO	Sec 4.5.1 Sec 4.5.2	

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ID	Section	Description	Inputs	Outputs	COMPLIANCE STATUS CO (Comply) CL (Clarification) DE (Deviation) EX (Exception)	SVVP Correlation	Remarks
IEEE1012:238	7.4.6	Tools that insert code into the software shall be verified and validated to the same rigor as the highest software integrity level of the software. Tools that do not insert code shall be verified and validated to assure that they meet their operational requirements. If partitioning of tool functions can be demonstrated, only those functions that are used in the V&V processes shall be verified to demonstrate that they perform correctly for their intended use.			N/A	N/A	V&V does not use tool to insert code into DCPD TSAP.
IEEE1012:239	7.4.6	The SVVP shall document the metrics to be used by V&V (see Annex E), and shall describe how these metrics support the V&V objectives.			CO	Sec 4.5.2	
IEEE1012:240	7.5	7.5 (SVVP Section 5) V&V processes			Title		
IEEE1012:241	7.5	The SVVP shall identify V&V activities and tasks to be performed for each of the V&V processes described in Clause 5 of this standard, and shall document those V&V activities and tasks. The SVVP shall contain an overview of the V&V activities and tasks for all software life cycle processes.			CO	Sec 5.0	
IEEE1012:242	7.5.1	7.5.1 (SVVP Sections 5.1 through 5.6) "Software life cycle"			Title		
IEEE1012:243	7.5.1	The SVVP shall include sections 5.1 through 5.6 for V&V activities and tasks as shown in SVVP Outline (boxed text).			CO	Sec 5.0 -1) Sec 5.0 -2) Sec 5.0 -3) Sec 5.0 -4) Sec 5.0 -5) Sec 5.0 -6)	The following sections are out of scope per contract: Sec 5.4.1 Concept Sec 5.4.6 Installation & Check out Sec 5.5 Operation Sec 5.6 Maintenance
IEEE1012:244	7.5.1	The SVVP shall address the following eight topics for each V&V activity: 1) V&V Tasks. The SVVP shall identify the V&V tasks to be performed. Table 1 describes the minimum V&V tasks, task criteria, and required inputs and outputs. Table 2 specifies the minimum V&V tasks that shall be performed for each software integrity level. The minimum tasks for software integrity level 4 are consolidated in graphic form in Figure 1.			CO	Sec 5.2.1.2 Sec 5.2.2.2 Sec 5.2.3.2 Sec 5.2.4.2 Sec 5.2.5.2	
IEEE1012:245	7.5.1	Optional V&V tasks may also be performed to augment the V&V effort to satisfy project needs. Optional V&V tasks are listed in Table 3 and described in Annex G. The list in Table 3 is illustrative and not exhaustive. The standard allows for optional V&V tasks to be used as appropriate.			Info		
IEEE1012:246		Figure 3—Framework of V&V processes, activities, and tasks hierarchy			Title		
IEEE1012:247	7.5.1	Some V&V tasks are applicable to more than one software integrity level. The degree of rigor and intensity in performing and documenting the task should be commensurate with the software integrity level. As the software integrity level decreases, so does the required scope, intensity, and degree of rigor associated with the V&V task. For example, a hazard analysis performed for software integrity level 4 software might be formally documented and consider failures at the module level; a hazard analysis for software integrity level 3 software may consider only significant software failures and be documented informally as part of the design review process.			Info		
IEEE1012:248	7.5.1	Testing requires advance planning that spans several development activities. Test documentation and its occurrence at specific processes in the life cycle are shown in Figures 1 and 2.			Info		
IEEE1012:249	7.5.1	2) Methods and Procedures. The SVVP shall describe the methods and procedures for each task, including on-line access, and conditions for observation/evaluation of development processes. The SVVP shall define the criteria for evaluating the task results.			CO	Sec 5.2.1.2 Sec 5.2.2.2 Sec 5.2.3.2 Sec 5.2.4.2 Sec 5.2.5.2	

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IEEE1012:250	7.5.1	3) Inputs. The SVVP shall identify the required inputs for each V&V task. The SVVP shall specify the source and format of each input. The inputs required for the minimum V&V tasks are identified in Table 1. Other inputs may be used. For any V&V activity and task, all of the required inputs from preceding activities and tasks may be used but for conciseness, only the primary inputs are listed in Table 1.			CO	Sec 5.2.1.2 Sec 5.2.2.2 Sec 5.2.3.2 Sec 5.2.4.2 Sec 5.2.5.2	
IEEE1012:251	7.5.1	4) Outputs. The SVVP shall identify the required outputs from each V&V task. The SVVP shall specify the purpose, format, and recipients of each output. The required outputs from each of the V&V tasks are identified in Table 1. Other outputs may be produced.			CO	Sec 5.2.1.2 Sec 5.2.2.2 Sec 5.2.3.2 Sec 5.2.4.2 Sec 5.2.5.2	
IEEE1012:252	7.5.1	The outputs of the Management of V&V and of the V&V tasks shall become inputs to subsequent processes and activities, as appropriate.			DE	Sec 5.2.2.2.1- 6) Sec 5.2.3.2.1- 8) Sec 5.2.4.2.1- 10) Sec 5.2.5.2.1- 6)	The outputs of the Management of V&V and of the V&V tasks are used as inputs to subsequent processes and activities, except for the planning phase.
IEEE1012:253	7.5.1	5) Schedule. The SVVP shall describe the schedule for the V&V tasks. The SVVP shall establish specific milestones for initiating and completing each task, for the receipt and criteria of each input, and for the delivery of each output.			CO	Sec 4.2	SVVP refers to project schedule.
IEEE1012:254	7.5.1	6) Resources. The SVVP shall identify the resources for the performance of the V&V tasks. The SVVP shall specify resources by category (e.g., staffing, equipment, facilities, travel, and training.)			CO	Sec 4.4	
IEEE1012:255	7.5.1	7) Risks and Assumptions. The SVVP shall identify the risks (e.g., schedule, resources, or technical approach) and assumptions associated with the V&V tasks. The SVVP shall provide recommendations to eliminate, reduce, or mitigate risks.			CO	Sec 5.4	
IEEE1012:256	7.5.1	8) Roles and Responsibilities. The SVVP shall identify the organizational elements or individuals responsible for performing the V&V tasks.			CO	Sec 4.1.2	
IEEE1012:257	7.6	7.6 (SVVP Section 6) V&V reporting requirements			Title		
IEEE1012:258	7.6	V&V reporting shall consist of Task Reports, V&V Activity Summary Reports, Anomaly Reports, and the V&V Final Report. Task report(s), V&V activity summary report(s), and anomaly report(s) are provided as feedback to the software development process regarding the technical quality of each software product and process.			CO	Sec 6.1 Sec 6.2 Sec 6.3 Sec 6.4	
IEEE1012:259	7.6	V&V reporting may also include optional reports such as special study reports. The format and grouping of the V&V reports are user defined. The required V&V reports shall consist of the following:			Info		
IEEE1012:260	7.6	1) Task Reports. V&V tasks shall document V&V task results and status, and shall be in a format appropriate for technical disclosure.			CO	Sec 5.2.1.2.1 -2) Sec 5.2.2.2.1 -1) Sec 5.2.2.2.1 -2) Sec 5.2.2.2.1 -5) Sec 5.2.3.2.1 -1) Sec 5.2.3.2.1 -2) Sec 5.2.4.2.1 -1) Sec 5.2.4.2.1 -4) Sec 5.2.5.2.1 -1)	

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IEEE1012:261	7.6	Examples of Task Reports include the following: a) Anomaly Evaluation b) Baseline Change Assessment c) Concept Documentation Evaluation d) Configuration Management Assessment e) Contract Verification f) Criticality Analysis g) Evaluation of New Constraints h) Hardware/Software/User Requirements Allocation Analysis i) Hazard Analysis j) Installation Checkout k) Installation Configuration Audit l) Interface Analysis m) Migration Assessment n) Operating Procedures Evaluation o) Proposed Change Assessment p) Recommendations q) Review Results r) Risk Analysis s) Software Design Evaluation t) Software Integrity Levels u) Software Requirements Evaluation v) Source Code and Source Code Documentation Evaluation w) System Requirements Review x) Test Results y) Traceability Analysis			Info		
IEEE1012:262	7.6	2) V&V Activity Summary Reports. An Activity Summary Report shall summarize the results of V&V tasks performed for each of the following V&V activities: Acquisition Support, Planning, Concept, Requirements, Design, Implementation, Test, and Installation and Checkout. For the Operation activity and Maintenance activity, V&V Activity Summary reports may be either updates to previous V&V activity summary reports or separate documents.			CO	Sec 5.2.2.2.1 -6) Sec 5.2.3.2.1 -8) Sec 5.2.4.2.1 -10) Sec 5.2.5.2.1 -6)	
IEEE1012:263	7.6	Each V&V Activity Summary Report shall contain the following: a) Description of V&V tasks performed			CO	Sec 6.1	
IEEE1012:264	7.6	b) Summary of task results			CO	Sec 6.1	
IEEE1012:265	7.6	c) Summary of anomalies and resolution			CO	Sec 6.1	
IEEE1012:266	7.6	d) Assessment of software quality			CO	Sec 6.1	
IEEE1012:267	7.6	e) Identification and assessment of technical and management risks			CO	Sec 6.1	
IEEE1012:268	7.6	f) Recommendations			CO	Sec 6.1	
IEEE1012:269	7.6	3) Anomaly Report. An Anomaly Report shall document each anomaly detected by the V&V effort. Each anomaly shall be evaluated for its impact on the software system and assessed as to whether it is a critical anomaly (e.g., IEEE Std 1044-1993 [B9]). The scope and application of V&V activities and tasks shall be revised to address the causes of these anomalies and risks.			CO	Sec 6.3	
IEEE1012:270	7.6	Each Anomaly Report shall contain the following: a) Description and location in document or code			CO	Sec 6.3	

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ID	Section	Description	Inputs	Outputs	COMPLIANCE STATUS CO (Comply) CL (Clarification) DE (Deviation) EX (Exception)	SVVP Correlation	Remarks
IEEE1012:271	7.6	b) Impact			CO	Sec 6.3	
IEEE1012:272	7.6	c) Cause of the anomaly and description of the error scenario			CO	Sec 6.3	
IEEE1012:273	7.6	d) Anomaly criticality level			CO	Sec 6.3	
IEEE1012:274	7.6	e) Recommendations			CO	Sec 6.3	
IEEE1012:275	7.6	4) V&V Final Report. The V&V Final Report shall be issued at the end of the Installation and Checkout activity or at the conclusion of the V&V effort			CO	Sec 6.4	
IEEE1012:276	7.6	The V&V Final Report shall include the following: a) Summary of all life cycle V&V activities			CO	Sec 6.4	
IEEE1012:277	7.6	b) Summary of task results			CO	Sec 6.4	
IEEE1012:278	7.6	c) Summary of anomalies and resolutions			CO	Sec 6.4	
IEEE1012:279	7.6	d) Assessment of overall software quality			CO	Sec 6.4	
IEEE1012:280	7.6	e) Lessons learned/best practices			CO	Sec 6.4	
IEEE1012:281	7.6	f) Recommendations			CO	Sec 6.4	
IEEE1012:282	7.6	Optional reports may include the following: 1) Special Studies Reports. These reports shall describe any special V&V studies conducted during the software life cycle. The title of the report may vary according to the subject matter. The reports shall document the results of technical and management tasks and shall include the following: a) Purpose and objectives b) Approach c) Summary of results			Info		
IEEE1012:283	7.6	2) Other Reports. These reports shall describe the results of tasks not defined in the SVVP. The title of the report may vary according to the subject matter. These other task reports may include, for example, quality assurance results, end user testing results, safety assessment report, or configuration and data management status results.			CO	Sec 5.2.5.2.1 -7)	
IEEE1012:284	7.7	7.7 (SVVP Section 7) V&V administrative requirements			Title		
IEEE1012:285	7.7	Administrative V&V requirements shall describe anomaly resolution and reporting, task iteration policy, deviation policy, control procedures, and standards, practices, and conventions.			CO	Sec 7.1 Sec 7.2 Sec 7.3 Sec 7.4 Sec 7.5	
IEEE1012:286	7.7.1	7.7.1 (SVVP Section 7.1) Anomaly resolution and reporting			Title		
IEEE1012:287	7.7.1	The SVVP shall describe the method of reporting and resolving anomalies, including the criteria for reporting an anomaly, the anomaly report distribution list, and the authority and time lines for resolving anomalies. The section shall define the anomaly criticality levels. Classification for software anomalies may be found in IEEE Std 1044-1993 [B9].			CO	Sec 7.1	
IEEE1012:288	7.7.2	7.7.2 (SVVP Section 7.2) Task iteration policy			Title		
IEEE1012:289	7.7.2	The SVVP shall describe the criteria used to determine the extent to which a V&V task shall be repeated when its input is changed or task procedure is changed. These criteria may include assessments of change, software integrity level, and effects on budget, schedule, and quality			CO	Sec 7.2	

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ID	Section	Description	Inputs	Outputs	COMPLIANCE STATUS CO (Comply) CL (Clarification) DE (Deviation) EX (Exception)	SVVP Correlation	Remarks
IEEE1012:290	7.7.3	7.7.3 (SVVP Section 7.3) Deviation policy			Title		
IEEE1012:291	7.7.3	The SVVP shall describe the procedures and criteria used to deviate from the Plan. The information required for deviations shall include task identification, rationale, and effect on software quality. The SVVP shall identify the authorities responsible for approving deviations.			CO	Sec 7.3	
IEEE1012:292	7.7.4	7.7.4 (SVVP Section 7.4) Control procedures			Title		
IEEE1012:293	7.7.4	The SVVP shall identify control procedures applied to the V&V effort. These procedures shall describe how software products and V&V results shall be configured, protected, and stored.			CO	Sec 7.4	
IEEE1012:294	7.7.4	These procedures may describe quality assurance, configuration management, data management, or other activities if they are not addressed by other efforts. The SVVP shall describe how the V&V effort shall comply with existing security provisions and how the validity of V&V results shall be protected from unauthorized alterations.			CO	Sec 7.4	
IEEE1012:295	7.7.5	7.7.5 (SVVP Section 7.5) Standards, practices, and conventions			Title		
IEEE1012:296	7.7.5	The SVVP shall identify the standards, practices, and conventions that govern the performance of V&V tasks including internal organizational standards, practices, and policies.			CO	Sec 7.5	
IEEE1012:297	7.8	7.8 (SVVP Section 8) V&V documentation requirements			Title		
IEEE1012:298	7.8	The SVVP shall define the purpose, format, and content of the test documents. A description of the format for these test documents may be found in IEEE Std 829-1983 [B5]. If the V&V effort uses test documentation or test types (e.g., component, integration, system, acceptance) different from those in this standard, the software V&V effort shall show a mapping of the proposed test documentation and execution to the test items defined in this standard. Test planning tasks defined in Table 1 shall be implemented in the test plan, test design(s), test case(s), and test procedure(s) documentation.			CO	Sec 5.2.2.2.1 -4) Sec 5.2.3.2.1 -5) Sec 5.2.3.2.1 -6) Sec 5.2.4.2.1 -5) Sec 5.2.5.2.1 -2)	
IEEE1012:299	7.8	The SVVP shall describe the purpose, format, and content for the following V&V test documents: 1) Test Plan			CO	Sec 5.2.2.2.1 -4)	
IEEE1012:300	7.8	2) Test Design			CO	Sec 5.2.3.2.1 -5) Sec 5.2.3.2.1 -6)	
IEEE1012:301	7.8	3) Test Cases			CO	Sec 5.2.4.2.1 -5)	
IEEE1012:302	7.8	4) Test Procedures			CO	Sec 5.2.5.2.1 -2)	
IEEE1012:303	7.8	5) Test Results			CO	Sec 5.2.5.2.1 -6)	
IEEE1012:304	7.8	All V&V results and findings shall be documented in the V&V Final Report.			CO	Sec 6.4	
IEEE1012:305	Table 1	Table 1—V&V tasks, inputs, and outputs			Title		
IEEE1012:306	Table 1	V&V tasks	Required inputs	Required outputs	Title		
IEEE1012:307	Table 1	5.1.1 Management of V&V Activity (in parallel with all processes)			Title		

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ID	Section	Description	Inputs	Outputs	COMPLIANCE STATUS CO (Comply) CL (Clarification) DE (Deviation) EX (Exception)	SVVP Correlation	Remarks
IEEE1012:308	Table 1	(1) Software Verification and Validation Plan (SVVP) Generation. Generate an SVVP for all life cycle processes. The SVVP may require updating throughout the life cycle. Outputs of other activities are inputs to the SVVP. Establish a baseline SVVP prior to the Requirements V&V activities. Identify project milestones in the SVVP. Schedule V&V tasks to support project management reviews and technical reviews. See Clause 7 for an example SVVP outline and content of the SVVP.	SVVP (previous update) Contract Concept Documentation (e.g., Statement of Need, Advance Planning Report, Project Initiation Memo, Feasibility Studies, System Requirements, Governing Regulations, Procedures, Policies, customer acceptance criteria and requirements, Acquisition Documentation, Business Rules, draft system architecture) Supplier Development Plans and Schedules	SVVP and Updates	Info		
IEEE1012:309	Table 1	(2) Baseline Change Assessment. Evaluate proposed software changes (e.g., anomaly corrections and requirement changes) for effects on previously completed V&V tasks. Plan iteration of affected tasks or initiate new tasks to address software baseline changes or iterative development processes. Verify and validate that the change is consistent with system requirements and does not adversely affect requirements directly or indirectly. An adverse effect is a change that could create new system hazards and risks or impact previously resolved hazards and risks.	SVVP Proposed Changes Hazard Analysis Report Risks identified by V&V Tasks	Updated SVVP Task Report(s) — Baseline Change Assessment Anomaly Report(s)	Info		
IEEE1012:310	Table 1	(3) Management Review of V&V. Review and summarize the V&V effort to define changes to V&V tasks or to redirect the V&V effort. Recommend whether to proceed to the next set of V&V and development life cycle activities, and provide task reports, anomaly reports, and V&V Activity Summary Reports to the organizations identified in the SVVP. Verify that all V&V tasks comply with task requirements defined in the SVVP. Verify that V&V task results have a basis of evidence supporting the results. Assess all V&V results and provide recommendations for program acceptance and certification as input to the V&V Final Report. The management review of V&V may use any review methodology such as provided in IEEE Std 1028-1988 [B8].	SVVP and Updates Supplier Development Plans and Schedules V&V task results [e.g., technical accomplishments, V&V reports, resource utilization, V&V metrics (see Annex E), plans, and identified risks]	Updated SVVP Task Report(s)— Recommendations V&V Activity Summary Reports Recommendations to the V&V Final Report	Info		
IEEE1012:311	Table 1	(4) Management and Technical Review Support. Support project management reviews and technical reviews (e.g., Preliminary Design Review, and Critical Design Review) by assessing the review materials, attending the reviews, and providing task reports and anomaly reports. Verify the timely delivery according to the approved schedule of all software products and documents. The management and technical review support may use any review methodology such as provided in IEEE Std 1028-1988 [B8].	V&V task results Materials for review (e.g., SRS, IRS, SDD, IDD, test documents)	Task Report(s)— Review Results Anomaly Report(s)	Info		
IEEE1012:312	Table 1	(5) Interface With Organizational and Supporting Processes. Coordinate the V&V effort with organizational (e.g., management, improvement) and supporting processes (e.g., quality assurance, joint review, and problem resolution). Identify the V&V data to be exchanged with these processes. Document the data exchange requirements in the SVVP.	SVVP Data identified in the SVVP from organizational and supporting processes	Updated SVVP	Info		
IEEE1012:313	Table 1	5.2.1 Acquisition Support V&V Activity (acquisition process)			Title		

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ID	Section	Description	Inputs	Outputs	COMPLIANCE STATUS CO (Comply) CL (Clarification) DE (Deviation) EX (Exception)	SVVP Correlation	Remarks
IEEE1012:314	Table 1	(1) Scoping the V&V Effort. Define the project V&V software criticality (e.g., safety, security, mission critical, technical complexity). Assign a software integrity level to the system and the software. Establish the degree of independence (see Annex C), if any, required for the V&V. Provide an estimate of the V&V budget, including test facilities and tools as required. To scope the V&V effort, the following steps shall be performed: (a) Adopt the system integrity scheme assigned to the project. If no system integrity level scheme exists, then one is selected. (b) Determine the minimum V&V tasks for the software integrity level using Table 2 and the selected software integrity level scheme. (c) Augment the minimum V&V tasks with optional V&V tasks, as necessary. (d) Establish the scope of the V&V from the description of V&V tasks, inputs, and outputs defined in Table 1.	Preliminary System Description Statement of Need Request for Proposal (RFP) or tender System Integrity Level Scheme	Updated SVVP	Info		
IEEE1012:315	Table 1	(2) Planning the Interface Between the V&V Effort and Supplier. Plan the V&V schedule for each V&V task. Identify the preliminary list of development processes and products to be evaluated by the V&V processes. Describe V&V access rights to proprietary and classified information. It is recommended that the plan be coordinated with the acquirer. Incorporate the project software integrity level scheme into the planning process.	SVVP RFP or tender Contract Supplier Development Plans and Schedules	Updated SVVP	Info		
IEEE1012:316	Table 1	(3) System Requirements Review. Review the system requirements (e.g., system requirements specification, feasibility study report, business rules description) in the RFP or tender to 1) verify the consistency of requirements to user needs, 2) validate whether the requirements can be satisfied by the defined technologies, methods, and algorithms defined for the project (feasibility), and 3) verify whether objective information that can be demonstrated by testing is provided in the requirements (testability). Review other requirements such as deliverable definitions, listing of appropriate compliance standards and regulations, user needs, etc., for completeness, correctness, and accuracy.	Preliminary System Description Statement of Need User Needs RFP or tender	Task Report(s)— System Requirements Review Anomaly Report(s)	Info		
IEEE1012:317	Table 1	5.3.1 Planning V&V Activity (supply process)			Title		
IEEE1012:318	Table 1	(1) Planning the Interface Between the V&V Effort and Supplier. Review the supplier development plans and schedules to coordinate the V&V effort with development activities. Establish procedures to exchange V&V data and results with the development effort. It is recommended that the plan be coordinated with the acquirer. Incorporate the project software integrity level scheme into the planning process.	SVVP Contract Supplier Development Plans and Schedules	Updated SVVP	Info		
IEEE1012:319	Table 1	(2) Contract Verification. Verify that 1) system requirements (from RFP or tender, and contract) satisfy and are consistent with user needs; 2) procedures are documented for managing requirement changes and for identifying the management hierarchy to address problems; 3) procedures for interface and cooperation among the parties are documented, including ownership, warranty, copyright, and confidentiality; and 4) acceptance criteria and procedures are documented in accordance with requirements.	SVVP RFP or tender Contract User Needs Supplier Development Plans and Schedules	Updated SVVP Task Report(s)— Contract Verification Anomaly Report(s)	Info		
IEEE1012:320	Table 1	5.4.1 Concept V&V Activity (development process)			Title		
IEEE1012:321	Table 1	(1) Concept Documentation Evaluation. Verify that the concept documentation satisfies user needs and is consistent with acquisition needs. Validate constraints of interfacing systems and constraints or limitations of proposed approach. Analyze system requirements and validate that the following satisfy user needs: 1) system functions; 2) end-to-end system performance; 3) feasibility and testability of the functional requirements; 4) system architecture design; 5) operation and maintenance requirements; and 6) migration requirements from an existing system where applicable.	Concept Documentation Supplier Development Plans and Schedules User Needs Acquisition Needs	Task Report(s)— Concept Documentation Evaluation Anomaly Report(s)	Info		

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ID	Section	Description	Inputs	Outputs	COMPLIANCE STATUS CO (Comply) CL (Clarification) DE (Deviation) EX (Exception)	SVVP Correlation	Remarks
IEEE1012:322	Table 1	(2) Criticality Analysis. Determine whether software integrity levels are established for requirements, detailed functions, software modules, subsystem, or other software partitions. Verify that the assigned software integrity levels are correct. If software integrity levels are not assigned, then assign software integrity levels to the system requirements. Document the software integrity level assigned to individual software components (e.g., requirements, detailed functions, software modules, subsystems, or other software partitions). For V&V planning purposes, the most critical software integrity level assigned to individual elements shall be the integrity level assigned to the entire software. Verify whether any software component can influence individual software components assigned a higher software integrity level, and if such conditions exist, then assign that software component the same higher software integrity level.	Concept Documentation (system requirements) Developer integrity level assignments	Task Report(s)— Software Integrity Levels Task Report(s)— Criticality Analysis Anomaly Report(s)	Info		
IEEE1012:323	Table 1	(3) Hardware/Software/User Requirements Allocation Analysis. Verify the correctness, accuracy, and completeness of the concept requirement allocation to hardware, software, and user interfaces against user needs. (3.1) Correctness a. Verify that performance requirements (e.g., timing, response time, and throughput) allocated to hardware, software, and user interfaces satisfy user needs. (3.2) Accuracy a. Verify that the internal and external interfaces specify the data formats, interface protocols, frequency of data exchange at each interface, and other key performance requirements to demonstrate compliance with user requirements. (3.3) Completeness a. Verify that application specific requirements such as functional diversity, fault detection, fault isolation, and diagnostic and error recovery satisfy user needs. b. Verify that the user's maintenance requirements for the system are completely specified. c. Verify that the migration from the existing system and replacement of the system satisfy user needs.	User Needs Concept Documentation	Task Report(s)— Hardware/ Software/User Requirements Allocation Analysis Anomaly Report(s)	Info		
IEEE1012:324	Table 1	(4) Traceability Analysis. Identify all system requirements that will be implemented completely or partially by software. Verify that these system requirements are traceable to acquisition needs. Start the software requirements traceability analysis with system requirements.	Concept Documentation	Task Report(s)— Traceability Analysis Anomaly Report(s)	Info		
IEEE1012:325	Table 1	(5) Hazard Analysis. Analyze the potential hazards to and from the conceptual system. The analysis shall 1) identify the potential system hazards; 2) assess the severity of each hazard; 3) assess the probability of each hazard; and 4) identify mitigation strategies for each hazard.	Concept Documentation	Task Report(s)— Hazard Analysis Anomaly Report(s)	Info		
IEEE1012:326	Table 1	(6) Risk Analysis. Identify the technical and management risks. Provide recommendations to eliminate, reduce, or mitigate the risks.	Concept Documentation Supplier Development Plans and Schedules Hazard Analysis Report V&V task results	Task Report(s)— Risk Analysis Anomaly Report(s)	Info		
IEEE1012:327	Table 1	5.4.2 Requirements V&V Activity (development process)			Title		

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ID	Section	Description	Inputs	Outputs	COMPLIANCE STATUS CO (Comply) CL (Clarification) DE (Deviation) EX (Exception)	SVVP Correlation	Remarks
IEEE1012:328	Table 1	1) Traceability Analysis. Trace the software requirements (SRS and IRS) to system requirements (Concept Documentation), and system requirements to the software requirements. Analyze identified relationships for correctness, consistency, completeness, and accuracy. The task criteria are as follows: (1.1) Correctness a. Validate that the relationships between each software requirement and its system requirement are correct. (1.2) Consistency a. Verify that the relationships between the software and system requirements are specified to a consistent level of detail. (1.3) Completeness a. Verify that every software requirement is traceable to a system requirement with sufficient detail to show compliance with the system requirement. b. Verify that all system requirements related to software are traceable to software requirements. (1.4) Accuracy a. Validate that the system performance and operating characteristics are accurately specified by the traced software requirements.	Concept Documentation (System requirements) SRS IRS	Task Report(s)— Traceability Analysis Anomaly Report(s)	CO	Sec 5.2.2.2.1_1)	
IEEE1012:329	Table 1	(2) Software Requirements Evaluation. Evaluate the requirements (e.g., functional, capability, interface, qualification, safety, security, human factors, data definitions, user documentation, installation and acceptance, user operation, and user maintenance) of the SRS and IRS for correctness, consistency, completeness, accuracy, readability, and testability. The task criteria are as follows: (2.1) Correctness a. Verify and validate that the software requirements satisfy the system requirements allocated to software within the assumptions and constraints of the system. b. Verify that the software requirements comply with standards, references, regulations, policies, physical laws, and business rules. c. Validate the sequences of states and state changes using logic and data flows coupled with domain expertise, prototyping results, engineering principles, or other basis. d. Validate that the flow of data and control satisfy functionality and performance requirements. e. Validate data usage and format. (2.2) Consistency a. Verify that all terms and concepts are documented consistently. b. Verify that the function interactions and assumptions are consistent and satisfy system requirements and acquisition needs. c. Verify that there is internal consistency between the soft- ware requirements and external consistency with the system requirements.	Concept Documentation SRS IRS	Task Report(s)— Software Requirements Evaluation Anomaly Report(s)	CO	Sec 5.2.2.2.1_2)	

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ID	Section	Description	Inputs	Outputs	COMPLIANCE STATUS CO (Comply) CL (Clarification) DE (Deviation) EX (Exception)	SVVP Correlation	Remarks
IEEE1012:330	Table 1	(2.3) Completeness a. Verify that the following elements are in the SRS or IRS, within the assumptions and constraints of the system: 1. Functionality (e.g., algorithms, state/mode definitions, input/output validation, exception handling, reporting, and logging); 2. Process definition and scheduling; 3. Hardware, software, and user interface descriptions. 4. Performance criteria (e.g., timing sizing, speed, capacity, accuracy, precision, safety, and security); 5. Critical configuration data; and 6. System, device, and software control (e.g., initialization, transaction and state monitoring, and self-testing). b. Verify that the SRS and IRS satisfy specified configuration management procedures.			CO	Sec 5.2.2.2.1_2)	
IEEE1012:331	Table 1	(2.4) Accuracy a. Validate that the logic, computational, and interface precision (e.g., truncation and rounding) satisfy the requirements in the system environment. b. Validate that the modeled physical phenomena conform to system accuracy requirements and physical laws. (2.5) Readability a. Verify that the documentation is legible, understandable, and unambiguous to the intended audience. b. Verify that the documentation defines all acronyms, mnemonics, abbreviations, terms, and symbols. (2.6) Testability a. Verify that there are objective acceptance criteria for validating the requirements of the SRS and IRS.			CO	Sec 5.2.2.2.1_2)	
IEEE1012:332	Table 1	(3) Interface Analysis. Verify and validate that the requirements for software interfaces with hardware, user, operator, and other systems are correct, consistent, complete, accurate, and testable. The task criteria are as follows: (3.1) Correctness a. Validate the external and internal system and software interface requirements. (3.2) Consistency a. Verify that the interface descriptions are consistent between the SRS and IRS. (3.3) Completeness a. Verify that each interface is described and includes data format and performance criteria (e.g., timing, bandwidth, accuracy, safety, and security). (3.4) Accuracy a. Verify that each interface provides information with the required accuracy. (3.5) Testability a. Verify that there are objective acceptance criteria for validating the interface requirements.	Concept Documentation SRS IRS	Task Report(s)— Interface Analysis Anomaly Report(s)	CO	Sec 5.2.2.2.1_3)	
IEEE1012:333	Table 1	(4) Criticality Analysis. Review and update the existing criticality analysis results from the prior Criticality Task Report using the SRS and IRS. Implementation methods and interfacing technologies may cause previously assigned software integrity levels to be raised or lowered for a given software element (i.e., requirement, module, function, subsystem, other software partition). Verify that no inconsistent or undes- ired software integrity consequences are introduced by reviewing the revised software integrity levels.	Task Report(s)— Criticality SRS IRS	Task Report(s)— Criticality Analysis Anomaly Report(s)	CO	Sec 5.2.2.2.1_3)	

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ID	Section	Description	Inputs	Outputs	COMPLIANCE STATUS CO (Comply) CL (Clarification) DE (Deviation) EX (Exception)	SVVP Correlation	Remarks
IEEE1012:334	Table 1	(5) System V&V Test Plan Generation and Verification. (For Software Integrity Levels 3 and 4) Plan system V&V testing to validate software requirements. Plan tracing of system requirements to test designs, cases, procedures, and results. Plan documentation of test designs, cases, procedures, and results. The System V&V Test Plan shall address the following: 1) compliance with all system requirements (e.g., functional, performance, security, operation, and maintenance) as complete software end items in the system environment, 2) adequacy of user documentation (e.g., training materials, procedural changes), and 3) performance at boundaries (e.g., data, interfaces) and under stress conditions. Verify that the System V&V Test Plan conform to Project defined test document purpose, format, and content (e.g., see IEEE Std 829-1983 [B5]). Validate that the System Test Plan satisfies the following criteria: 1) test coverage of system requirements; 2) appropriateness of test methods and standards used; 3) conformance to expected results; 4) feasibility of system qualification testing; and 5) feasibility and testability of operation and maintenance requirements.	Concept Documentation (System requirements) SRS IRS User Documentation System Test Plan	Anomaly Report(s) System V&V Test Plan	CO	Sec 5.2.2 Sec 5.2.2.1_4)	System Test Plan is described in System Validation Test Plan.
IEEE1012:335	Table 1	(For Software Integrity Levels 1 and 2) Verify that developer's System Test Plans conform to Project defined test document purpose, format, and content (e.g., see IEEE Std 829-1983 [B5]). Validate that the System Test Plan satisfies the following criteria: 1) test coverage of system requirements; 2) appropriateness of test methods and standards used; 3) conformance to expected results; 4) feasibility of system qualification testing; and 5) capability to be operated and maintained.			Info		
IEEE1012:336	Table 1	(6) Acceptance V&V Test Plan Generation and Verification. (For Software Integrity Levels 3 and 4) Plan Acceptance V&V testing to validate that software correctly implements system and software requirements in an operational environment. The task criteria are 1) compliance with acceptance requirements in the operational environment, and 2) adequacy of user documentation. Plan tracing of acceptance test requirements to test design, cases, procedures, and execution results. Plan documentation of test tasks and results. Verify that the Acceptance V&V Test Plan complies with Project defined test document purpose, format, and content (e.g., see IEEE Std 829-1983 [B5]). Validate that the Acceptance Test Plan satisfies the following criteria: 1) test coverage of system requirements; 2) conformance to expected results; and 3) feasibility of operation and maintenance (e.g., capability to be operated and maintained in accordance with user needs).	Concept Documentation SRS IRS User Documentation Acceptance Test Plan	Acceptance V&V Test Plan Anomaly Report(s)	N/A	N/A	Acceptance V&V Test Plan Generation and Verification (Out of Scope).
IEEE1012:337	Table 1	(For Software Integrity Level 2) Verify that the developer's Acceptance Test Plan conforms to Project defined test document purpose, format, and content (e.g., see IEEE Std 829-1983 [B5]). Validate that the developer's Acceptance Test Plan satisfies the following criteria: 1) test coverage of system requirements; 2) conformance to expected results; and 3) feasibility of operation and maintenance (e.g., capability to be operated and maintained in accordance with user needs). (For Software Integrity Level 1, there are no acceptance test requirements.)					
IEEE1012:338	Table 1	(7) Configuration Management Assessment. Verify that the Configuration Management process is complete and adequate. The task criteria are as follows: (7.1) Completeness a. Verify that there is a process for describing the software product functionality, tracking program versions, and managing changes. (7.2) Adequacy a. Verify that the configuration management process is adequate for the development complexity, software and system size, software integrity level, project plans, and user needs.	Software Configuration Management Process Documentation	Task Report (s)— Configuration Management Assessment Anomaly Report (s)	CO	Sec 5.2.2.1_5)	

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ID	Section	Description	Inputs	Outputs	COMPLIANCE STATUS CO (Comply) CL (Clarification) DE (Deviation) EX (Exception)	SVVP Correlation	Remarks
IEEE1012:339	Table 1	(8) Hazard Analysis. Determine software contributions to system hazards. The hazard analysis shall a) identify the software requirements that contribute to each system hazard; and b) validate that the software addresses, controls, or mitigates each hazard.	SRS IRS Hazard Analysis Report	Task Report(s)— Hazard Analysis Anomaly Report(s)	CO	Sec 5.2.2.2.1_3)	
IEEE1012:340	Table 1	(9) Risk Analysis. Review and update risk analysis using prior task reports. Provide recommendations to eliminate, reduce, or mitigate the risks.	Concept Documentation SRS IRS Supplier Development Plans and Schedules Hazard Analysis Report V&V task results	Task Report(s)— Risk Analysis Anomaly Report(s)	CO	Sec 5.2.2.2.1_3)	
IEEE1012:341	Table 1	5.4.3 Design V&V Activity (development process)			Title		
IEEE1012:342	Table 1	(1) Traceability Analysis. Trace design elements (SDD and IDD) to requirements (SRS and IRS), and requirements to design elements. Analyze relationships for correctness, consistency, and completeness. The task criteria are as follows: (1.1) Correctness a. Validate the relationship between each design element and the software requirement. (1.2) Consistency a. Verify that the relationship between the design elements and the software requirements are specified to a constant level of detail. (1.3) Completeness a. Verify that all design elements are traceable from the software requirements. b. Verify that all software requirements are traceable to the design elements.	SRS SDD IRS IDD	Task Report(s)— Traceability Analysis Anomaly Report(s)	CO	Sec 5.2.3.2.1_1)	
IEEE1012:343	Table 1	(2) Software Design Evaluation. Evaluate the design elements (SDD and IDD) for correctness, consistency, completeness, accuracy, readability, and testability. The task criteria are as follows: (2.1) Correctness a. Verify and validate that the source code component satisfies the software design. b. Verify that the source code components comply with standards, references, regulations, policies, physical laws, and business rules. c. Validate the source code component sequences of states and state changes using logic and data flows coupled with domain expertise, prototyping results, engineering principles, or other basis. d. Validate that the flow of data and control satisfy functionality and performance requirements. e. Validate data usage and format. f. Assess the appropriateness of coding methods and standards. (2.2) Consistency a. Verify that all terms and code concepts are documented consistently. b. Verify that there is internal consistency between the source code components.	SRS IRS SDDIDD Design Standards (e.g., standards, practices, and conventions)	Task Report(s)— Software Design Evaluation Anomaly Report(s)	CO	Sec 5.2.3.2.1_2)	

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ID	Section	Description	Inputs	Outputs	COMPLIANCE STATUS CO (Comply) CL (Clarification) DE (Deviation) EX (Exception)	SVVP Correlation	Remarks
IEEE1012:344	Table 1	(2.3) Completeness a. Verify that the following elements are in the SDD, within the assumptions and constraints of the system: 1. Functionality (e.g., algorithms, state/mode definitions, input/output validation, exception handling, reporting and logging); 2. Process definition and scheduling; 3. Hardware, software, and user interface descriptions; 4. Performance criteria (e.g., timing, sizing, speed, capacity, accuracy, precision, safety, and security); 5. Critical configuration data; 6. System, device, and software control (e.g., initialization, transaction and state monitoring, and self-testing). b. Verify that the SDD and IDD satisfy specified configuration management procedures.			CO	Sec 5.2.3.2.1_2)	
IEEE1012:345	Table 1	(2.4) Accuracy a. Validate that the logic, computational, and interface precision (e.g., truncation and rounding) satisfy the requirements in the system environment. b. Validate that the modeled physical phenomena conform to system accuracy requirements and physical laws. (2.5) Readability a. Verify that the documentation is legible, understandable, and unambiguous to the intended audience. b. Verify that the documentation defines all acronyms, mnemonics, abbreviations, terms, symbols, and design language, if any. (2.6) Testability a. Verify that there are objective acceptance criteria for validating each software design element and the system design. b. Verify that each software design element is testable to objective acceptance criteria.			CO	Sec 5.2.3.2.1_2)	
IEEE1012:346	Table 1	(3) Interface Analysis. Verify and validate that the software design interfaces with hardware, user, operator, software, and other systems for correctness, consistency, completeness, accuracy, and testability. The task criteria are as follows: (3.1) Correctness a. Validate the external and internal software interface design in the context of system requirements. (3.2) Consistency a. Verify that the interface design is consistent between the SDD and IDD. (3.3) Completeness a. Verify that each interface is described and includes data format and performance criteria (e.g., timing, bandwidth, accuracy, safety, and security). (3.4) Accuracy a. Verify that each interface provides information with the required accuracy. (3.5) Testability a. Verify that there are objective acceptance criteria for validating the interface design.	Concept Documentation (System requirements) SRS IRS SDD IDD	Task Report(s)— Interface Analysis Anomaly Report(s)	CO	Sec 5.2.3.2.1_7)	
IEEE1012:347	Table 1	(4) Criticality Analysis. Review and update the existing criticality analysis results from the prior Criticality Task Report using the SDD and IDD. Implementation methods and interfacing technologies may cause previously assigned software integrity levels to be raised or lowered for a given software element (i.e., requirement, module, function, subsystem, other software partition). Verify that no inconsistent or undesired software integrity consequences are introduced by reviewing the revised software integrity levels.	Task Report(s)—Criticality SDD IDD	Task Report(s)— Criticality Analysis Anomaly Report(s)	CO	Sec 5.2.3.2.1_7)	

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ID	Section	Description	Inputs	Outputs	COMPLIANCE STATUS CO (Comply) CL (Clarification) DE (Deviation) EX (Exception)	SVVP Correlation	Remarks
IEEE1012:348	Table 1	(5) Component V&V Test Plan Generation and Verification. (For Software Integrity Levels 3 and 4.) Plan component V&V testing to validate that the software components (e.g., units, source code modules) correctly implement component requirements. The task criteria are 1) compliance with design requirements; 2) assessment of timing, sizing, and accuracy; 3) performance at boundaries and interfaces and under stress and error conditions; and 4) measures of requirements test coverage and software reliability and maintainability. Plan tracing of design requirements to test design, cases, procedures, and results. Plan documentation of test tasks and results. Verify that the Component V&V Test Plan complies with Project defined test document purpose, format, and content (e.g., see IEEE Std 829-1983 [B5]). Validate that the Component V&V Test Plan satisfies the following criteria: 1) traceable to the software requirements and design; 2) external consistency with the software requirements and design; 3) internal consistency between unit requirements; 4) test coverage of requirements in each unit; 5) feasibility of software integration and testing; and 6) feasibility of operation and maintenance (e.g., capability to be operated and maintained in accordance with user needs).	SRS SDD IRS IDD Component Test Plan	Component V&V Test Plan Anomaly Report(s)	CO	Sec 5.2.3.2.1 -4)	Component V&V Test Plan is described in Software Verification Test Plan.
IEEE1012:349	Table 1	(For Software Integrity Level 2.) Verify that the developer's Component Test Plan conforms to Project defined test document purpose, format, and content (e.g., see IEEE Std 829-1983). Validate that the developer's Component Test Plan satisfies the following criteria: 1) traceable to the software requirements and design; 2) external consistency with the software requirements and design; 3) internal consistency between unit requirements; 4) test coverage of units; 5) feasibility of software integration and testing; and 6) feasibility of operation and maintenance (e.g., capability to be operated and maintained in accordance with user needs). (For Software Integrity Level 1, there are no component test requirements.)			Info		
IEEE1012:350	Table 1	(6) Integration V&V Test Plan Generation and Verification. (For Software Integrity Levels 3 and 4.) Plan integration testing to validate that the software correctly implements the software requirements and design as each software component (e.g., units or modules) is incrementally integrated with each other. The task criteria are 1) compliance with increasingly larger set of functional requirements at each stage of integration; 2) assessment of timing, sizing, and accuracy; 3) performance at boundaries and under stress conditions; and 4) measures of requirements test coverage and software reliability. Plan tracing of requirements to test design, cases, procedures, and results. Plan documentation of test tasks and results. Verify that the Integration V&V Test Plan complies with Project defined test document purpose, format, and content (e.g., see IEEE Std 829-1983 [B5]). Validate that the Integration V&V Test Plan satisfies the following criteria: 1) traceable to the system requirements; 2) external consistency with the system requirements; 3) internal consistency; 4) test coverage of the software requirements; 5) appropriateness of test standards and methods used; 6) conformance to expected results; 7) feasibility of software qualification testing; and 8) feasibility of operation and maintenance (e.g., capability to be operated and maintained in accordance with user needs).	SRS IRS SDD IDD Integration Test Plan	Integration V&V Test Plan Anomaly Report(s)	CO	Sec 5.2.3.2.1 -4)	Integration V&V Test Plan is described in Software Verification Test Plan.
IEEE1012:351	Table 1	(For Software Integrity Levels 1 and 2.) Verify that the developer's Integration Test Plan conform to Project defined test document purpose, format, and content (e.g., see IEEE Std 829-1983). Validate that the developer's Integration Test Plan satisfies the following criteria: 1) traceable to the system requirements; 2) external consistency with the system requirements; 3) internal consistency; 4) test coverage of the software requirements; 5) appropriateness of test standards and methods; 6) conformance to expected results; 7) feasibility of software qualification testing; and 8) feasibility of operation and maintenance (e.g., capability to be operated and maintained in accordance with user needs).			Info		

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ID	Section	Description	Inputs	Outputs	COMPLIANCE STATUS CO (Comply) CL (Clarification) DE (Deviation) EX (Exception)	SVVP Correlation	Remarks
IEEE1012:352	Table 1	(7) V&V Test Design Generation and Verification. (For Software Integrity Levels 3 and 4.) Design tests for: 1) component testing; 2) integration testing; 3) system testing; and 4) acceptance testing. Continue tracing required by the V&V Test Plan. Verify that the V&V Test Designs comply with Project defined test document purpose, format, and content (e.g., see IEEE Std 829-1983 [B5]). Validate that the V&V Test Designs satisfy the criteria in V&V tasks 5.4.3 Task 5; 5.4.3 Task 6; 5.4.2 Task 5; and 5.4.2 Task 6, for component, integration, system, and acceptance testing, respectively.	SDD IDD User Documentation Test Plans Test Designs	Component V&V Test Design(s) Integration V&V Test Design(s) System V&V Test Design(s) Acceptance V&V Test Design(s) Anomaly Report(s)	CO	Sec 5.2.3.2.1 -5) Sec 5.2.3.2.1 -6)	Test Design Generation and Verification is addressed in two documents: 1) Software Verification Test Specification. 2) System Validation Test Specification.
IEEE1012:353	Table 1	(For Software Integrity Levels 1 and 2.) Verify that the developer's Test Designs conform to Project defined test document purpose, format, and content (e.g., see IEEE Std 829-1983). Validate that the developer's Test Designs satisfy the criteria in V&V tasks 5.4.3 Task 5; 5.4.3 Task 6; 5.4.2 Task 5; and 5.4.2 Task 6 for component (level 2 only), integration (levels 1 and 2), system (levels 1 and 2), and acceptance (level 2 only) testing, respectively.			Info		
IEEE1012:354	Table 1	(8) Hazard Analysis. Verify that logic design and associated data elements correctly implement the critical requirements and introduce no new hazards. Update the hazard analysis.	SDD IDD Hazard Analysis Report	Task Report(s)— Hazard Analysis Anomaly Report(s)	CO	Sec 5.2.3.2.1_7)	
IEEE1012:355	Table 1	(9) Risk Analysis. Review and update risk analysis using prior task reports. Provide recommendations to eliminate, reduce, or mitigate the risks.	SDD IDD Supplier Development Plans and Schedules Hazard Analysis Report V&V task results	Task Report(s)— Risk Analysis Anomaly Report(s)	CO	Sec 5.2.3.2.1_7)	
IEEE1012:356	Table 1	5.4.4 Implementation V&V Activity (development process)			Title	Sec 5.2.4	
IEEE1012:357	Table 1	(1) Traceability Analysis. Trace the source code components to corresponding design specification(s), and design specification(s) to source code components. Analyze identified relationships for correctness, consistency, and completeness. The task criteria are as follows: (1.1) Correctness a. Validate the relationship between the source code components and design element(s). (1.2) Consistency a. Verify that the relationships between the source code components and design elements are specified to a consistent level of detail. (1.3) Completeness a. Verify that all source code components are traceable from the design elements. b. Verify that all design elements are traceable to the source code components.	SDD IDD Source Code	Task Report(s)— Traceability Analysis Anomaly Report(s)	CO	Sec 5.2.4.2.1_1)	

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ID	Section	Description	Inputs	Outputs	COMPLIANCE STATUS CO (Comply) CL (Clarification) DE (Deviation) EX (Exception)	SVVP Correlation	Remarks
IEEE1012:358	Table 1	<p>(2) Source Code and Source Code Documentation Evaluation. Evaluate the source code components (Source Code Documentation) for correctness, consistency, completeness, accuracy, readability, and testability. The task criteria are as follows:</p> <p>(2.1) Correctness</p> <p>a. Verify and validate that the source code component satisfies the software design.</p> <p>b. Verify that the source code components comply with standards, references, regulations, policies, physical laws, and business rules.</p> <p>c. Validate the source code component sequences of states and state changes using logic and data flows coupled with domain expertise, prototyping results, engineering principles, or other basis.</p> <p>d. Validate that the flow of data and control satisfy functionality and performance requirements.</p> <p>e. Validate data usage and format.</p> <p>f. Assess the appropriateness of coding methods and standards.</p> <p>(2.2) Consistency</p> <p>a. Verify that all terms and code concepts are documented consistently.</p> <p>b. Verify that there is internal consistency between the source code components.</p> <p>c. Validate external consistency with the software design and requirements.</p>	Source Code SDD IDD Coding Standards (e.g., standards, practices, project restrictions, and conventions) User Documentation	Task Report(s)— Source Code and Source Code Documentation Evaluation Anomaly Report(s)	CO	Sec 5.2.4.2.1_4)	
IEEE1012:359	Table 1	<p>(2.3) Completeness</p> <p>a. Verify that the following elements are in the source code, within the assumptions and constraints of the system:</p> <p>1. Functionality (e.g., algorithms, state/mode definitions, input/output validation, exception handling, reporting and logging);</p> <p>2. Process definition and scheduling;</p> <p>3. Hardware, software, and user interface descriptions;</p> <p>4. Performance criteria (e.g., timing, sizing, speed, capacity, accuracy, precision, safety, and security);</p> <p>5. Critical configuration data;</p> <p>6. System, device, and software control (e.g., initialization, transaction and state monitoring, and self-testing).</p> <p>b. Verify that the source code documentation satisfies specified configuration management procedures.</p> <p>(2.4) Accuracy</p> <p>a. Validate the logic, computational, and interface precision (e.g., truncation and rounding) in the system environment. b. Validate that the modeled physical phenomena conform to system accuracy requirements and physical laws.</p> <p>(2.5) Readability</p> <p>a. Verify that the documentation is legible, understandable, and unambiguous to the intended audience.</p> <p>b. Verify that the documentation defines all acronyms, mnemonics, abbreviations, terms, and symbols.</p> <p>(2.6) Testability</p> <p>a. Verify that there are objective acceptance criteria for validating each source code component.</p> <p>b. Verify that each source code component is testable against objective acceptance criteria.</p>			CO	Sec 5.2.4.2.1_4)	

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ID	Section	Description	Inputs	Outputs	COMPLIANCE STATUS CO (Comply) CL (Clarification) DE (Deviation) EX (Exception)	SVVP Correlation	Remarks
IEEE1012:360	Table 1	(3) Interface Analysis. Verify and validate that the software source code interfaces with hardware, user, operator, soft- ware, and other systems for correctness, consistency, completeness, accuracy, and testability. The task criteria are as follows: (3.1) Correctness a. Validate the external and internal software interface code in the context of system requirements. (3.2) Consistency a. Verify that the interface code is consistent between source code components and to external interfaces (i.e., hardware, user, operator, and other software). (3.3) Completeness a. Verify that each interface is described and includes data format and performance criteria (e.g., timing, bandwidth, accuracy, safety, and security). (3.4) Accuracy a. Verify that each interface provides information with the required accuracy. (3.5) Testability a. Verify that there are objective acceptance criteria for validating the interface code.	Concept Documentation (System requirements) SDD IDD Source Code User Documentation	Task Report(s)— Interface Analysis Anomaly Report(s)	CO	Sec 5.2.4.2.1_6)	
IEEE1012:361	Table 1	(4) Criticality Analysis. Review and update the existing criticality analysis results from the prior Criticality Task Report using the source code. Implementation methods and interfacing technologies may cause previously assigned software integrity levels to be raised or lowered for a given software element (i.e., requirement, module, function, subsystem, other software partition). Verify that no inconsistent or undesired software integrity consequences are introduced by reviewing the revised software integrity levels.	Task Report(s)— Criticality Source Code	Task Report(s)—Criticality Analysis Anomaly Report(s)	CO	Sec 5.2.4.2.1_6)	
IEEE1012:362	Table 1	(5) V&V Test Case Generation and Verification. (For Software Integrity Levels 3 and 4.) Develop V&V Test Cases for 1) component testing; 2) integration testing; 3) system testing; and 4) acceptance testing. Continue tracing required by the V&V Test Plans. Verify that the V&V Test Cases comply with Project defined test document purpose, format, and content (e.g., see IEEE Std 829-1983 [B5]). Validate that the V&V Test Cases satisfy the criteria in V&V tasks 5.4.3 Task 5; 5.4.3 Task 6; 5.4.2 Task 5; and 5.4.2 Task 6 for component, integration, system, and acceptance testing, respectively.	SRS IRS SDD IDD User Documentation Test Design Test Cases	Component V&V Test Cases Integration V&V Test Cases System V&V Test Cases Acceptance V&V Test Cases Anomaly Report(s)	CO	Sec 5.2.4.2.1 -5)	Software Verification Test Case Generation and Verification.
IEEE1012:363	Table 1	(For Software Integrity Levels 1 and 2.) Verify that the developer's Test Cases conform to Project defined test document purpose, format, and content (e.g., see IEEE Std 829-1983). Validate that the developer's Test Cases satisfy the criteria in V&V tasks 5.4.3 Task 5; 5.4.3 Task 6; 5.4.2 Task 5; and 5.4.2 Task 6 for component (level 2 only); integration (levels 1 and 2); system (levels 1 and 2); and acceptance (level 2 only) testing, respectively.			Info		
IEEE1012:364	Table 1	(6) V&V Test Procedure Generation and Verification. (For Software Integrity Levels 3 and 4.) Develop V&V Test Proce- dures for 1) component testing; 2) integration testing; and 3) system testing. Continue tracing required by the V&V Test Plans. Verify that the V&V Test Procedures comply with Project defined test document purpose, format, and content (e.g., see IEEE Std 829-1983 [B5]). Validate that the V&V Test Procedures satisfy the criteria in V&V tasks 5.4.3 Task 5; 5.4.3 Task 6; and 5.4.2 Task 5 for component, integration, and system testing, respectively.	SRS IRS SDD IDD User Documentation Test Cases Test Procedures	Component V&V Test Procedures Integration V&V Test Procedures System V&V Test Procedures Anomaly Report(s)	CO	Sec 5.2.4.2.1 -5) Sec 5.2.5.2.1 -2)	Software Verification Test Procedure Generation and Verification. System Validation Test Procedure Generation and Verification (Done in Invensys Test Phase).

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ID	Section	Description	Inputs	Outputs	COMPLIANCE STATUS CO (Comply) CL (Clarification) DE (Deviation) EX (Exception)	SVVP Correlation	Remarks
IEEE1012:365	Table 1	(For Software Integrity Levels 1 and 2.) Verify that the developer's Test Procedures conform to Project defined test document purpose, format, and content (e.g., see IEEE Std 829-1983). Validate that the developer's Test Procedures satisfy the criteria in V&V tasks 5.4.3 Task 5; 5.4.3 Task 6; and 5.4.2 Task 5 for component (level 2 only); integration (levels 1 and 2); system (levels 1 and 2); and acceptance (level 2 only) testing, respectively.			Info		
IEEE1012:366	Table 1	(7) Component V&V Test Execution and Verification. (For Software Integrity Levels 3 and 4.) Perform V&V component testing. Analyze test results to validate that software correctly implements the design. Validate that the test results trace to test criteria established by the test traceability in the test planning documents. Document the results as required by the Component V&V Test Plan. Use the V&V component test results to validate that the software satisfies the V&V test acceptance criteria. Document discrepancies between actual and expected test results.	Source Code Executable Code SDD IDD Component Test Plans Component Test Procedures Component Test Results	Task Report(s)— Test Results Anomaly Report(s)	CO	Sec 5.2.4.2.1 -5)	Software Verification Test Procedure Execution and Verification.
IEEE1012:367	Table 1	(For Software Integrity Level 2.) Use the developer's component test results to validate that the software satisfies the test acceptance criteria. (For Software Integrity Level 1, there are no component test requirements.)			Info		
IEEE1012:368	Table 1	(8) Hazard Analysis. Verify that the implementation and associated data elements correctly implement the critical requirements and introduce no new hazards. Update the hazard analysis.	Source Code SDD IDD Hazard Analysis Report	Task Report(s)— Hazard Analysis Anomaly Report(s)	CO	Sec 5.2.4.2.1_6)	
IEEE1012:369	Table 1	(9) Risk Analysis. Review and update risk analysis using prior task reports. Provide recommendations to eliminate, reduce or mitigate the risks.	Source Code Supplier Development Plans and Schedules Hazard Analysis Report V&V task results	Task Report(s)— Risk Analysis Anomaly Report(s)	CO	Sec 5.2.4.2.1_6)	
IEEE1012:370	Table 1	5.4.5 Test V&V Activity (development process)			Title		
IEEE1012:371	Table 1	(1) Traceability Analysis. Analyze relationships in the V&V Test Plans, Designs, Cases, and Procedures for correctness and completeness. For correctness, verify that there is a valid relationship between the V&V Test Plans, Designs, Cases, and Procedures. For completeness, verify that all V&V Test Procedures are traceable to the V&V Test Plans.	V&V Test Plans V&V Test Designs V&V Test Procedures	Task Report(s)— Traceability Analysis Anomaly Report(s)	CO	Sec 5.2.5.2.1_1)	
IEEE1012:372	Table 1	(2) Acceptance V&V Test Procedure Generation and Verification. (For Software Integrity Levels 3 and 4.) Develop Acceptance V&V Test Procedures. Continue the tracing required by the Acceptance V&V Test Plan. Verify that the V&V Test Procedures comply with Project defined test document purpose, format, and content (e.g., see IEEE Std 829-1983 [B5]). Validate that the Acceptance V&V Test Procedures satisfy the criteria in V&V task 5.4.2 Task 6.	SDD IDD Source Code User Documentation Acceptance Test Plan Acceptance Test Procedures	Acceptance V&V Test Procedures Anomaly Report(s)	N/A	N/A	Acceptance V&V Test Procedure Generation and Verification (Out of Scope).
IEEE1012:373	Table 1	(For Software Integrity Level 2.) Verify that the developer's Acceptance Test Procedures conform to Project defined test document purpose, format, and content (e.g., see IEEE Std 829-1983). Validate that the developer's Test Procedures satisfy the criteria in V&V task 5.4.2 Task 6. (For Software Integrity Level 1, there are no acceptance test requirements.)			Info		

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ID	Section	Description	Inputs	Outputs	COMPLIANCE STATUS CO (Comply) CL (Clarification) DE (Deviation) EX (Exception)	SVVP Correlation	Remarks
IEEE1012:374	Table 1	(3) Integration V&V Test Execution and Verification. (For Software Integrity Levels 3 and 4.) Perform V&V integration testing. Analyze test results to verify that the software components are integrated correctly. Validate that the test results trace to test criteria established by the test traceability in the test planning documents. Document the results as required by the Integration V&V Test Plan. Use the V&V integration test results to validate that the software satisfies the V&V test acceptance criteria. Document discrepancies between actual and expected test results.	Source Code Executable Code Integration Test Plan Integration Test Procedures Integration Test Results	Task Report(s)— Test Results Anomaly Report(s)	CO	Sec 5.2.4.2.1 -5)	Software Verification Test Procedure Execution and Verification (Done in Invensys Implementation Phase).
IEEE1012:375	Table 1	(For Software Integrity Levels 1 and 2.) Use the developer's integration test results to verify that the software satisfies the test acceptance criteria.			Info		
IEEE1012:376	Table 1	(4) System V&V Test Execution and Verification. (For Software Integrity Levels 3 and 4.) Perform V&V system testing. Analyze test results to validate that the software satisfies the system requirements. Validate that the test results trace to test criteria established by the test traceability in the test planning documents. Document the results as required by the System V&V Test Plan. Use the V&V system test results to validate that the software satisfies the V&V test acceptance criteria. Document discrepancies between actual and expected test results.	Source Code Executable Code System Test Plan System Test Procedures System Test Results	Task Report(s)— Test Results Anomaly Report(s)	CO	Sec 5.2.5.2.1 -3)	System Validation Test Procedure Execution and Verification.
IEEE1012:377	Table 1	(For Software Integrity Levels 1 and 2.) Use the developer's system test results to verify that the software satisfies the test acceptance criteria.			Info		
IEEE1012:378	Table 1	(5) Acceptance V&V Test Execution and Verification. (For Software Integrity Levels 3 and 4.) Perform acceptance V&V testing. Analyze test results to validate that the software satisfies the system requirements. Validate that the test results trace to test criteria established by the test traceability in the test planning documents. Document the results as required by the Acceptance V&V Test Plan. Use the acceptance V&V test results to validate that the software satisfies the V&V test acceptance criteria. Document discrepancies between actual and expected test results.	Source Code Executable Code User Documentation Acceptance Test Plan Acceptance Test Procedures Acceptance Test Results	Task Report(s)— Test Results Anomaly Report(s)	N/A	N/A	Acceptance V&V Test Execution and Verification (Out of Scope).
IEEE1012:379	Table 1	(For Software Integrity Level 2.) Use the developer's acceptance test results to verify that the software satisfies the test acceptance criteria. (For Software Integrity Level 1, there are no acceptance test requirements.)			Info		
IEEE1012:380	Table 1	(6) Hazard Analysis. Verify that the test instrumentation does not introduce new hazards. Update the hazard analysis.	Source Code Executable Code Test Results Hazard Analysis Report	Task Report(s)— Hazard Analysis Anomaly Report(s)	CO	Sec 5.2.5.2.1_5)	
IEEE1012:381	Table 1	(7) Risk Analysis. Review and update risk analysis using prior task reports. Provide recommendations to eliminate, reduce, or mitigate the risks.	Supplier Development Plans and Schedules Hazard Analysis Report V&V task results	Task Report(s)— Risk Analysis Anomaly Report(s)	CO	Sec 5.2.5.2.1_5)	
IEEE1012:382	Table 1	5.4.6 Installation and Checkout V&V Activity (development process)			Title		

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ID	Section	Description	Inputs	Outputs	COMPLIANCE STATUS CO (Comply) CL (Clarification) DE (Deviation) EX (Exception)	SVVP Correlation	Remarks
IEEE1012:383	Table 1	(1) Installation Configuration Audit. Verify that all software products required to correctly install and operate the software are present in the installation package. Validate that all site-dependent parameters or conditions to verify supplied values are correct.	Installation Package (e.g., Source Code, Executable Code, User Documentation, SDD, IDD, SRS, IRS, Concept Documentation, Installation Procedures, site-specific parameters, Installation Tests, and Configuration Management Data)	Task Report(s)— Installation Configuration Audit Anomaly Report(s)	Info		
IEEE1012:384	Table 1	(2) Installation Checkout. Conduct analyses or tests to verify that the installed software corresponds to the software subjected to V&V. Verify that the software code and databases initialize, execute, and terminate as specified. In the transition from one version of software to the next, the V&V effort shall validate that the software can be removed from the system without affecting the functionality of the remaining system components. The V&V effort shall verify the requirements for continuous operation and service during transition, including user notification.	User Documentation Installation Package	Task Report(s)— Installation Checkout Anomaly Report(s)	Info		
IEEE1012:385	Table 1	(3) Hazard Analysis. Verify that the installation procedures and installation environment does not introduce new hazards. Update the hazard analysis.	Installation Package Hazard Analysis Report	Task Report(s)— Hazard Analysis Anomaly Report(s)	Info		
IEEE1012:386	Table 1	(4) Risk Analysis. Review and update risk analysis using prior task reports. Provide recommendations to eliminate, reduce, or mitigate the risks.	Installation Package Supplier Development Plans and Schedules V&V task results	Task Report(s)— Risk Analysis Anomaly Report(s)	Info		
IEEE1012:387	Table 1	(5) V&V Final Report Generation. Summarize in the V&V final report the V&V activities, tasks and results, including status and disposition of anomalies. Provide an assessment of the overall software quality and provide recommendations.	V&V Activity Summary Report (s)	V&V Final Report	Info		
IEEE1012:388	Table 1	5.5.1 Operation V&V Activity (operation process)			Title		
IEEE1012:389	Table 1	(1) Evaluation of New Constraints. Evaluate new constraints (e.g., operational requirements, platform characteristics, operating environment) on the system or software requirements to verify the applicability of the SVVP. Software changes are maintenance activities (see 5.6.1).	SVVP New constraints	Task Report(s)— Evaluation of New Constraints	Info		
IEEE1012:390	Table 1	(2) Proposed Change Assessment. Assess proposed changes (e.g., modifications, enhancements, or additions) to determine the effect of the changes on the system. Determine the extent to which V&V tasks would be iterated.	Proposed Changes Installation Package	Task Report(s)— Proposed Change Assessment	Info		
IEEE1012:391	Table 1	(3) Operating Procedures Evaluation. Verify that the operating procedures are consistent with the user documentation and conform to the system requirements.	Operating Procedures User Documentation Concept Documentation	Task Report(s)— Operating Procedures Evaluation Anomaly Report(s)	Info		
IEEE1012:392	Table 1	(4) Hazard Analysis. Verify that the operating procedures and operational environment does not introduce new hazards. Update the hazard analysis.	Operating Procedures Hazard Analysis Report	Task Report(s)— Hazard Analysis Anomaly Report(s)	Info		
IEEE1012:393	Table 1	(5) Risk Analysis. Review and update risk analysis using prior task reports. Provide recommendations to eliminate, reduce, or mitigate the risks.	Installation Package Proposed Changes Hazard Analysis Report Supplier Development Plans and Schedules Operation problem reports	Task Report(s)— Risk Analysis Anomaly Report(s)	Info		

Compliance Matrix
Software Verification Validation Plan Compliance to IEEE Standard 1012-1998

ID	Section	Description	Inputs	Outputs	COMPLIANCE STATUS CO (Comply) CL (Clarification) DE (Deviation) EX (Exception)	SVVP Correlation	Remarks
IEEE1012:394	Table 1	5.6.1 Maintenance V&V Activity (maintenance process)			Title		
IEEE1012:395	Table 1	(1) SVVP Revision. Revise the SVVP to comply with approved changes. When the development documentation required by this standard is not available, generate a new SVVP and consider the methods in Annex D (V&V of reusable software) for deriving the required development documentation.	SVVP Approved Changes Installation Package Supplier Development Plans and Schedules	Updated SVVP	Info		
IEEE1012:396	Table 1	(2) Proposed Change Assessment. Assess proposed changes (i.e., modifications, enhancements, or additions) to determine the effect of the changes on the system. Determine the extent to which V&V tasks would be iterated.	Proposed Changes Installation Package Supplier Development Plans and Schedules	Task Report(s)— Proposed Change Assessment	Info		
IEEE1012:397	Table 1	(3) Anomaly Evaluation. Evaluate the effect of software operation anomalies.	Anomaly Report(s)	Task Report(s)— Anomaly Evaluation	Info		
IEEE1012:398	Table 1	(4) Criticality Analysis. Determine the software integrity levels for proposed modifications. Validate the integrity levels provided by the maintainer. For V&V planning purposes, the highest software integrity level assigned to the software shall be the software system integrity level.	Proposed Changes Installation Package Maintainer Integrity Levels	Task Report(s)— Criticality Analysis Anomaly Report(s)	Info		
IEEE1012:399	Table 1	(5) Migration Assessment. Assess whether the software requirements and implementation address 1) specific migration requirements, 2) migration tools, 3) conversion of software products and data, 4) software archiving, 5) support for the prior environment, and 6) user notification.	Installation Package Approved Changes	Task Report(s)— Migration Assessment Anomaly Report(s)	Info		
IEEE1012:400	Table 1	(6) Retirement Assessment. For software retirement, assess whether the installation package addresses: 1) software support, 2) impact on existing systems and databases, 3) software archiving, 4) transition to a new software product, and 5) user notification.	Installation Package Approved Changes	Task Report(s)— Retirement Assessment Anomaly Report(s)	Info		
IEEE1012:401	Table 1	(7) Hazard Analysis. Verify that software modifications correctly implement the critical requirements and introduce no new hazards. Update the hazard analysis.	Proposed Changes Installation Package Hazard Analysis Report	Task Report(s)— Hazard Analysis Anomaly Report(s)	Info		
IEEE1012:402	Table 1	(8) Risk Analysis. Review and update risk analysis using prior task reports. Provide recommendations to eliminate, reduce, or mitigate the risks.	Installation Package Proposed Changes Hazard Analysis Report Supplier Development Plans and Schedules Operation problem reports V&V task results	Task Report(s)— Risk Analysis Anomaly Report(s)	Info		
IEEE1012:403	Table 1	(9) Task Iteration. Perform V&V tasks, as needed, to ensure that 1) planned changes are implemented correctly; 2) documentation is complete and current; and 3) changes do not cause unacceptable or unintended system behaviors.	Approved Changes Installation Package	Task Report(s) Anomaly Report(s)	Info		
IEEE1012:404		Table 2—Minimum V&V tasks assigned to each software integrity level			Title		