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Sandia National Laboratories Advanced Simulation and Computing (ASC) Software Quality Plan

Part 2: Mappings for the ASC Software Quality Engineering Practices

Version 2.0

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Abstract

The purpose of the Sandia National Laboratories Advanced Simulation and Computing (ASC) Software Quality Plan is to clearly identify the practices that are the basis for continually improving the quality of ASC software products. The plan defines the ASC program software quality practices and provides mappings of these practices to Sandia Corporate Requirements CPR001.3.2 and CPR001.3.6 and to a Department of Energy document, *ASCI Software Quality Engineering: Goals, Principles, and Guidelines*. This document also identifies ASC management and software project teams' responsibilities in implementing the software quality practices and in assessing progress towards achieving their software quality goals.

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Please note that the authors listed for Version 1.0 of this document (which was published in January 2005) are again recognized as authors for Version 2.0 since the majority of the originating document did not change. Furthermore, although many of these authors have changed organizations since their contribution, it was felt that their former organizations should continue to be attributed herein since those organizations were responsible for the authors' work.

Additionally, the authors would like to once again thank the following individuals for their careful and thoughtful reviews, comments, and contributions in preparing the original version (Version 1.0) of this document in 2004: Ken Alvin, Kathy Aragon, Noel Belcourt, Manoj Bhardwaj, Ted Blacker, Bill Bohnhoff, Steve Bova, Pete Dean, Karen Devine, Martha Ernest, Ernest Friedman-Hill, Brian Grant, Pat Griffin, Arne Gullerud, Patricia Hackney, Mike Heroux, Gene Hertel, Rob Hoekstra, Lisa Ice, Karen Jefferson, Philip Kegelmeyer, Tom Laub, Alfred Lorber, Len Lorence, Mike McGlaun, Sue Kelly, Bob Kerr, John Noe, Pat Notz, Curt Ober, Shawn Pautz, Sharon Petney, Kendall Pierson, Allen Robinson, Leonard Stans, Jim Stewart, Randy Summers, Pamela Williams, and David Womble, and all other code team members and managers who reviewed that edition.

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1 Introduction

This document, *Part 2: Mappings for the ASC Software Quality Engineering Practices*, contains the mappings for the practices and artifacts found in *Part 1: Practices* of the *Sandia National Laboratories Advanced Simulation and Computing (ASC) Software Quality Plan* (Software Quality Plan). The purpose of the mappings contained herein is to provide requirements traceability from the Software Quality Plan to the driver documents as well as to two additional ASC program and industry standards requested by the ASC Quality Management Council (AQMC). Figure 1 illustrates the relationship between the software quality plan and the standards and guidelines that are mapped in this document.

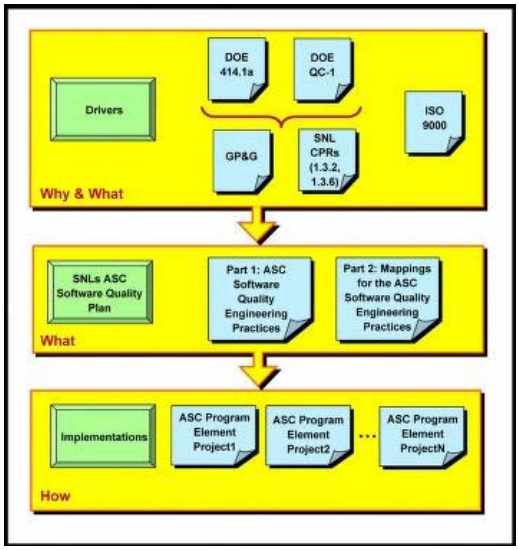

Figure 1. Relationship Between Software Quality Plan and Mapping Documents.

In all mappings provided, practice numbers or sections of Part 1 of the Software Quality Plan are listed to indicate a mapping to a particular requirement. Gaps between the various requirements and the Software Quality Plan are indicated in a light red color. An "N/A" is used where a particular requirement appears non-applicable. No degree of conformance is denoted or implied to the various requirements by the mappings. The practitioner or reader should not interpret indicated mappings to guarantee compliance.

This document is organized as follows:

- Section 1: Introduction
- Section 2: ASC Software Quality Plan Practices and Artifacts Tables
- Section 3: Mappings to the *Department of Energy, DOE/AL Quality Criteria (QC-1),* Revision 10, February 2004.
- Section 4: Mappings to the *ASCI Software Quality Engineering: Goals, Principles, and Guidelines* (GP&G),
- Section 5: Mappings to the SNL Corporate Process Reports
  - Section 5.1: CPR001.3.2, Corporate Quality Assurance Program (February 2006)
  - Section 5.2: CPR001.3.6, Corporate Software Quality Assurance (March 2006)
- Section 6: Mappings to the *ISO 9001:2000 Quality Management Systems – Requirements*, International Standards Organization, December 2000.

2 ASC Software Quality Plan Practices and Artifacts

The following tables provide lists of the practices and artifacts stated in *Part 1: Practices* of the Software Quality Plan.

Practice Number	Description of Software Quality Plan Practices
PR1	Document and maintain a strategic plan**.**
PR2	Perform a risk-based assessment, determine level of formality and applicable practices, and obtain approvals.
PR3	Document lifecycle processes and their interdependences, and obtain approvals.
PR4	Define, collect, and monitor appropriate process metrics.
PR5	Periodically evaluate quality problems and implement process improvements.
PR6	Identify stakeholders and other requirements sources.
PR7	Gather and manage stakeholders' expectations and requirements.
PR8	Derive, negotiate, manage, and trace requirements.
PR9	Identify and analyze risk events.
PR10	Define, monitor, and implement the risk response.
PR11	Create and manage the project plan.
PR12	Track project performance versus project plan and implement needed (corrective) actions.
PR13	Communicate and review design.
PR14	Create required software and product documentation.
PR15	Identify and track third party software products and follow applicable agreements.
PR16	Identify, accept ownership, and manage assimilation of other software products.
PR17	Perform version control of identified software product artifacts.
PR18	Record and track issues associated with the software product.
PR19	Ensure backup and disaster recovery of software product artifacts.
PR20	Plan and generate the release package.
PR21	Certify that the software product (code and its related artifacts) is ready for release and distribution.
PR22	Distribute release to customers.
PR23	Define and implement a customer support plan.
PR24	Implement the training identified in the customer support plan.
PR25	Evaluate customer feedback to determine customer satisfaction.
PR26	Develop and maintain a software verification plan.
PR27	Conduct tests to demonstrate that acceptance criteria are met and to ensure that previously tested capabilities continue to perform as expected.
PR28	Conduct independent technical reviews to evaluate adequacy with respect to requirements.
PR29	Determine project team training needs to fulfill assigned roles and responsibilities.
PR30	Track training undertaken by project team.

Artifact Number	Description of Software Quality Plan Artifacts
AR1	Strategic plan: [project's mission, management, stakeholders]
AR2	Approved level of formality and applicable practices
AR3	Approved project processes
AR4	Process and product metrics
AR5	Project process improvement actions
AR6	Product expectations and requirements
AR7	Software requirements and attributes
AR8	List of stakeholders and organizational commitments
AR9	Project plan: [risks events, risk plan, overview, milestones, task list, resource information, roles and responsibility assignments, assumptions, constraints, dependencies, budget, schedule, SCM plan, etc.]
AR10	Project reviews and needed (corrective) actions: [risk responses, tracking and oversight responses]
AR11	Design artifacts: [documentation and/or reviews]
AR12	Implementation artifacts: [software code, assimilated other software, design documents, user documentation, developer's guide, installation guide, theory manual, interface manual, etc.]
AR13	Identification and acquisition records
AR14	Version controlled records, including baselines and associated configurations
AR15	Backup records and recovery test results
AR16	Managed issues: [product quality results (for example, non-conformances), enhancements, defects, questions, inquiries]
AR17	Release specification
AR18	Product release package (bill of materials, release notes, certification, software, etc.)
AR19	Customer support plan including training
AR20	Customer training records
AR21	Customer satisfaction evaluation
AR22	Software verification plan
AR23	Test artifacts: [test cases, test results]
AR24	Technical reviews (evidence that review occurred and review results)
AR25	Project team training needs
AR26	Project team training records

3 DOE/AL QC-1 Revision 10 Mappings

The following table maps the requirements of the DOE QC-1 (sections 2.1 through 4.1) to the ASC Software Quality Plan.

QC-1 Section Number	QC-1 Section Title	QC-1 Requirements	ASC Software Quality Plan
2.1	**Risk-Based Program**	To have a cohesive, effective and integrated quality management system, a risk-based approach must be used to determine the extent (tailoring) of application of QC-1 requirements.	PR1, PR2
2.1		An organization shall use a risk management process when choosing to apply the "shall" requirements of this document in a graded (tailored) manner and document that process in their QAP or WQAP.	PR1, PR2
2.1		Factors that may be considered in the risk management process for graded application include a. the consequences of malfunction or failure of an item,	PR1, PR2
2.1		b. the inappropriate use of the results of services provided,	PR1, PR2
2.1		c. the probability of the occurrence of the postulated consequences,	PR1, PR2
2.1		d. the design and fabrication complexity of an item or difficulty of performing the service,	PR1, PR2
2.1		e. the need for special controls and oversight of processes, equipment, and performance,	PR1, PR2
2.1		f. the degree to which functional compliance can be demonstrated by inspection, test, or performance verification,	PR1, PR2, PR26, PR27, PR28
2.1		g. the quality history and degree of standardization of an item or service, and	PR1, PR2
2.1		h. the difficulty of repair, replacement, or replication of an item or service.	PR1, PR2
2.2	**Quality Management Program**	NNSA and its contractors shall integrate quality principles with risk-based analysis into management and work practices at all levels so that missions are accomplished and customer requirements are met.	PR1, PR2, PR9, PR10
2.2		Organizations shall integrate quality management into all facets of work planning and execution.	Software Quality Plan
2.2		A written QAP or WQAP shall be developed, implemented, and maintained that meets the requirements of this document.	Software Quality Plan
2.2		The QAP or WQAP shall a. describe the organizational structure, functional responsibilities, levels of authority, and interfaces for those managing, performing, and assessing work;	Tables 1 & 2, PR1, PR11
2.2		b. identify the organization's senior management positions;	Table 1, PR1
2.2		c. identify QC-1 requirements and other weapon quality requirements contained in contractual documents and their flow down to implementing procedures;	Figure 1, Appendix C, Appendix G, CPR001.3.2, CPR001.3.6
2.2		d. state the justification for graded (tailored) application of QC-1 requirements (if any); and	Appendix C, Appendix G, Figure 1, PR1, PR2
2.2		e. describe management processes, including planning, scheduling, and resource considerations.	Table 1, PR1, PR11

QC-1 Section Number	QC-1 Section Title	QC-1 Requirements	ASC Software Quality Plan
2.2.1	**Submittal, Approval, Implementation and Reporting**	NNSA and its contractors responsible for work in any weapon life-cycle phase shall a. submit a QAP or WQAP and implementation plan for achieving full compliance to requirements where not presently in compliance to the appropriate NNSA approval authority,	Software Quality Plan
2.2.1		b. follow the submitted QAP or WQAP and implementation plan, pending response from the NNSA approval authority;	Table 1, PR1, PR11
2.2.1		c. submit any significant changes to the QAP or WQAP and any associated implementation plan for approval and describe how the changes continue to satisfy the quality requirements;	Table 1, PR1, PR11
2.2.1		d. conduct work in accordance with the approved QAP or WQAP and implementation plan;	Software Quality Plan
2.2.1		e. report quality management system and weapon activity metrics annually and on request to provide objective evidence of performance; and	Software Quality Plan
2.2.1		f. provide a management self-assessment report on performance to the QAP or WQAP annually.	Software Quality Plan
2.2.1		The approved organization QAP or WQAP and any associated implementation plan will be the basis for assessment of the organization's weapon quality program.	Software Quality Plan
2.3	**Organization**	There shall be a process to establish and document the organization structure, functional responsibilities, levels of authority, and lines of communication.	see NWSMU or ASC Organizational structure, Table 1, PR1
2.3		Where more than one organization is involved in the execution of activities, the responsibilities, interfaces, and authority of each organization shall be clearly defined and documented.	see NWSMU or ASC Organizational structure, Table 1, PR1, PR6
2.3		The external interfaces between organizations and the internal interfaces between organizational units, and changes thereto, shall be documented.	see NWSMU or ASC Organizational structure, Table 1, PR1, PR6, PR11
2.3		Personnel verifying quality achievement shall not be directly responsible for performing the work being evaluated and shall have the authority, direct access to management, organizational freedom, and access to work to perform their function.	PR1, Section 4.4 Overview Description, PR28
2.4	**Early and Continuous Application of Quality Principles**	The organization responsible for any product or process design shall ensure that operating, production, and quality requirements are incorporated in the design process as early as feasible.	PR13
2.4		The design process shall provide for the timely identification and evaluation of key elements that are critical to program success and shall provide an objective means to measure design, product, process, and production readiness.	PR1, PR6, PR7, PR8, PR11, PR13, PR29
2.4		Producibility shall be formally addressed in the design and design change processes.	PR13
2.4		The design authority and production organization shall establish and document a process for evaluating producibility.	PR3, PR21
2.4		This process shall require the design and …	N/A –Software Quality Plan does not apply to non-software requirements

QC-1 Section Number	QC-1 Section Title	QC-1 Requirements	ASC Software Quality Plan
2.5	**Establishing and Validating Requirements**	Beginning with development and continuing throughout the life cycle of the activity, processes shall be in place to identify, document, validate, control and maintain customer requirements.	PR3, PR6, PR7, PR8, PR13, PR17, PR18, PR20, PR23, PR26
2.5		Each organization shall document their process, including roles, responsibilities, and interfaces.	PR1, PR3, PR11
2.6	**Planning**	A risk management process shall be used to determine the extent of formal planning (including quality plans) that is required for development, programs, projects, processes, activities, materials, products, services, functions, product and stockpile certification, or organizational entities	Section 4, PR1, PR2, PR9, PR10
2.6		NNSA shall address quality requirements in…	N/A –Software Quality Plan does not apply to NNSA
2.7	**Metrics**	Each organization shall identify, track, trend, and report metrics and utilize them for corrective action and continuous improvement.	PR3, PR4, PR5
3.0	**Quality Requirements**	(Heading only, no requirement text)	(No required mapping)
3.1	**Quality Improvement**	(Heading only, no requirement text)	(No required mapping)
3.1.1	**Continuous Improvement Process**	Processes to detect and prevent quality problems shall be established and implemented.	PR3, PR4, PR5
3.1.1		Items, services, and processes that do not meet established requirements shall be identified, controlled, and corrected according to the importance of the problem and the work affected.	PR3, PR4, PR5
3.1.1		Correction shall include identifying the causes of problems and working to prevent recurrence.	PR3, PR4, PR5
3.1.1		Item characteristics, process implementation, and other quality related information shall be reviewed and the data analyzed to identify items, services, and processes needing improvement.	PR3, PR4, PR5
3.1.2	**Prevention Versus Detection**	The objective of a quality management system is to prevent errors and nonconformance, reduce variability, and build quality into products and processes.	Section 4.2.3, PR3, PR4, PR5
3.1.2		Fundamental methods such as design of experiments, prototyping, process capability studies, Pareto analyses, and statistical process controls may be used to a. characterize processes,	PR3, PR4, PR5, Appendix F
3.1.2		b. simplify processes,	PR3, PR4, PR5, Appendix F
3.1.2		c. mistake-proof processes,	PR3, PR4, PR5, Appendix F
3.1.2		d. continually reduce product and process variability,	PR3, PR4, PR5, Appendix F
3.1.2		e. identify and minimize the number of unstable or error prone processes, and	PR3, PR4, PR5, Appendix F
3.1.2		f. provide early feedback of engineering and manufacturing data to determine the need for product or process changes.	PR3, PR4, PR5, Appendix F

QC-1 Section Number	QC-1 Section Title	QC-1 Requirements	ASC Software Quality Plan
3.1.3	**Quality Cost Management**	Quality cost management shall be applied to weapon activities throughout the entire weapon program life cycle.	PR1, PR3, PR11
3.1.3		A method for identifying, recording, and reporting the quality costs shall be established and documented in formal procedures.	PR3, PR11
3.1.3		These costs include but are not limited to cost of prevention, cost of appraisal, cost of internal failure, and cost of external failure.	PR3, PR11
3.1.3		The cost of nonconformance plus the cost of conformance and/or other appropriate cost metrics shall be utilized for performance measurement, problem identification, and problem prevention.	PR11, PR4
3.2	**Training**	Personnel shall be trained and qualified to ensure they are capable of performing their assigned work.	PR11, PR29, PR30
3.2		Personnel shall be provided continuing training to ensure that job proficiency is maintained.	PR11, PR29, PR30
3.2		Evidence of training, qualification, and certification shall be maintained.	PR11, PR30
3.2		Training is conducted to help ensure that personnel are competent to perform the assigned work to the quality required.	PR11, PR29, PR30
3.2		Competency is based on a combination of factors including education, training, skills and experience.	PR11, PR29, PR30
3.2		Processes are required to ensure that personnel have appropriate and adequate experience, education, skills and training, i.e., ensure the use of competent personnel for assigned work.	PR11, PR29, PR30
3.2		Highly qualified and motivated personnel, who are engaged, should be the goal of any training program.	PR1, PR11, PR29, PR30
3.3	**Design**	The design authority shall be responsible for the design of items and processes under its responsibility.	PR1, PR11, PR13
3.3		Procedures shall be established and maintained to define and control the design process, including design-related development.	PR1, PR3, PR11, PR13, PR18
3.3.1	**Design Input**	Design inputs (customer requirements, etc.) shall be identified and documented, and their selection reviewed and approved prior to the final design implementation.	PR3, PR6, PR7, PR8, PR13
3.3.2	**Design Process**	Items and processes shall be designed using sound engineering/scientific principles and appropriate standards.	PR3, PR13
3.3.2		Designs shall provide a clear link between design inputs and design requirements, including production requirements and specifications.	PR3, PR6, PR7, PR8, PR13
3.3.2		Design work, including changes, shall incorporate applicable requirements and design bases.	PR6, PR7, PR8, PR13, PR17, PR18
3.3.2		Designs shall also incorporate critical characteristics required for function, reliability, interchangeability, design life, safety, and dismantlement.	PR13
3.3.2		Design requirements shall not be more restrictive than essential for achieving required performance with appropriate margin.	PR13
3.3.2		The design authority shall determine and set the value and tolerance for design specifications.	PR13

QC-1 Section Number	QC-1 Section Title	QC-1 Requirements	ASC Software Quality Plan
3.3.2		The design authority should produce designs that minimize the opportunity for incorrect manufacture, assembly, use, or operation.	PR13
3.3.2		Calculations, modeling, and testing shall establish the design parameters and maintain the appropriate margins by taking into account uncertainties associated with the design envelope.	PR9, PR10, PR13, PR26, PR27
3.3.2		Test equipment and instrumentation used. ..	N/A –Software Quality Plan does not apply to hardware such as "test equipment and instrumentation"
3.3.2		Design information that supports the disposition…	N/A –Software Quality Plan does not apply to "non-conforming material"
3.3.3	**Design Verification**	The adequacy of designs shall be verified and documented before approval and implementation.	PR13, PR26, PR27, PR28
	Design Reviews	Design reviews shall be conducted by individuals or groups other than those who performed the work to ensure, at the time of the review, that a. design inputs are complete and correct;	PR13, PR26, PR28
		b. assumptions necessary to perform the design are adequately described and valid;	PR8,PR9, PR10, PR13,
		c. applicable design standards are used;	PR13, PR28
		d. computer programs, including mathematical models used in simulation codes, are adequately verified and validated and recorded for future retrieval;	PR26, PR27, PR28
		e. suitable materials, parts, processes, and inspection and testing criteria are specified; and	PR26, PR27, PR28
		f. design qualification methods are adequate.	PR13, PR26, PR28
		The design review process shall accommodate observation or subsequent review(s) by NNSA and/or independent third parties if requested.	PR26, PR28
	Design Qualification	The design authority shall specify the qualification methods to be used to confirm customer requirements are met.	PR13, PR26, PR27
		Qualification test plan(s) shall be developed and documented.	PR26
		Qualification test results shall also be documented.	PR26, PR27, PR28
		The design authority shall obtain concurrence from the using organization that specifications in design documents are complete and the detail is understood.	PR13, PR14
		For the production design, the design authority shall obtain concurrence from the applicable production facilities or organization that the producibility of the design is mutually acceptable.	PR8, PR13, PR14
3.3.4	**Design Documents**	A process shall be established for approving, issuing, and distributing designs, including changes.	PR3, PR8, PR13, PR14, PR18
3.3.4		Design information transmitted across organization interfaces shall identify the status of information provided and any incomplete items that require further evaluation, review, or approval.	PR11, PR13

QC-1 Section Number	QC-1 Section Title	QC-1 Requirements	ASC Software Quality Plan
3.3.5	**Design Change Control and Configuration Management**	Changes to design inputs and final designs shall be subject to control measures (including design reviews) commensurate with the risk introduced by the change.	PR9, PR10, PR13
3.3.5		These measures shall include evaluation of effects of the changes on the overall design and on any analyses upon which the design is based.	PR1, PR2, PR7, PR8, PR28
3.3.5		A design configuration management process shall be established and documented.	PR13, PR17, PR18, PR19
3.3.5		The process shall ensure that (a) configuration control is established as early as possible in the design process, and	PR3, PR13, PR17
3.3.5		(b) configuration control is applied to design inputs, design calculations and analyses, design qualification, and design documents.	PR3, PR13, PR17
3.3.6	**Interface Control**	Design interfaces shall be identified and controlled.	PR3, PR13
3.3.7	**Records**	Complete and accurate records of design shall be maintained and retrievable.	PR13
3.4	**Instructions, Procedures and Drawings**	Work shall be prescribed by and performed in accordance with documented instructions, procedures, drawings, specifications, other documents, or models that include or reference appropriate quantitative or qualitative acceptance criteria for determining	PR3, PR9, PR10, PR11, PR13
3.4		Current instructions, procedures, drawings, specifications, other documents, and models shall be available to and used by the personnel performing the work.	PR3, PR13, PR14
3.5	**Document Control**	Documents shall be prepared, reviewed, approved, issued, used, and revised to prescribe processes, specify requirements, or establish design.	PR3, PR4, PR11, PR13, PR14
3.5		A documented process shall be established and maintained to control documents, including models and data.	PR3, PR13, PR14
3.5		The process shall define responsibility for preparing, reviewing, approving, issuing, and distributing documents that are adequate, complete, and correct.	PR3, PR11, PR13, PR20
3.5		The process shall ensure a. identification of controlled documents;	PR14, PR17
3.5		b. identification of individuals responsible for the preparation, review, approval, and distribution of controlled documents;	PR11, PR14, PR17, PR20
3.5		c. review of controlled documents for completeness, and approval prior to distribution;	PR17, PR18, PR20, PR21
3.5		d. correct documents are used;	PR17
3.5		e. documents specify effectivity; and	PR17, PR18
3.5		f. timely release, distribution, and implementation.	PR20, PR21, PR22
3.6	**Procurement**	The procurement process shall be documented and ensure that a. procurement documents contain correct requirements;	PR3, PR15, PR16
3.6		b. prospective suppliers are evaluated and selected on the basis of specified criteria;	PR3, PR15, PR16
3.6		c. procured items and services meet established requirements and perform as specified; and	PR3, PR15, PR16
3.6		d. Suppliers continue to provide acceptable items and services.	PR3, PR15, PR16

QC-1 Section Number	QC-1 Section Title	QC-1 Requirements	ASC Software Quality Plan
3.6.1	**Supplier Evaluation, Selection, and Monitoring**	The Purchaser shall select Suppliers on the basis of assessment of ability to meet requirements, including quality requirements.	PR3, PR13, PR15, PR16
3.6.1		Supplier evaluation and selection shall be documented and shall include one or more of the following: a. Supplier's history and current capability for providing an identical or similar product that performs satisfactorily in actual use;	PR15, PR16
3.6.1		b. Supplier's current quality records supported by documented information that can be objectively evaluated; or	PR15, PR16
3.6.1		c. Supplier's capability as determined by a direct evaluation of the facilities, personnel, and the implementation of the Supplier's quality management system.	PR15, PR16
3.6.1		Suppliers shall be monitored with regard to the effectiveness of their quality management system and the quality of their product.	PR3, PR15, PR16
3.6.1		NNSA and its contractors reserve the right to perform quality surveys and inspections at vendor and Supplier locations where materials or services are rendered under a contractor's purchase order or contract.	N/A –Outside scope of Software Quality Plan
3.6.2	**Procurement Documentation**	Procurement documents shall specify that the Supplier have an effective quality management system that complies with the applicable requirements of this document.	PR15, PR16, Section 4.3.2 Overview Description
3.6.2		Procurement documents shall be controlled.	PR17, PR18
3.6.2		They shall identify documentation required, indicate records to be submitted or maintained, and specify record retention and disposition requirements.	PR17, PR18
3.6.2		Procurement documents shall provide for return of nonconforming material, access to the Supplier's facility, and inspection of records by the procuring agency and NNSA.	N/A –Software Quality Plan does not apply to "non-conforming material"
3.6.3	**Acceptance of Procured Items, Materials and Services**	(Heading only, no requirement text)	(No required mapping)
	Items and Materials	Items and materials shall be evaluated to determine conformance to applicable specifications.	PR15, PR16
		When Supplier provided reports are used as a basis of acceptance, the reported results shall be compared with requirements.	PR15, PR16
		The validity of Supplier provided reports shall be periodically verified by the purchaser by at least one of the following methods: (a) independent evaluation to requirements, or	PR15, PR16, PR28
		(b) assessment (to establish the validity of the Supplier-provided reports).	PR15, PR16, PR28
	Services	In cases involving procurement of services only (such as third party inspection; engineering and consulting services; assessment; and installation, repair, overhaul, or maintenance work), the Purchaser shall accept the service by any or all of the following a) technical variability	PR26, PR27, PR28
		b. surveillance and/or assessment of the activity, or	PR26, PR27, PR28
		c. review of objective evidence for conformance to the procurement document requirements.	PR28

QC-1 Section Number	QC-1 Section Title	QC-1 Requirements	ASC Software Quality Plan
3.6.4	**Certificate of Conformance**	(None of the requirements listed in this section apply to the Software Quality Plan)	N/A –Software Quality Plan does not apply to the "certificate of conformance" required for "weapon and weapon-related material and hardware"
3.7	**Identification, Control and Status of Items**	A process shall be established and documented so that items are identified and controlled to ensure proper use and maintained to prevent damage, loss, or deterioration.	S/W - PR17 Non-S/W- N/A – Software Quality Plan does not apply to non-software work products
3.7		Physical identification shall be used where possible.	S/W - PR17 Non-S/W- N/A – Software Quality Plan does not apply to non-software work products
3.7		Identification markings shall be applied using materials and methods that provide a clear and legible identification and do not degrade the function or service life of the item.	S/W - PR17 Non-S/W- N/A – Software Quality Plan does not apply to non-software work products
3.7		Where practical, markings shall be transferred to each part of an identified item when subdivided and shall not be obliterated or hidden unless other means of identification are substituted.	S/W - PR17 Non-S/W- N/A – Software Quality Plan does not apply to non-software work products
3.7		Where physical identification on the item is either impractical or insufficient, physical separation, procedural control, or other appropriate means shall be employed.	S/W - PR17 Non-S/W- N/A – Software Quality Plan does not apply to non-software work products
3.7		Markings, authorized stamps, tags, labels, routing cards, physical location, or other suitable means shall identify the status of items from the initial receipt and fabrication of items up to and including use.	S/W - PR17 Non-S/W- N/A – Software Quality Plan does not apply to non-software work products
3.7		When required, traceability of an item shall ensure applicable specification and grade of material; heat, batch, lot, part, or serial number; or specified inspection, test, or other records.	S/W - PR17 Non-S/W- N/A – Software Quality Plan does not apply to non-software work products
3.7		The process shall provide for maintenance or replacement of markings and identification records due to damage from handling or aging, as well as protection of identifications on items subject to excessive deterioration due to environmental exposure.	S/W - PR3, PR17 Non-S/W- N/A – Software Quality Plan does not apply to non-software work products
3.7		The status of inspection and test activities shall be identified either on the items or in documents traceable to the items where it is necessary to ensure that required inspections and tests are performed and that items which have not passed the required	PR26, PR27, PR28

QC-1 Section Number	QC-1 Section Title	QC-1 Requirements	ASC Software Quality Plan
3.7.1	**Tooling and Fixtures**	(None of the requirements listed in this section apply to the Software Quality Plan)	N/A –Software Quality Plan does not apply to "tooling and fixtures"
3.7.2	**Limited-Life Materials and Components**	(None of the requirements listed in this section apply to the Software Quality Plan)	N/A –Software Quality Plan does not apply to "materials and components"
3.7.3	**Materials or Items Designated for Destructive Testing**	(None of the requirements listed in this section apply to the Software Quality Plan)	N/A –Software Quality Plan does not apply to "materials or items"
3.7.4	**Special Instructions and Environments**	(None of the requirements listed in this section apply to the Software Quality Plan)	N/A –Software Quality Plan does not apply to "items" requiring "special instructions and environments"
3.8	**Control of Processes**	Work shall be performed to established technical standards and administrative controls using approved instructions, procedures, or other appropriate means.	PR3, PR17
3.8		To the extent practical, criteria for workmanship shall be stipulated in written standards or by means of representative standards.	PR3, PR17
3.8		Processes shall be characterized, documented, and maintained under controlled conditions to minimize variability and to prevent nonconformance.	PR3, PR17
3.8		Proposed process changes shall be evaluated for their potential impact on quality, producibility, and maintainability prior to incorporation.	PR3,PR4, PR5, PR17
3.8		The design authority and production organization shall jointly qualify processes (including inspection, test, and acceptance processes) and document the qualification prior to use for production and acceptance.	PR3, PR20, PR21, PR26
3.8		Equipment used for process monitoring …	N/A –Software Quality Plan does not apply to "equipment used for process monitoring or data collection"
3.8		A process to formally suspend weapon work …	N/A –Software Quality Plan does not apply to "a process to formally suspend weapon work"
3.8		The process shall establish measurable criteria…	N/A –Software Quality Plan does not apply to "a process to formally suspend weapon work"
3.8		Records shall be maintained for all situations…	N/A –Software Quality Plan does not apply to "a process to formally suspend weapon work"

QC-1 Section Number	QC-1 Section Title	QC-1 Requirements	ASC Software Quality Plan
3.8.1	**Process Control Methods**	When production quantities are sufficient in number, statistical methods (such as statistical process control) shall be used to ensure continuous control over production processes and to identify and continually reduce variability.	PR3, PR4, PR5
3.8.1		When production quantities are not large enough to permit the use of statistical methods, alternative control methods shall be applied, such as 100 percent test and inspection when that degree of rigor is necessary to confirm compliance to specification.	Appendix F
3.8.2	**Special Processes**	Special processes shall be identified and procedures, processes, and controls implemented to ensure a high level of confidence in the control of product variability and to minimize nonconformances.	PR4, PR5
3.8.2		Special-process equipment and procedures shall be...	N/A –Software Quality Plan does not apply to "special process equipment and procedures"
		When the outcome of a special process is dependent upon the skill of the person performing the process, that person shall be certified to written procedure.	PR29, PR30
3.8.2		Evidence of qualification of equipment and procedures and certification of personnel shall be maintained.	PR30
3.8.2		When available, codes and standards (including acceptance criteria for the process) shall be specified or referenced in procedures or instructions.	PR3
3.8.2		For special processes not covered by existing codes and standards or where quality requirements specified exceed those of existing codes or standards, the necessary requirements for qualification of personnel, procedures, or equipment shall be specified or referenced in procedures or instructions.	PR3, PR29, PR30
3.9	**Inspection, Test and Acceptance**	Inspection and testing of specified items, services, and processes shall be conducted under controlled conditions using established acceptance and performance criteria.	PR4, PR5 (processes), PR27 (software)
3.9		Inspection and test requirements and results shall be documented.	PR26, PR27, PR28
3.9		Equipment used for inspections and tests shall be…	N/A –Software Quality Plan does not apply to hardware such as "equipment used for inspections and tests"
3.9		Measurement uncertainty requirements and capability of inspection and test processes shall be determined and documented.	PR3, PR4, PR5
3.9		Qualified persons other than those who perform or directly supervise the work being inspected or tested shall perform acceptance inspections and tests verifying product conformance to design criteria.	PR27, PR28
3.9		Where independent inspections and tests are not feasible because of special requirements, the responsible organization shall develop an alternative method, document it and the basis for requesting exception, and obtain design authority approval for use.	PR26

QC-1 Section Number	QC-1 Section Title	QC-1 Requirements	ASC Software Quality Plan
3.9		There shall be a documented process and procedures for contractor submittal of completed product and for NNSA acceptance of that product.	PR3, PR20, PR21, PR26
3.9		The process shall ensure that product was manufactured to and conforms to the correct design definition and that the quality evidence is correct and represents that product.	PR27, PR28
3.9		When automated manufacturing processes are used …	N/A –Software Quality Plan does not apply to "automated manufacturing processes"
3.9		When fixtures, molds, and other such tooling are used …	N/A –Software Quality Plan does not apply to hardware such as "fixtures, molds, and other such tooling"
3.9		These devices shall be controlled and recertified…	N/A –Software Quality Plan does not apply to hardware such as "fixtures, molds, and other such tooling"
3.9		When material requires modification, repair, or…	N/A –Software Quality Plan does not apply to "material"
3.9		Sampling plans shall prescribe random sampling…	N/A –Software Quality Plan does not apply to "sampling plans"
3.10	**Control of Measuring and Test Equipment**	(None of the requirements listed in this section apply to the Software Quality Plan)	N/A –Software Quality Plan does not apply to hardware such as "measuring and test equipment"
3.11	**Handling, Storage, Packaging, and Delivery**	Handling, storage, packaging, and delivery shall be controlled to prevent damage, loss, deterioration, or substitution, and the process to control handling, storage, packaging, and delivery shall be documented. These activities shall be conducted in accordance with specifications, instructions, procedures, and drawings. Special handling tools and equipment shall be utilized and controlled where necessary to ensure safe and adequate handling. Special handling tools and equipment shall be inspected and tested according to established criteria to ensure performance.	S/W - PR20, PR21, PR22 H/W - N/A –Software Quality Plan does not apply to non-software products
3.11.1	**Government-Furnished Material**	(None of the requirements listed in this section apply to the Software Quality Plan)	N/A –Software Quality Plan does not apply to "material"
3.11.2	**NNSA-Accepted Material**	(None of the requirements listed in this section apply to the Software Quality Plan)	N/A –Software Quality Plan does not apply to "material"
3.12	**Nonconformance**	Whenever a weapon program requirement of any type is not met, a nonconforming condition exists.	PR5, PR10, PR12, PR18, PR28

QC-1 Section Number	QC-1 Section Title	QC-1 Requirements	ASC Software Quality Plan
3.12		Nonconforming conditions include, but are not limited, to nonconforming operations, activities, procedures, software, and items (including material and product).	PR5, PR10, PR12, PR18, PR28
3.12		When a potential or actual nonconformance is identified, the situation shall be evaluated and appropriate action shall be taken.	PR5, PR10, PR12, PR18, PR28
3.12		A process shall be documented to prescribe actions to address potential and actual nonconforming conditions.	PR3, PR10, PR12, PR18
3.12		Procedures shall be established and maintained that define processes for identifying, investigating, and dispositioning nonconforming conditions.	PR3, PR4, PR5
3.12		These procedures shall clearly define the level and qualification of personnel authorized to disposition nonconformances.	PR3, PR11, PR29
3.12		Personnel performing evaluations to determine disposition of a nonconformance shall have demonstrated competence in the specific area they are evaluating, have an adequate understanding of the requirements, and have access to pertinent background information.	PR11, PR29, PR30
3.12.1	**Nonconforming Item Control**	(None of the requirements listed in this section apply to the Software Quality Plan)	N/A –Software Quality Plan does not apply to "nonconforming weapon program items"
3.12.2	**Nonconforming Item Disposition**	(None of the requirements listed in this section apply to the Software Quality Plan)	N/A –Software Quality Plan does not apply to "nonconforming weapon program items"
3.13	**Corrective Action**	A process shall be established and documented for corrective action, and procedures shall be established and implemented to a. identify and categorize conditions adverse to quality (including criteria for determining significant conditions adverse to quality);	PR3, PR4, PR5, PR9, PR12
3.13		b. track, trend, and report conditions adverse to quality;	PR10, PR12, PR18
3.13		c. apply compensatory measures;	PR5, PR18
3.13		d. perform causal analysis of a significant condition adverse to quality to determine if the condition is incidental or systemic;	PR5, Appendix F
3.13		e. develop and implement corrective action to preclude recurrence;	PR10, PR12
3.13		f. verify that the corrective action precludes a recurrence of the condition adverse to quality; and	Section 4.2.3 Overview Description
3.13		g. capture and communicate lessons learned internally and to NNSA for use in preventing problems and making improvements.	PR5
3.13		Recurring deficiencies are an indication of systemic failure of the quality management system.	PR1, PR3, PR4, PR5
3.13		Senior management shall take appropriate action to determine the cause(s) and permanently correct the systemic problem.	Table 1
3.14	**Records**	A process shall be established and documented for records management.	PR3
3.14		Records shall be specified, prepared, reviewed, approved, and maintained to demonstrate achievement of quality requirements and effective operation of the quality management system.	Section 4.3.3

QC-1 Section Number	QC-1 Section Title	QC-1 Requirements	ASC Software Quality Plan
3.14		Procedures shall be established and implemented for the identification, collection, organization, filing, storage, maintenance, retrieval, distribution, retention, and disposition of records.	Section 4.3.3 Overview Description
3.14		Records shall be maintained to furnish objective evidence that items or activities meet specified requirements.	PR17, Section 4.1 "Artifacts"
3.14		Records shall be identifiable as a record; completely and accurately reflect the work accomplished or information required; be legible; and be traceable to associated requirements, items, and activities.	PR17, Section 4.1 "Artifacts"
3.14		Records may be originals, copies, or electronic.	PR17, Section 4.1 "Artifacts"
3.14		Records shall be authenticated and dated by authorized personnel.	PR17, Section 4.1 "Artifacts"
3.14		Acceptable methods of authentication include statements of authenticity, handwritten signatures, electronic signatures, or any other means that ensure traceability to a specific authenticating individual and organization and to an authentication date.	Section 4.3.3 Overview Description
3.14		Records shall be stored such that they are readily retrievable in facilities that provide a suitable environment to minimize deterioration or damage and to prevent loss.	PR17, PR19
3.14		Records management shall comply with DOE O 200.1, Information Management Program.	Section 4.3.3 Overview Description
3.15	**Assessments**	Management and independent assessments shall be planned and conducted to (a) evaluate item and service quality,	Section 5, Table 1, PR25, PR27
3.15		(b) measure the adequacy of work performance, and	Table 1, PR12
3.15		(c) promote improvement.	Section 5, Table 1
3.15		Processes for management assessments and independent assessments shall be established and documented.	Table 1, PR3, Section 5
3.15		Managers shall assess their management processes.	Table 1, PR2, Section 5
3.15		Problems that hinder the organization from achieving its objectives shall be identified and corrected.	Table 1, PR2, Section 5
3.15		Personnel performing independent assessments shall have sufficient authority and freedom from the line organization to carry out their responsibilities.	Section 5
3.15.1	**Assessor Qualification**	Personnel conducting independent assessments shall be technically qualified and knowledgeable in the areas assessed.	Section 5, PR28
3.15.1		Personnel conducting independent assessments shall be qualified to a documented set of criteria, including education, training, and experience.	Section 5, PR28
3.15.2	**Scheduling**	Risk (considering the status, history, and importance of the activity) shall be used as a basis for scheduling management and independent assessments.	Table 1, Section 5
3.15.2		The management and independent assessment schedules and associated risk bases shall be documented.	Section 5, PR11
3.15.3	**Planning**	Management and independent assessment plans shall be established and documented.	Section 5, PR11, Table 1
3.15.3		The plans shall identify the objectives, scope, approach, and performance criteria to be used.	Section 5, PR12

QC-1 Section Number	QC-1 Section Title	QC-1 Requirements	ASC Software Quality Plan
3.15.4	**Performance**	Management and independent assessments shall compare actual performance with performance criteria.	Section 5, PR12
3.15.4		Objective evidence shall be examined to the depth necessary to determine if requirements and criteria are being met.	Section 5, PR11, PR12
3.15.4		Conditions requiring prompt corrective action shall be reported immediately to management of the assessed organization.	Section 5, PR11, PR12
3.15.5	**Reporting**	Management and independent assessment reports shall be prepared, signed and dated by the lead assessor, and sent to the responsible management in accordance with established procedures.	Section 5, PR11, PR12
	Management Assessment Reporting	Management assessment reports shall include a. an identification and summary of underlying assessments performed,	PR3, PR11, Section 5
		b. a discussion of deficiencies identified and trends,	PR3, PR11, Section 5
		c. an evaluation of the effectiveness of corrective actions, and	PR3, PR11, Section 5
		d. a discussion of continuous improvement initiatives.	PR3, PR11, Section 5
	Independent Assessment Reporting	Independent assessment reports shall a. describe the assessment objectives, scope, approach, and performance requirements and quantitative criteria;	Section 5
		b. identify assessors and persons contacted;	Section 5
		c. identify documents, material, operations, activities, and conditions assessed;	Section 5
		d. present deficiencies observed, and	Section 5
		e. summarize the extent of compliance and performance relative to assessment scope, performance requirements, and associated criteria.	Section 5
3.16	**Software Quality Assurance**	A software quality assurance (SQA) process shall be established to provide assurance that software will satisfy customer requirements.	Software Quality Plan
3.16		The process shall apply to software that is purchased, developed under contract, or developed by NNSA or its contractors.	Software Quality Plan
3.16		The SQA process shall address applicable elements of QC-1.	Software Quality Plan
3.16		SQA activities shall be commensurate with the complexity and the risk associated with failure of the software to meet established requirements.	PR2
3.16		A documented risk-based and graded approach shall be used to balance cost, risk and program flexibility.	PR2, Table 1
3.16		The SQA process shall use a software life-cycle management methodology based upon a consensus SQA standard or an equivalently rigorous contractor-specific standard that addresses software development from beginning to end and the flow of activities and it	PR3
3.16		Software life-cycle stages may include a. concept,	PR3
3.16		b. requirements,	PR3
3.16		c. design,	PR3
3.16		d. implementation,	PR3
3.16		e. operation,	PR3
3.16		f. maintenance, and	PR3
3.16		g. retirement.	PR3
3.16		Requirements shall be identified, testable, and controlled.	PR6, PR7, PR8

QC-1 Section Number	QC-1 Section Title	QC-1 Requirements	ASC Software Quality Plan
3.16		Software configuration management shall ensure a. a software baseline is established no later than the completion of the software validation process, and	PR17
3.16		b. changes subsequent to the baseline are traceable to software requirements, approved, documented, and added to the baseline so that the baseline defines the most recently approved software configuration.	PR17, PR18
3.16		Software verification and validation activities shall be controlled, documented, and demonstrate requirements are met.	PR26, PR27, PR28, Section 4.4 Overview Description
4.0	**Responsibilities**	(Heading only, no requirement text)	(No required mapping)
4.1	**Senior Management**	Senior NNSA and Contractor management shall a. establish the organization's quality policy;	CPR001.3.2, CPR001.3.6, Software Quality Plan
4.1		b. assign responsibility for establishment, implementation, and oversight of the quality management system, including preparation of the QAP or WQAP and any associated implementation plan;	CPR001.3.2, CPR001.3.6, Software Quality Plan
4.1		c. actively participate in quality management system development, implementation and improvement;	CPR001.3.2, CPR001.3.6, Software Quality Plan
4.1		d. ensure that customer requirements are determined, documented, and met with the aim of enhancing customer satisfaction;	CPR001.3.2, CPR001.3.6, Software Quality Plan
4.1		e. review the organization's quality management system at planned intervals to ensure its continuing suitability, adequacy, and effectiveness; and	CPR001.3.2, CPR001.3.6, Table 1
4.1		f. take appropriate action to determine the cause(s) of recurring nonconformances and permanently correct the systemic problem.	CPR001.3.2, CPR001.3.6, Table 1

4 GP&G Mappings

The following chart maps between the SNL site-specific practices described in *Part 1: Practices* of the Software Quality Plan and the *ASCI Software Quality Engineering: Goals, Principles and Guidelines* (GPP&G), a report developed collaboratively as high-level SQE guidelines for software developed in the Tri-Laboratory ASCI Program.

GP&G SQE Guidelines		SNL Practices
Software Verification	**Technical reviews** • Technical soundness • Static analysis	 PR26, PR28 PR26, PR28
	Unit testing • Traceable, repeatable component tests	PR26, PR27, PR17, PR18
	Regression testing • Building the code • Executing tests • Feature-based test suite for multiple platforms	 PR17, PR18, PR19, PR20, PR21 PR27 PR26
	Comparison techniques • Analytic solutions • Other codes' results	 PR26, PR27 PR26, PR27
	User acceptance testing • Applicability evaluation • Usability evaluation • Code confidence • Results credibility	 PR7, PR8, PR13, PR14, PR20, PR26, PR27, App. E, Table 2, PR28, App. E PR20, PR27, App. E Goals of SQ Plan, PR20, PR27, App. E, App. F Goals of SQ Plan, PR20, PR27, App. E, App. F
	Training • Verification methods and techniques	PR29, PR30, Table 1
Software Engineering	**Lifecycle management** • Time-based work flow • Requirements Design Construction Test Support activities	 PR3 PR6, PR7, PR8 PR13 PR14 PR23, PR24 PR8, PR15, PR16, PR17, PR18, PR19, PR22, PR23, PR24, PR25
	Configuration management • Version management • Issue tracking • Release management	 PR15, PR16, PR17 PR18 PR17, PR18, PR19
	Measurements and metrics • Software products • Software processes	 PR4, all practices suggest metrics PR4, all practices suggest metrics
	Reviews and assessments • Management reviews • Technical reviews	 PR12, Section 5, App. D PR27, Section 5, App. D

GP&G SQE Guidelines		SNL Practices
	Process improvement • Engineering process baseline • Identified improvements • Improvement implementation	 PR3 PR5 PR5, PR18, PR21
	Training • Software practice methods and techniques	PR29, PR30, Table 1
Project Management	**Risk management** • Risk assessment • Risk control	 PR9 PR10
	Requirements management • Gathering, documenting, verifying, managing change to requirements	PR6, PR7, PR8, PR26, PR27, PR28, PR18
	Project planning • Statement of work • Constraints and goals • Implementation plan • Resource assessment	 PR11 PR11 PR11 PR11
	Tracking and oversight • Actual results vs. planned results • Corrective action	 PR12 PR12
	Process management • Process documentation and plans • Technology improvement • Improvement leverage	 Table 1, PR3 PR4, Section 5, Table 1 PR4, Section 5, Table 1
	Training • Project management methods and techniques	PR29, PR30, Table 1

5 SNL Corporate Process Requirements Mappings

This section presents the mappings for the two SNL Corporate Process Requirement (CPR) documents, CPR001.3.2 *Corporate Quality Assurance Program* and CPR001.3.6 *Corporate Software Quality Assurance*.

5.1 CPR001.3.2 Mapping

CPR001.3.2 Requirements		ASC Software Quality Plan
1.0	**Purpose** The primary purpose of the Sandia Corporate Quality Assurance Program is to meet the requirements established in DOE O 414.1C, Quality Assurance and 10 CFR 830, Subpart A, Quality Assurance Requirements for a quality program and to support the implementation of CPS 001 Corporate Policy Statement and CPSR 001.3 Integrated Laboratory Management System (ILMS), in ways that implement Sandia's Multi-Year Vision for Management Excellence. This CPR will help managers at all levels determine when a local Quality Assurance Plan (QAP) is needed.	(Informational, no mapping required)
2.0	**Statement of Applicability** This Corporate Process Requirement applies to all SNL organizations, activities, and personnel. The requirements in this CPR apply to Sandia's contractors, sub-contractors, and suppliers through the flow-down of requirements in Sandia's procurement contract terms and conditions, in accordance with the objectives of DOE O 414.1C, Quality Assurance and 10CFR830 Subpart A. This CPR defines the process for flowing down the quality requirements from the ILMS Corporate Policy Requirements Statement (CPSR) 001.3 to all work performed at Sandia. Requests for exceptions to this policy must be submitted in writing to the Sponsor of this policy. Consequences for violating this policy will be determined in the same manner as other disciplinary actions for business rules violations.	(Informational, no mapping required)
3.0	**Corporate Quality Assurance Program Requirements**The following requirements apply to managers at all levels.	(Heading only, no mapping required)
3.1	**Plan Work**	(Heading only, no mapping required)
3.1.1	Managers shall determine the nature and complexity of the processes and the associated requirements of work for which they are responsible.	PR1 & PR2 establish nature and level of formality PR3-PR30 applies appropriate software quality assurance

CPR001.3.2 Requirements		ASC Software Quality Plan
	Requirements may be imposed by customers, regulations, and applicable standards (e.g., QC-1, NQA-1). Plans shall be documented as specified by contractual or corporate process requirements. Managers may prepare quality assurance plans when not otherwise required.	Figure 1, Relationship of Drivers, Software Quality Plan and Project Implementation Software Quality Plan issued as a SAND Report
3.1.2	Managers shall determine how the Sandia's Corporate Business Rules apply to the planned work.	CPR001.3.2 and CPR001.3.6 drivers shown in Figure 1, Relationship of Drivers, Software Quality Plan and Project Implementation
3.1.3	Managers shall determine how the quality requirements of DOE O 414.1C apply to the work.	Table 1, Section 4.2.2
3.1.4	Managers shall implement quality requirements prescribed by Corporate, SMU, and Division levels as well as organizational, administrative, technical, and other specialized criteria as applicable.	Responsibility for managers to implement all SMU, Division, organizational, administrative, technical and specialized criteria outside scope of Software Quality Plan Corporate Requirements: CPR001.3.2 and CPR001.3.6 drivers for Software Quality Plan, also provide corporate level requirements
3.1.5	Managers shall be familiar with the applicability of the following programs and CPRs. These specify the analysis, controls and documentation whose objective is to avoid consequences of particular concern to Sandia Corporation. • Environment Safety & Health Program • Integrated Security Program • CPR400.1.3 Price Anderson Act and Nuclear Safety Requirements • CPR500.2.1 Quality Significant Procurement Handbook • Suspect Counterfeit Program • CPR001.3.6 Corporate Software Quality Assurance • CPR001.3.3 Formality of Operations Program	All but one of these requirements are general management requirements, not ASC program related requirements; these requirements outside scope of Software Quality Plan Software Quality Plan maps to CPR001.3.6.
3.1.6	Managers shall integrate controls for suspect-counterfeit items into planned work as shown on Attachment 1: Supplemental Requirements for the Control of Suspect Counterfeit Items, Work Process Controls Relative to S/CI and Attachment 3: Suspect/Counterfeit Items Programs.	N/A – Software Quality Plan does not apply to "suspect-conterfeit items"
3.2	**Evaluate Risk**	(Heading only, no mapping required)
3.2.1	Managers shall identify and evaluate the risks associated with planned work following Attachment 2: Process for Risk Evaluation at Work. Sources of applicable risk identification include SMU, Division, and policy area risk matrices, customer feedback, audit and assessment results, lessons learned from the Corporate Issues Management and Corrective Action Processes, technical evaluation of the work, and experience	PR2, Section 4.2.5

CPR001.3.2 Requirements		ASC Software Quality Plan
	from other projects and activities. A more detailed discussion about risk management can be found at Sandia's Enterprise Risk Management CPR.	
3.2.2	Managers shall determine if the program, project or activity is subject to the Price Anderson Amendments Act by referring to CPR400.1.3 Price-Anderson Amendments Act (PAAA) and Nuclear Safety Requirements. If the work is subject to PAAA, the manager shall also consult 10 CFR 830 Subpart A, Quality Assurance Requirements, for its applicability, and potential effect on the assigned risk level.	Requirement outside scope of Software Quality Plan
3.3	**Implement Controls**	(Heading only, no mapping required)
3.3.1	Managers are required to conduct work and control the risks identified in Section 3.2, in accordance with Sandia's Corporate Business Rules using a risk-based graded approach.	PR2 describes a risk-based, graded approach for determining the level of formality required.; PR10 describes project level risk management requirements
3.3.2	Managers are required to prepare additional quality documentation for the program, project, or activity if any of the following criteria are "true": 1. Additional controls are required beyond those provided by Sandia's Corporate Business Rules which are already applied to the work. (e.g., if the manager prefers to utilize program management tools to manage a program, the manager can and should.) 2. Regulations or customer requirements specify the need for a quality plan to govern the work (e.g., Sandia's Radiological Waste Management program has a quality plan in response to requirements contained in the Nevada Test Site Waste Acceptance Criteria (NTS-WAC)). 3. The manager prefers to generate a quality plan as an assurance mechanism … .	Software Quality Plan
3.3.3	If additional quality documentation is needed or selected, managers shall: • Ensure that all 10 elements of DOE O 414.1C are addressed by the total of the resulting quality documentation. • Indicate if the activity is subject to compliance with 10 CFR 830 and, hence, subject to PAAA regulatory criteria. • Identify, design and implement the additional controls necessary. • Ensure the quality documentation is reviewed by an independent reviewer having no substantive involvement in the work, but who has the knowledge to conduct a critical review. (Division QA Coordinators are an excellent choice). • Ensure approval of the quality documentation by the level of management with adequate authority to manage the activity. • Specify the schedule to periodically review and	• See mappings for CPR001.3.6 • 10 CFR 830 relates to nuclear safety of DOE nuclear facilities; in general outside scope/use of modeling/simulation ASC codes • PR1, PR2, PR5, PR10, PR12 • Section 5 • Table 1, PR2

CPR001.3.2 Requirements		ASC Software Quality Plan
	revise quality documents to ensure currency.	Table 1
3.3.4	Managers shall document their decision regarding whether they need a separate Quality Plan or enhanced quality processes using the "Manager's Record of Quality Assurance Review." The "Manager's Record of Quality Assurance Review" shall be completed using the linked form, and a copy shall be kept for their files.	PR2
3.4	**Perform Work**	(Heading only, no mapping required)
3.4.1	Managers shall ensure performance of the work complies with Sandia's Corporate Business Rules, applicable SMU, Division and customer requirements, and applicable quality assurance plans.	CPRs - Table 1 Applicable SMU, Division and customer requirements out of scope for Software QualityPlan Applicable QA Plans - Table 1, figure 1
3.5	**Improve Process**	(Heading only, no mapping required)
3.5.1	Managers shall review item characteristics, process implementation, and other quality-related information to identify and address items, services, and processes needing improvement.	Table 1
3.5.2	Managers shall apply the requisite ILMS processes (CPR001.3.4, Corporate Work Process; CPR001.3.9, Corporate Issues Management Process; CPR001.3.10, Self Assessment Process; and CPR001.3.11, Corrective Action Process) and SMU/Division processes, to the extent applicable.	Requirement out of scope for Software Quality Plan; managers have many other general responsibilities not called out in Software QualityPlan
4.0	**Roles and Responsibilities**	(Heading only, no mapping required)
4.1	**Managers at all levels** are responsible to ensure that the requirements of this CPR are integrated into programs, projects, processes and activities by members of the work force, and that these individuals have and maintain the requisite qualifications.	Table 1, PR29,PR30.
4.2	**Executive Policy Sponsors** are responsible to ensure that appropriate quality criteria are integrated into policies in their area.	Table 1
4.3	**The Corporate Quality Assurance Department** has the following responsibilities pursuant to implementing this Corporate Quality Assurance Program: • Maintain and revise this CPR as needed, by assessing it for gaps in meeting internal and external customer requirements and expectations and corporate needs and objectives. • Report changes made to this CPR to DOE annually. • Maintain and revise the following processes whose implementation is integral to quality management, as needed: Formality of Operations, Technical Standards Program, Presidents Quality Award, and the ISO 9000 Program. • Review the following corporate processes whose implementation is closely allied with the Corporate Quality Assurance Program, and	Corporate QA Department activities out of scope for Software Quality Plan

CPR001.3.2 Requirements		ASC Software Quality Plan
	advise the owners of any suggestions: Corporate Software Quality, Standards and Calibration, the Corporate Issues Management System, Enterprise Risk Management CPR, Corporate Self-Assessment Process, Corporate Corrective Action Development & Tracking Process, and Price Anderson Amendments Act and Nuclear Safety Requirements. • Provide tools, guidance, training and subject-matter experts as appropriate to assist organizations at all levels in accomplishing the purpose of this CPR. • Review documentation and advise organizations at all levels on their quality management programs, processes and procedures in relation to the purposes and requirements of CPS001, Corporate Policy Statement, and CPSR001.3, Integrated Laboratory Management System. • Conduct periodic self-assessments of the effectiveness of this Program. • Convene the Quality Assurance Working Group to provide implementation guidance and tactical planning for Sandia's management system related to the quality assurance program.	
5.0	**Required Records** Records required by this CPR include (1) documented Quality Assurance Plans or quality assurance documents (including work control documents), (2) the "Manager's Record of Quality Assurance Review", and (3) all other documentation required by the Corporate Business Rules and applicable SMU/Division Business Rules and QAPs. Quality Assurance Plans and/or documents which describe the controls used to manage the work shall be kept by the manager. The "Manager's Record of Quality Assurance Review" is filed electronically and retained by the Corporate Quality Office. For more information regarding records requirements see Recorded Information Management and CPR001.3.3 Formality of Operations Manual (Ch 11).	Software Quality Plan PR2, Table 1, Table 8
6.0	**References**	(Heading only, no mapping required)
6.1	**Drivers**	(Informational, no mapping required)
6.2	**DOE Guidance**	(Informational, no mapping required)
6.3	**Related Sandia Business Rule** CPR001.3.6, Corporate Software Quality Assurance	See mappings in Section 5.2

5.2 CPR001.3.6 Mappings

CPR001.3.6 Requirements		ASC Software Quality Plan
1.0	**Purpose**	(Informational, no mapping required)
2.0	**Statement of Applicability** This document applies to all software developed, subcontracted for development, acquired, modified, maintained, or used at Sandia (referred to herein as "applicable software"). Etc.	Figure 1
3.0	**Policy Requirements** Each Sandia organization that develops, subcontracts for development, acquires, modifies, maintains, or uses applicable software does so in accordance with a documented software process that also manages and realizes our customers' requirements. Additional requirements (e.g., nuclear safety software[1] and weapon/weapon-related software[2]) may apply to specific types of software. Software quality activities have a graded level of formality that is determined via a risk-based approach that considers the likelihood and consequence of failure. For further guidance, refer to Section 7.0, which contains a few software-specific risk evaluation examples, and to CPR001.3.2, which contains a general risk evaluation process.	Software Quality Plan is the documented software process Mapping to CPR001.3.2 provided in Software Quality Plan, part 2
	CPR001.3.2 requires that quality assurance issues be reported and independent assessments be performed. Self-assessment for each organization is a recognized component of Software Quality Engineering Excellence. For further guidance, refer to the Corporate Self-Assessment Process described in CPR001.3.10. An external independent assessment is to be conducted when such an assessment provides a business or mission advantage to the organization or its customers.	Section 5
	Each organization (or project) must implement the following software quality process areas to the degree appropriate for the risk level that the organization determined by tailoring the criteria in CPR001.3.2 to its mission. Given this risk level, a corresponding level of formality is determined. For example, if the risk level is high, a high level of formality helps to manage and mitigate risks. These process areas are elements of the implementation required under this CPR.	PR 2
	• Project Planning and Oversight	PR11, PR12
	• Risk Management	PR2, PR9, PR10
	• Requirements Development and Management	PR7, PR8
	• Technical Solution	PR14

[1] Refer to DOE Order 414.1C, Attachment 2
[2] Refer to Technical Business Practice 306

CPR001.3.6 Requirements		ASC Software Quality Plan
	• Verification • and Validation	PR26, PR27, PR28 Validation out of scope
	• Deployment and Life Cycle Support	PR21, PR22, PR23
	• Configuration Management	PR15, PR16, PR17
	• Measurement and Analysis	PR4, PR5
	These process areas are common to international software quality standards and frameworks. The process areas must be documented and quality records must provide evidence that documented practices are being performed. The level of formality determines each project's implementation of the process areas cited above. Within each of the process areas, associated dimensions are to be considered and documented [3] to include: • Identified and involved stakeholder(s) • Ongoing process monitoring and control • Collected improvement information • Objective evaluations • Quantitative objectives defined for processes • Stable subprocess performance • Training • Problem reporting and corrective action	(Informational, no mapping required) PR1-PR30, Table 8. Software Quality Plan Artifacts • PR6 • PR4, PR5 • PR4, PR18 • PR28 • PR4 • PR5 • PR29, PR30 • PR18
4.0	**Definitions**	(Informational, no mapping required)
5.0	**Drivers**	(Informational, no mapping required)
6.0	**Resources and References**	(Informational, no mapping required)
7.0	**Templates and Examples**	(Informational, no mapping required)

[3] The process areas and their associated dimensions are not required to be separately documented. The documentation for the process areas can be grouped in a way that is most beneficial to the organization.

6 ISO 9001-2000 Mapping

The following chart maps requirements between *Part 1: Practices* of the Software Quality Plan and the ISO 9001-2000 document.

ISO 9001:2000 Quality Management Systems – Requirements	ASC Software Quality Plan
1 Scope **1.1 General** This International Standard specifies requirements for a quality management system where an organization a) needs to demonstrate its ability to consistently provide product that meets customer and applicable regulatory requirements, and b) aims to enhance customer satisfaction through the effective application of the system, including processes for continual improvement of the system and the assurance of conformity to customer and applicable regulatory requirements.	Section 1.1, PR3-5, PR6-8, PR25
1.2 Application All requirements of this International Standard are generic and are intended to be applicable to all organizations, regardless of type, size and product provided. Where any requirement(s) of this International Standard cannot be applied due to the nature of an organization and its product, this can be considered for exclusion. Where exclusions are made, claims of conformity to this International Standard are not acceptable unless these exclusions are limited to requirements within clause 7, and such exclusions do not affect the organization's ability, or responsibility, to provide product that meets customer and applicable regulatory requirements.	ISO 9001:2000 §7.6, Control of monitoring and measuring devices allowed exclusions
2 Normative reference The following normative document contains provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the normative document indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards. ISO 9000:2000, Quality management systems — Fundamentals and vocabulary.	N/A – (Informational, no mapping required)
3 Terms and definitions For the purposes of this International Standard, the terms and definitions given in ISO 9000 apply. The following terms, used in this edition of ISO 9001 to describe the supply chain, have been changed to reflect the vocabulary currently used: **supplier -> organization -> customer** Throughout the text of this International Standard, wherever the term "product" occurs, it can also mean "service".	Some ISO 9000:2000 definitions referenced in Glossary (e.g. "requirement"); set of definitions (which words included) is different; definitions different from QC-1
4 Quality management system	(Heading only, no mapping required)
4.1 General requirements The organization shall establish, document, implement and maintain a quality management system and continually improve its effectiveness in accordance with the requirements of this International Standard. The organization shall a) identify the processes needed for the quality management system and their	Software Quality Plan

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application throughout the organization (see 1.2), b) determine the sequence and interaction of these processes, c) determine criteria and methods needed to ensure that both the operation and control of these processes are effective, d) ensure the availability of resources and information necessary to support the operation and monitoring of these processes, e) monitor, measure and analyze these processes, and f) implement actions necessary to achieve planned results and continual improvement of these processes. These processes shall be managed by the organization in accordance with the requirements of this International Standard. Where an organization chooses to outsource any process that affects product conformity with requirements, the organization shall ensure control over such processes. Control of such outsourced processes shall be identified within the quality management system.	PR1, PR3 PR3 PR3, PR4, PR5 PR4, PR5, PR11 PR3, PR4, PR5 PR5
4.2 Documentation requirements	(Heading only, no mapping required)
4.2.1 General The quality management system documentation shall include a) documented statements of a quality policy and quality objectives, b) a quality manual, c) documented procedures required by this International Standard, d) documents needed by the organization to ensure the effective planning, operation and control of its processes, and e) records required by this International Standard (see 4.2.4).	 Section 1, Section 2, Section 3 Software Quality Plan Software Quality Plan PR3, PR4, PR5 PR17, PR19
4.2.2 Quality manual The organization shall establish and maintain a quality manual that includes a) the scope of the quality management system, including details of and justification for any exclusions (see 1.2), b) the documented procedures established for the quality management system, or reference to them, and c) a description of the interaction between the processes of the quality management system.	 Sections 1-3, PR1, PR2 PR3 PR3
4.2.3 Control of documents Documents required by the quality management system shall be controlled. Records are a special type of document and shall be controlled according to the requirements given in 4.2.4. A documented procedure shall be established to define the controls needed a) to approve documents for adequacy prior to issue, b) to review and update as necessary and re-approve documents, c) to ensure that changes and the current revision status of documents are identified, d) to ensure that relevant versions of applicable documents are available at points of use, e) to ensure that documents remain legible and readily identifiable, f) to ensure that documents of external origin are identified and their distribution controlled, and g) to prevent the unintended use of obsolete documents, and to apply suitable identification to them if they are retained for any purpose.	 PR3 PR3 PR17 PR17, PR22 PR17 PR15, PR16, PR17, PR22 PR17, PR22
4.2.4 Control of records Records shall be established and maintained to provide evidence of conformity to requirements and of the effective operation of the quality management system. Records shall remain legible, readily identifiable and retrievable. A documented procedure shall be established to define the controls needed for the	PR3, PR17, PR18, PR19, Section 4.3.3 Configuration Management, Overview Description

ISO 9001:2000 Quality Management Systems – Requirements	ASC Software Quality Plan
identification, storage, protection, retrieval, retention time and disposition of records.	CPR400.2.13 defines SNL records policy
5 Management responsibility	(Heading only, no mapping required)
5.1 Management commitment Top management shall provide evidence of its commitment to the development and implementation of the quality management system and continually improving its effectiveness by a) communicating to the organization the importance of meeting customer as well as statutory and regulatory requirements, b) establishing the quality policy, c) ensuring that quality objectives are established, d) conducting management reviews, and e) ensuring the availability of resources.	Commitment, Table 1 Sections 1-3, Table 1, PR1 Sections 1-3, Table 1 Sections 1-3, Table 1 Table 1, PR1, PR12 Table 1, PR1, PR11
5.2 Customer focus Top management shall ensure that customer requirements are determined and are met with the aim of enhancing customer satisfaction (see 7.2.1 and 8.2.1).	Commitment, Table 1, PR1, PR6, PR7, PR8, PR23, PR24, PR25
5.3 Quality policy Top management shall ensure that the quality policy a) is appropriate to the purpose of the organization, b) includes a commitment to comply with requirements and continually improve the effectiveness of the quality management system, c) provides a framework for establishing and reviewing quality objectives, d) is communicated and understood within the organization, and e) is reviewed for continuing suitability.	Table 1, PR1 Section 1.1, Figure 1, Section 2, Table 1, PR1 Table 1, PR1 Table 1, PR1 Table 1, PR1
5.4 Planning	(Heading only, no mapping required)
5.4.1 Quality objectives Top management shall ensure that quality objectives, including those needed to meet requirements for product [see 7.1 a)], are established at relevant functions and levels within the organization. The quality objectives shall be measurable and consistent with the quality policy.	Section 1.1, Table 1, PR1
5.4.2 Quality management system planning Top management shall ensure that a) the planning of the quality management system is carried out in order to meet the requirements given in 4.1, as well as the quality objectives, and b) the integrity of the quality management system is maintained when changes to the quality management system are planned and implemented.	Table 1, PR1 Table 1, PR1
5.5 Responsibility, authority and communication	(Heading only, no mapping required)
5.5.1 Responsibility and authority Top management shall ensure that responsibilities and authorities are defined and communicated within the organization.	Table 1, PR1-3, PR6 , PR11
5.5.2 Management representative Top management shall appoint a member of management who, irrespective of other responsibilities, shall have responsibility and authority that includes a) ensuring that processes needed for the quality management system are established, implemented and maintained, b) reporting to top management on the performance of the quality management system and any need for improvement, and c) ensuring the promotion of awareness of customer requirements throughout the organization. NOTE The responsibility of a management representative can include liaison	Table 1, PR1-5, PR7-8, PR11-12, Section 5 PR3-5, PR7-8, PR11-12, Section 5 PR1, PR3-5, PR7-8, PR11-12

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with external parties on matters relating to the quality management system.	
5.5.3 Internal communication Top management shall ensure that appropriate communication processes are established within the organization and that communication takes place regarding the effectiveness of the quality management system.	Table 1, PR1, PR11
5.6 Management review	(Heading only, no mapping required)
5.6.1 General Top management shall review the organization's quality management system, at planned intervals, to ensure its continuing suitability, adequacy and effectiveness. This review shall include assessing opportunities for improvement and the need for changes to the quality management system, including the quality policy and quality objectives. Records from management reviews shall be maintained (see 4.2.4).	Table 1, PR1, Section 5
5.6.2 Review input The input to management review shall include information on a) results of audits, b) customer feedback, c) process performance and product conformity, d) status of preventive and corrective actions, e) follow-up actions from previous management reviews, f) changes that could affect the quality management system, and g) recommendations for improvement.	(Audits & audit reports) Table 1, PR1, PR28, Section 5 PR6-8, PR25 PR9-10, PR11-12, PR13-16, PR17-19, PR27, PR28 PR4, PR10, PR12, PR17 PR11-12 PR5, Section 5 Table 1, PR1, PR5, PR12, PR25, PR28, Section 5
5.6.3 Review output The output from the management review shall include any decisions and actions related to a) improvement of the effectiveness of the quality management system and its processes, b) improvement of product related to customer requirements, and c) resource needs.	Table 1, PR1 PR11-12 PR11-12 PR1, PR11-12
6 Resource management	(Heading only, no mapping required)
6.1 Provision of resources The organization shall determine and provide the resources needed a) to implement and maintain the quality management system and continually improve its effectiveness, and b) to enhance customer satisfaction by meeting customer requirements.	 Table 1, PR1-5 PR1-PR3, PR6-8, PR11, PR25
6.2 Human resources	(Heading only, no mapping required)
6.2.1 General Personnel performing work affecting product quality shall be competent on the basis of appropriate education, training, skills and experience.	Table 1, PR1, PR11-12, PR29-30
6.2.2 Competence, awareness and training The organization shall a) determine the necessary competence for personnel performing work affecting product quality, b) provide training or take other actions to satisfy these needs, c) evaluate the effectiveness of the actions taken, d) ensure that its personnel are aware of the relevance and importance of their activities and how they contribute to the achievement of the quality objectives, and e) maintain appropriate records of education, training, skills and experience (see 4.2.4).	 PR29 PR30 PR12, PR28 PR11, PR29 PR30

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6.3 Infrastructure The organization shall determine, provide and maintain the infrastructure needed to achieve conformity to product requirements. Infrastructure includes, as applicable a) buildings, workspace and associated utilities, b) process equipment (both hardware and software), and c) supporting services (such as transport or communication).	 PR1, PR11 PR13, PR15-16 PR1, PR11-12
6.4 Work environment The organization shall determine and manage the work environment needed to achieve conformity to product requirements.	PR1, PR11
7 Product realization	(Heading only, no mapping required)
The organization shall plan and develop the processes needed for product realization. Planning of product realization shall be consistent with the requirements of the other processes of the quality management system (see 4.1). In planning product realization, the organization shall determine the following, as appropriate: a) quality objectives and requirements for the product; b) the need to establish processes, documents, and provide resources specific to the product; c) required verification, validation, monitoring, inspection and test activities specific to the product and the criteria for product acceptance; d) records needed to provide evidence that the realization processes and resulting product meet requirements (see 4.2.4).	 PR1-3, PR6-8, PR20 PR1-3, PR11, PR20 PR8, PR11-12, PR17-19, PR21, PR26-28 PR17-19, PR21, PR26-28
7.2 Customer-related processes	(Heading only, no mapping required)
7.2.1 Determination of requirements related to the product The organization shall determine a) requirements specified by the customer, including the requirements for delivery and post-delivery activities, b) requirements not stated by the customer but necessary for specified or intended use, where known, c) statutory and regulatory requirements related to the product, and d) any additional requirements determined by the organization.	 PR6-8, PR23 PR6-8, PR23 PR8, PR13, PR15-16 PR8, PR9-10
7.2.2 Review of requirements related to the product The organization shall review the requirements related to the product. This review shall be conducted prior to the organization's commitment to supply a product to the customer (e.g. submission of tenders, acceptance of contracts or orders, acceptance of changes to contracts or orders) and shall ensure that a) product requirements are defined, b) contract or order requirements differing from those previously expressed are resolved, and c) the organization has the ability to meet the defined requirements. Records of the results of the review and actions arising from the review shall be maintained (see 4.2.4). Where the customer provides no documented statement of requirement, the customer requirements shall be confirmed by the organization before acceptance. Where product requirements are changed, the organization shall ensure that relevant documents are amended and that relevant personnel are made aware of the changed requirements.	 Table 1, PR1, PR28 PR6-8 PR8, PR11-12 PR9-10, PR11-12

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7.2.3 Customer communication The organization shall determine and implement effective arrangements for communicating with customers in relation to a) product information, b) enquiries, contracts or order handling, including amendments, and c) customer feedback, including customer complaints.	 PR6-8, PR13, PR23-PR25 PR6-8, PR13, PR23-PR25 PR6-8, PR23-PR25
7.3 Design and development	(Heading only, no mapping required)
7.3.1 Design and development planning The organization shall plan and control the design and development of product. During the design and development planning, the organization shall determine a) the design and development stages, b) the review, verification and validation that are appropriate to each design and development stage, and c) the responsibilities and authorities for design and development. The organization shall manage the interfaces between different groups involved in design and development to ensure effective communication and clear assignment of responsibility. Planning output shall be updated, as appropriate, as the design and development progresses.	 PR1- 3, PR11, PR13 PR11, PR13, PR26 PR1, PR6, PR11, PR13
7.3.2 Design and development inputs Inputs relating to product requirements shall be determined and records maintained (see 4.2.4). These inputs shall include a) functional and performance requirements, b) applicable statutory and regulatory requirements, c) where applicable, information derived from previous similar designs, and d) other requirements essential for design and development. These inputs shall be reviewed for adequacy. Requirements shall be complete, unambiguous and not in conflict with each other.	 PR1, PR3, PR6-8, PR13 PR6-8, PR13, PR15-16 PR6-8, PR13, PR15-16 PR9-10, PR28
7.3.3 Design and development outputs The outputs of design and development shall be provided in a form that enables verification against the design and development input and shall be approved prior to release. Design and development outputs shall a) meet the input requirements for design and development, b) provide appropriate information for purchasing, production and for service provision, c) contain or reference product acceptance criteria, and d) specify the characteristics of the product that are essential for its safe and proper use.	 PR13, PR15-16, PR28 PR13, PR15-16, PR28 PR27-28 PR23
7.3.4 Design and development review At suitable stages, systematic reviews of design and development shall be performed in accordance with planned arrangements (see 7.3.1) a) to evaluate the ability of the results of design and development to meet requirements, and b) to identify any problems and propose necessary actions. Participants in such reviews shall include representatives of functions concerned with the design and development stage(s) being reviewed. Records of the results of the reviews and any necessary actions shall be maintained (see 4.2.4).	 Table 1, PR1, PR3, PR11, PR13, PR17-19, PR28 PR5, PR8, PR12, PR17-19
7.3.5 Design and development verification Verification shall be performed in accordance with planned arrangements (see 7.3.1) to ensure that the design and development outputs have met the design and development input requirements. Records of the results of the verification and any necessary actions shall be maintained (see 4.2.4).	PR17-19, PR26-28

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7.3.6 Design and development validation Design and development validation shall be performed in accordance with planned arrangements (see 7.3.1) to ensure that the resulting product is capable of meeting the requirements for the specified application or intended use, where known. Wherever practicable, validation shall be completed prior to the delivery or implementation of the product. Records of the results of validation and any necessary actions shall be maintained (see 4.2.4).	PR17-19, PR26-28
7.3.7 Control of design and development changes Design and development changes shall be identified and records maintained. The changes shall be reviewed, verified and validated, as appropriate, and approved before implementation. The review of design and development changes shall include evaluation of the effect of the changes on constituent parts and product already delivered. Records of the results of the review of changes and any necessary actions shall be maintained.	PR8, PR13, PR17-19, PR23-25, PR26-28, PR15-16
7.4 Purchasing	(Heading only, no mapping required)
7.4.1 Purchasing process The organization shall ensure that purchased product conforms to specified purchase requirements. The type and extent of control applied to the supplier and the purchased product shall be dependent upon the effect of the purchased product on subsequent product realization or the final product. The organization shall evaluate and select suppliers based on their ability to supply product in accordance with the organization's requirements. Criteria for selection, evaluation and re-evaluation shall be established. Records of the results of evaluations and any necessary actions arising from the evaluation shall be maintained (see 4.2.4).	PR15-16, PR17-19
7.4.2 Purchasing information Purchasing information shall describe the product to be purchased, including where appropriate a) requirements for approval of product, procedures, processes and equipment, b) requirements for qualification of personnel, and c) quality management system requirements. The organization shall ensure the adequacy of specified purchase requirements prior to their communication to the supplier.	 PR6-8, PR11, PR29-30 PR11, PR29-30 PR6-8, PR11, PR29-30
7.4.3 Verification of purchased product The organization shall establish and implement the inspection or other activities necessary for ensuring that purchased product meets specified purchase requirements. Where the organization or its customer intends to perform verification at the supplier's premises, the organization shall state the intended verification arrangements and method of product release in the purchasing information.	PR15-16, PR26-28
7.5 Production and service provision	(Heading only, no mapping required)
7.5.1 Control of production and service provision The organization shall plan and carry out production and service provision under controlled conditions. Controlled conditions shall include, as applicable a) the availability of information that describes the characteristics of the product, b) the availability of work instructions, as necessary, c) the use of suitable equipment, d) the availability and use of monitoring and measuring devices, e) the implementation of monitoring and measurement, and f) the implementation of release, delivery and post-delivery activities.	 PR23-25 PR23-25, PR29-30 PR11-12 PR11-12 PR3-5 PR20-22, PR23-25

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7.5.2 Validation of processes for production and service provision The organization shall validate any processes for production and service provision where the resulting output cannot be verified by subsequent monitoring or measurement. This includes any processes where deficiencies become apparent only after the product is in use or the service has been delivered. Validation shall demonstrate the ability of these processes to achieve planned results. The organization shall establish arrangements for these processes including, as applicable a) defined criteria for review and approval of the processes, b) approval of equipment and qualification of personnel, c) use of specific methods and procedures, d) requirements for records (see 4.2.4), and e) revalidation.	 PR26-28 N/A –Software Quality Plan does not apply to non-software requirements PR3 CRP400.2.13 defines SNL policy PR8
7.5.3 Identification and traceability Where appropriate, the organization shall identify the product by suitable means throughout product realization. The organization shall identify the product status with respect to monitoring and measurement requirements. Where traceability is a requirement, the organization shall control and record the unique identification of the product (see 4.2.4).	PR1, PR7-8, PR26-28, PR15-16, PR17-19
7.5.4 Customer property The organization shall exercise care with customer property while it is under the organization's control or being used by the organization. The organization shall identify, verify, protect and safeguard customer property provided for use or incorporation into the product. If any customer property is lost, damaged or otherwise found to be unsuitable for use, this shall be reported to the customer and records maintained (see 4.2.4). NOTE Customer property can include intellectual property.	PR15-16
7.5.5 Preservation of product The organization shall preserve the conformity of product during internal processing and delivery to the intended destination. This preservation shall include identification, handling, packaging, storage and protection. Preservation shall also apply to the constituent parts of a product.	PR15-16, PR17-19, , PR20-21, PR 26-28
7.6 Control of monitoring and measuring devices The organization shall determine the monitoring and measurement to be undertaken and the monitoring and measuring devices needed to provide evidence of conformity of product to determined requirements (see 7.2.1). The organization shall establish processes to ensure that monitoring and measurement can be carried out and are carried out in a manner that is consistent with the monitoring and measurement requirements. Where necessary to ensure valid results, measuring equipment shall a) be calibrated or verified at specified intervals, or prior to use, against measurement standards traceable to international or national measurement standards; where no such standards exist, the basis used for calibration or verification shall be recorded; b) be adjusted or re-adjusted as necessary; c) be identified to enable the calibration status to be determined; d) be safeguarded from adjustments that would invalidate the measurement result; e) be protected from damage and deterioration during handling, maintenance	N/A – Software Quality Plan does not apply to non-software requirements; requirement applicable for validation activities that rely on experiments and associated test equipment; excluded for software development w/o measurement instruments

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and storage. In addition, the organization shall assess and record the validity of the previous measuring results when the equipment is found not to conform to requirements. The organization shall take appropriate action on the equipment and any product affected. Records of the results of calibration and verification shall be maintained (see 4.2.4). When used in the monitoring and measurement of specified requirements, the ability of computer software to satisfy the intended application shall be confirmed. This shall be undertaken prior to initial use and reconfirmed as necessary.	
8 Measurement, analysis and improvement	(Heading only, no mapping required)
8.1 General The organization shall plan and implement the monitoring, measurement, analysis and improvement processes needed a) to demonstrate conformity of the product, b) to ensure conformity of the quality management system, and c) to continually improve the effectiveness of the quality management system. This shall include determination of applicable methods, including statistical techniques, and the extent of their use.	Each phase contains set of metrics to assess conformity of product PR26-28 Table 1, PR1 Table 1, PR1, PR3-5
8.2 Monitoring and measurement	(Heading only, no mapping required)
8.2.1 Customer satisfaction As one of the measurements of the performance of the quality management system, the organization shall monitor information relating to customer perception as to whether the organization has met customer requirements. The methods for obtaining and using this information shall be determined.	PR6, PR7, PR23, PR25
8.2.2 Internal audit The organization shall conduct internal audits at planned intervals to determine whether the quality management system a) conforms to the planned arrangements (see 7.1), to the requirements of this International Standard and to the quality management system requirements established by the organization, and b) is effectively implemented and maintained. An audit program shall be planned, taking into consideration the status and importance of the processes and areas to be audited, as well as the results of previous audits. The audit criteria, scope, frequency and methods shall be defined. Selection of auditors and conduct of audits shall ensure objectivity and impartiality of the audit process. Auditors shall not audit their own work. The responsibilities and requirements for planning and conducting audits, and for reporting results and maintaining records (see 4.2.4) shall be defined in a documented procedure. The management responsible for the area being audited shall ensure that actions are taken without undue delay to eliminate detected nonconformities and their causes. Follow-up activities shall include the verification of the actions taken and the reporting of verification results (see 8.5.2).	Table 1, PR1, PR28, Section 5 Table 1, PR1, PR28, Section 5
8.2.3 Monitoring and measurement of processes The organization shall apply suitable methods for monitoring and, where applicable, measurement of the quality management system processes. These methods shall demonstrate the ability of the processes to achieve planned results. When planned results are not achieved, correction and corrective action shall be taken, as appropriate, to ensure conformity of the product.	Table 1, PR1, PR3-5, Section 5

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8.2.4 Monitoring and measurement of product The organization shall monitor and measure the characteristics of the product to verify that product requirements have been met. This shall be carried out at appropriate stages of the product realization process in accordance with the planned arrangements (see 7.1). Evidence of conformity with the acceptance criteria shall be maintained. Records shall indicate the person(s) authorizing release of product (see 4.2.4). Product release and service delivery shall not proceed until the planned arrangements (see 7.1) have been satisfactorily completed, unless otherwise approved by a relevant authority and, where applicable, by the customer.	PR26-28, PR1, PR7-8, PR17-19, PR20-22
8.3 Control of nonconforming product The organization shall ensure that product which does not conform to product requirements is identified and controlled to prevent its unintended use or delivery. The controls and related responsibilities and authorities for dealing with nonconforming product shall be defined in a documented procedure. The organization shall deal with nonconforming product by one or more of the following ways: a) by taking action to eliminate the detected nonconformity; b) by authorizing its use, release or acceptance under concession by a relevant authority and, where applicable, by the customer; c) by taking action to preclude its original intended use or application. Records of the nature of nonconformities and any subsequent actions taken, including concessions obtained, shall be maintained (see 4.2.4). When nonconforming product is corrected it shall be subject to re-verification to demonstrate conformity to the requirements. When nonconforming product is detected after delivery or use has started, the organization shall take action appropriate to the effects, or potential effects, of the nonconformity.	PR13-16, PR26-28, PR17-19 PR1, PR11, PR13, , PR7-8, PR23 PR13-16, PR26-28, PR17-19
8.4 Analysis of data The organization shall determine, collect and analyze appropriate data to demonstrate the suitability and effectiveness of the quality management system and to evaluate where continual improvement of the effectiveness of the quality management system can be made. This shall include data generated as a result of monitoring and measurement and from other relevant sources. The analysis of data shall provide information relating to a) customer satisfaction (see 8.2.1), b) conformity to product requirements (see 7.2.1), c) characteristics and trends of processes and products including opportunities for preventive action, and d) suppliers.	Section 5 PR23, PR25 PR1, PR6-8, PR26-28 PR3-5 PR15, PR16
8.5 Improvement	(Heading only, no mapping required)
8.5.1 Continual improvement The organization shall continually improve the effectiveness of the quality management system through the use of the quality policy, quality objectives, audit results, analysis of data, corrective and preventive actions and management review.	Table 1, PR1-5, PR12, PR28, Section 5
8.5.2 Corrective action The organization shall take action to eliminate the cause of nonconformities in order to prevent recurrence. Corrective actions shall be appropriate to the effects of the nonconformities encountered. A documented procedure shall be established to define requirements for a) reviewing nonconformities (including customer complaints), b) determining the causes of nonconformities , c) evaluating the need for action to ensure that nonconformities do not recur, d) determining and implementing action needed, e) records of the results of action taken (see 4.2.4), and	PR5, PR12, PR17-19, PR25, PR28, Section 5

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f) reviewing corrective action taken.	
8.5.3 Preventive action The organization shall determine action to eliminate the causes of potential nonconformities in order to prevent their occurrence. Preventive actions shall be appropriate to the effects of the potential problems. A documented procedure shall be established to define requirements for a) determining potential nonconformities and their causes, b) evaluating the need for action to prevent occurrence of nonconformities, c) determining and implementing action needed, d) records of results of action taken (see 4.2.4), and e) reviewing preventive action taken.	PR5, PR12, PR17-19, PR26-28, Section 5

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