Handbook

CMU/SEI-94-HB-01
September 1994

A Software Process Framework for the SEI Capability Maturity Model[sm]

Timothy G. Olson
Neal R. Reizer
James W. Over

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FOR THE COMMANDER

(signature on file)

Thomas R. Miller, Lt Col, USAF
SEI Joint Program Office

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To the Reader

Introduction

The Software Process Framework (SPF) is a document that provides information contained in the SEI Capability Maturity Model (CMM) for Software v1.1 [Paulk93a] in a format suitable for process definition and improvement. The SPF allows users to determine if their organization's software process documentation is consistent with the recommendations made by the CMM. When organizational software process documentation is found to be inconsistent with the CMM, the SPF provides the ability to make informed decisions regarding the applicability of specific CMM recommendations.

Background

Many organizations have started down the path of software process improvement by conducting a software process assessment and then responding with action plans to address the assessment findings. At this point, many organizations find themselves struggling to develop software processes that are consistent with the CMM. The SPF helps to address part of this implementation barrier by answering the question:

How does an organization know if its software policies, standards, processes, procedures, training, and tools are consistent with the CMM?

Primary audiences

The primary audiences of this document are:

- *Software engineering process groups (SEPGs) or process engineers:* Organizational units or personnel responsible for facilitating software process improvement.
- *Software process improvement groups*: Organizational teams responsible for improving software processes such as process action teams (PATs), quality improvement teams, or technical working groups (e.g., a PAT addressing a software process assessment finding).
- *Software quality assurance groups or process assurance:* Organizational groups or personnel responsible for auditing, reviewing, verifying, or validating software processes.

Assumption: The primary audiences of this document are assumed to be experienced in software process improvement, experienced using the SEI CMM, and familiar with CMM-based appraisals (software process assessments and software capability evaluations).

Continued on next page

Secondary audiences

Secondary audiences of this document include:

- *Managers:* Individuals or groups who are responsible for planning, controlling, and improving software acquisition, development, or maintenance processes and are interested in using the CMM for software process improvement.
- *Software process participants:* Individuals or groups responsible for implementing some portion of a software acquisition, development, or maintenance process.
- *Sponsors:* Personnel responsible for funding, authorizing, and providing the needed resources for software process improvement efforts that are based on the CMM.

Primary uses

The primary uses of the SPF are to:

- Analyze and review software processes to check consistency with the CMM (in the context of process assurance or process verification).
- Design software processes so that they are consistent with the CMM.
- Serve as a technical reference for the SEI workshop "Defining Software Processes: Getting Started."

Additional uses

Additional uses of the SPF include:

Improvement efforts:
- Help identify who should be involved in a software process improvement effort.
- Guide charter and plan development for process action teams (PATs).
- Guide PATs in establishing selection criteria for process improvement pilot projects.
- Help measure success criteria for pilot projects and for installing and institutionalizing a software process.

Defining organizational roles:
- Provide a checklist for software quality assurance (SQA) reviews and audits.
- Help define organizational roles, responsibilities, and scope (e.g., software configuration management).

Others:
- Provide criteria for a "good process definition."
- Help communicate the CMM recommendations to achieve a particular maturity level to senior management (or others).
- Help develop process guides and process models (e.g., SEPG uses the SPF as a template to build a process guide).
- Help tailor software processes (e.g., structure and content).

Continued on next page

Do not use for appraisals

This document contains a set of checklists to help an organization determine if its software policies, standards, processes, procedures, training, and tools are consistent with the CMM.

The checklists are *not* intended to be scored or used as the basis for an appraisal (i.e., software capability evaluation or software process assessment).

Chapter 1. Introduction

Overview

Introduction This chapter will provide the rationale for the development of the Software Process Framework (SPF). This chapter also describes the major concepts underlying the development of the SPF.

In this chapter This chapter contains the following topics:

Topic	See page
About this document	Introduction-2
Organization of this document	Introduction-4
Questions addressed by the SPF	Introduction-5
Process definition criteria	Introduction-6
Relation to the CMM	Introduction-8
The operational framework	Introduction-9

About this Document

Introduction

This section provides an overview of this document.

Purpose

The purpose of the SPF is to provide guidance for designing, analyzing, and reviewing software processes for consistency with the CMM.

To fulfill its purpose, the SPF:

- Is based on the CMM and the principles of quality and process management.
- Presents information recommended by the CMM in a format suitable for software process definition and improvement.
- Identifies policies, standards, processes, procedures, training, and tools recommended by the CMM.
- Provides checklists for designing, analyzing, and reviewing software policies, standards, processes, procedures, training, and tools so that they can be consistent with the CMM.

Scope

The SPF addresses levels 2 through 5 of the CMM, version 1.1.

The SPF is not...

The Software Process Framework *is not*:

- *A procedure for reaching a particular maturity level.*
  The SPF doesn't tell you how to get to a particular maturity level, but rather what the "goal state" looks like from a process definition and improvement perspective.
- *Process definition training.*
  The SPF does not provide all the needed knowledge and skills for defining a software process.
- *A method or process.*
  The SPF does not provide a method or process for defining a software process.
- *A replacement for the CMM.*
  The CMM contains information about organizational software process maturity; the SPF contains similar information but it is organized for the purpose of designing, analyzing, and reviewing software processes for consistency with the CMM.
- *A process model or process guide.*

Tailoring the SPF

We recommend that organizations tailor the checklists for their own use by restating and adding terminology that is organization specific.

Continued on next page

In this document

This document contains the following chapters and appendices.

Chapter	Title	Description
1	Introduction	Rationale for development of the SPF
2	Features of the SPF	Descriptions and examples of SPF features
3	How to use the SPF	Guidance and examples of using the SPF
4	Repeatable Level (Level 2)	Checklists of CMM recommended information for maturity level 2
5	Defined Level (Level 3)	Checklists of CMM recommended information for maturity level 3
6	Managed Level (Level 4)	Checklists of CMM recommended information for maturity level 4
7	Optimizing Level (Level 5)	Checklists of CMM recommended information for maturity level 5
Appendix A	List of Acronyms	Acronyms used in the SPF
Appendix B	Glossary of Terms	CMM glossary, with additional terms that have been introduced in the SPF
Appendix C	Role Translation Table	A tool to translate generic CMM roles into organization specific roles
Appendix D	General Term Translation Table	A tool to translate generic terms used in the CMM into equivalent organization terms
Appendix E	References	References upon which the SPF is based

Organization of this Document

Introduction	This section provides an overview of the organization of this document.
CMM maturity levels	Each level of the CMM is presented as a separate chapter in the SPF. Gray tabs are used to delimit individual maturity levels. **Example**: Maturity level 2 is presented in chapter 4 of the SPF.
Organization of each maturity level	Each maturity level of the CMM is presented with separate sections for software policies, standards, processes, and procedures. **Example**: Chapter 4 contains sections for the policies, standards, processes, and procedures recommended by the CMM for maturity level 2.
Division of KPAs	Each section within a maturity level (i.e., policies) is further divided by key process area (KPA). **Example**: The policy section of chapter 4 contains a separate entry for each level 2 KPA (e.g., requirements management policy information).

Questions Addressed by the SPF

Introduction

This section presents the questions facing process definers that the SPF has been developed to address.

Relationship between the SPF and CMM

The CMM contains many of the best practices for developing and maintaining software. People defining software processes consistent with the CMM require the information in the CMM to be presented in a format that helps them to analyze and structure their process information.

The SEI Software Process Definition Project has developed the SPF to support the definition of software processes. It accomplishes this by examining the CMM from the perspective of process definition and presenting the results as a series of checklists.

Questions facing process definers

When developing software process documentation, process definers are faced with three challenging questions:

- What software process information do I need to document?
- What recommendations does the CMM make about this process information?
- How do I effectively organize the process information once I have found it?

The SPF addresses these questions

The SPF was developed to address these questions. In other words, it serves as a bridge from current practice to defined software processes that are consistent with what the CMM recommends.

Each question facing a process definer is addressed by a different aspect of the SPF. The aspects of the SPF that address the questions presented above are shown in the table below.

This question...	Is answered by this aspect of the SPF...
What software process information do I need to document?	Process definition criteria
What does the CMM say about this process information?	Relation to the CMM
How do I organize the process information once I have found it?	Operational framework

Process Definition Criteria

Introduction

This section describes process definition criteria and their relationship to the SPF.

Definition: Process definition criteria

Process definition criteria are the set of information that must be included in a software process description for it to be usable by the people performing the process.

Rationale for the criteria

Determining the appropriate process definition criteria answers the question, "What software process information do I need to document?"

Satisfying the criteria

Satisfying the process definition criteria requires developing and maintaining process descriptions that contain the information necessary for the software process description to be usable by the people performing the process. The process definition criteria can be satisfied by answering the basic set of questions given below.

Process elements

Each basic question is answered by an associated *process element*. The set of basic process questions and their associated process elements are shown in the table below.

This process element...	Answers this basic question...
Purpose	Why is a process performed?
Input	What work products are used?
Output	What work products are produced?
Role	Who (or what) performs the activities?
Activity	What is done?
Entry criteria	When (under what circumstances) can processes begin?
Exit criteria	When (under what circumstances) can processes be considered complete?
Procedure	How are activities implemented?

Process Definition Criteria, Continued

Additional process elements

In addition to the process elements shown above, there are several other pieces of information that are useful to include in process descriptions. They are:

- Reviews and audits performed.
- Work products that are to be managed and controlled (or placed under configuration management).
- Measurements to be made.
- Training.
- Tools.

Process elements and the SPF

Every CMM key process area is presented as a series of checklists (see Chapter 2, Features of the SPF). There is one checklist for each process element (except purpose). For example, the software project planning KPA has checklists for inputs, outputs, roles, activities, and so on.

The content of these checklists is derived from the recommendations made by the CMM (see the next section, Relation to the CMM).

Relation to the CMM

Introduction

This section describes the relationship between the CMM and the SPF.

Relation between the CMM and the SPF

In the previous section, we discussed the types of information that must be included in a software process description. This lead to a set of basic questions to ask regarding a software process description.

Once the basic set of questions has been asked, the next challenge is to find the answers. The CMM is a normative model of best practice from the software engineering community and is a source of one set of answers.

Definition

The recommendations made by the CMM are presented as checklists. A *process element checklist* contains the information recommended by the CMM for a particular process element.

Example: A *roles* checklist describes the roles recommended by the CMM for a particular key process area.

Process element checklists

Using the CMM as a source of answers to the basic set of process questions, we developed a series of process element checklists for each key process area. These checklists are described in the table below.

Checklist	Description
Roles	List of roles participating in process activities
Entry Criteria	Description of when the process can start
Inputs	Description of the work products used by the process
Activities	Description of the activities of the process
Outputs	Description of the work products produced by the process
Exit Criteria	Description of when the process is complete
Reviews and Audits	List of reviews and audits performed during the process
Work Products Managed and Controlled	List of work products to be managed and controlled
Measurements	Description of process measurements
Documented Procedures	List of the activities to be completed according to a documented procedure
Training	List of training for the process
Tools	List of tools to support the process

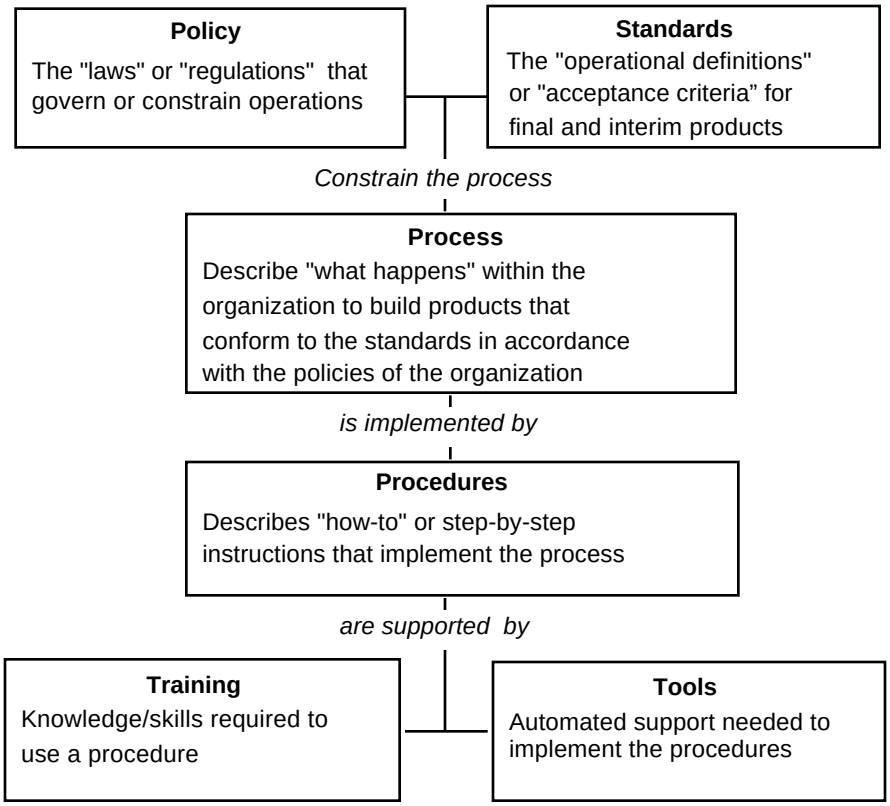
The Operational Framework

Introduction

This section describes the operational framework and its relation to the SPF.

Operational framework and the SPF

The SPF separates information within a CMM maturity level into an organizational structure for software process documentation called the *operational framework*. The operational framework contains the following process information types:



Rationale for the operation framework

Software process documentation must be usable for people. Process documentation that is organized poorly will inhibit people from using it and reduce its effectiveness. The operational framework helps to eliminate this problem because it helps to:

- *Separate information into usable parts:* The operational framework separates information into usable parts used for different purposes. For example, if you want to see an organizational policy, detailed training information included with the policy is irrelevant information (meaning either wasted time or ignoring the policy).

Continued on next page

The Operational Framework, Continued

Rationale for the operation framework, continued

- *Identify and use only the relevant information for each part:* Only relevant information needs to be in each part of the operational framework. For example, training information should only be in training documents, and policies should contain information that does not change frequently. By placing only relevant information in each part of the operational framework, people will learn where to look for information.

- *Manage changes and improvements:* Changes and improvements to the operational parts will be easier to manage because the information is well defined. For example, once defined, policies should not frequently change. Processes probably do not need to change if a step by step procedure changes. Training changes can be isolated to training documents. Only the necessary and important relationships between the operational parts need to be managed.

- *Manage and improve communication:* Communication improves because people know where to look for certain types of information, and they know the relationships between the information. Since the changes are isolated to the operational parts, less communication is needed and only the relevant changes need to be managed and communicated.

Impact on SPF organization

Within each maturity level of the CMM, the SPF is organized according to the operational framework. Therefore, each maturity level is presented with separate sections for:

- policies
- standards,
- processes, and
- procedures.

Note: Training and tools are closely related to processes and are presented as checklists with the process they support.

Chapter 2. Features of the Software Process Framework

Overview

Chapter purpose

The purpose of this chapter is to describe the features of the Software Process Framework (SPF).

In this chapter

This chapter discusses the following features:

Feature	See Page
Checklists	Features-2
CMM context	Features-4
CMM reference text	Features-5
CMM role identification	Features-8
Entry and exit criteria	Features-9
Translation tables	Features-11
User references	Features-15

Checklists

Introduction

The SPF presents information in checklists, which provide various perspectives of the recommendations made by the CMM. Organizations can use these checklists to compare their process documentation to the CMM.

The purpose of this section is to describe how the checklists in the SPF can be used.

Types of checklists

There are five types of checklists in the SPF. Their names and descriptions are provided below.

Checklist Type	Description
Policy	Describes the policy contents and KPA goals recommended by the CMM.
Standard	Describes the recommended content of select work products described in the CMM.
Process	Describes the process information content recommended by the CMM. The process checklists are further refined into checklists for: • roles, • entry criteria, • inputs, • activities, • outputs, • exit criteria, • reviews and audits, • work products managed and controlled, • measurements, • documented procedures, • training, and • tools.
Procedure	Describes the recommended content of documented procedures described in the CMM.
Level Overview	Provides an overview of an entire maturity level. The level overview checklists are further refined into checklists for: • KPA purposes, • KPA goals, • policies, • standards, • process descriptions, • procedures, • training, • tools, • reviews and audits, • work products managed and controlled, and • measurements.

Continued on next page

Checklists, Continued

Use

A checklist is used to:

- allow process designers, analyzers, or reviewers to check whether their software processes are consistent with the CMM.
- indicate that a particular item is being addressed by the organization.

Example of use

The following example illustrates how the SPF checklists are used to show consistency with the CMM, and illustrate compliance and noncompliance with specific CMM recommendations. As shown in the example below, a check (✓) in the left column is used to indicate that a role has been completely satisfied.

The checkboxes "❑" are used when there are checklists within checklists (nested checklists). When there are nested checklists, the left column becomes the parent checklist. Only check the parent checklist if all the checkboxes in that parent are satisfied.

In the example below, the SCCB role is not satisfied (the parent checklist is not checked) because all of the checkboxes within that parent have not been checked. Only the project manager role has been completely satisfied (indicated by the check in the left column).

Roles

The table below describes the activities that are performed by the CMM roles in the software configuration management process.

✓	Role	Activity	Reference
✓	**Project Manager**	The SCM activities are reviewed with the **project manager** on both a periodic and event-driven basis. (L2-83, V2)	*V1 S5.2*
	SCCB	The **SCCB**: (L2-73, Ab1)	
		❑ Authorizes the establishment of software baselines and the identification of configuration items/units.	*V1 S4.6.2*
		✓ Represents the interests of the project manager and all groups who may be affected by changes to the software baselines.	*V1 S4.6*
		✓ Reviews and authorizes changes to the software baselines.	*V1 S4.6.2a*
		✓ Authorizes the creation of products from the software baseline library.	*V1 S4.6.2.b*

CMM Context

Introduction

There are many places where extracting a passage from the CMM results in lost context. This section describes how CMM-specific context within the SPF is provided.

Indicating added context

Parentheses are used to provide CMM-specific context within the SPF.

Example

The following example from the intergroup coordination key process area shows the use of parentheses to maintain context:

IC Process - Inputs

Inputs

The table below lists the recommended inputs to the intergroup coordination process.

↑	Input	Org. Input	References
	Actual completion (of critical dependencies). (L3-89, A4, 5.1)		
	Changes to intergroup commitments. (L3-88, A3, 4)		
	Changes to the plan (used to communicate intergroup commitments and to coordinate and track the work performed). (L3-88, A3, 5)		
	Changes to the project-level objectives. (L3-87, A2, 1.2)		
	Changes to the system requirements. (L3-87, A2, 1.2)		
	Commitments. (L3-90, A7, 4)		
	Customer's requirements. (L3-87, A1, 1)		
	End users requirements. (L3-87, A1, 1)		
	Intergroup commitments. (L3-88, A3)		
	Plan (used to communicate intergroup commitments and to coordinate and track the work performed). (L3-88, A3)		
	Project schedule. (L3-89, A4, 3)		
	Projected completion (of critical dependencies). (L3-89, A4, 5.1)		
	Software schedule. (L3-89, A4, 3)		
	Status (of critical dependencies). (L3-89, A4, 5.1)		
	System requirements. (L3-90, A7, 3)		
	Technical issues. (L3-90, A7, 5)		
	Technical requirements. (L3-90, A7, 3)		
	Technical risks. (L3-88, A2, 1.4)		

Context added

CMM Reference Text

Introduction

The ability to trace from process documentation to the CMM is essential for software organizations. This section describes the convention used to cross-reference information items of the SPF to the CMM source documentation.

Definition

CMM reference text identifies the location of the CMM source material from which the SPF derives its information.

Expected use

CMM reference text is used to:

- Identify a passage in the CMM quickly.
- Maintain traceability from organizational process documentation to the CMM.

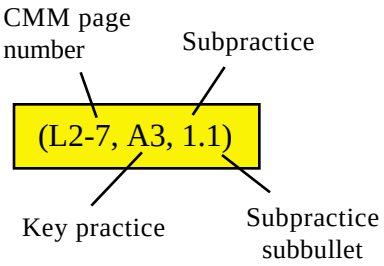
Syntax

The syntax of CMM reference text is:

([CMM page], [Key practice], [Subpractice].[Subpractice subbullet])

Example: CMM reference text

This is an example of CMM reference text.



Note: Text which spans page boundaries of the CMM is referenced by the ***first*** page only.

Continued on next page

Abbreviations: Key practices

The abbreviations used for the key practice component of the CMM reference text are listed in the table below.

CMM Common Features (key practice type)	Abbreviation
Goal (not a common feature, but added as an SPF abbreviation)	G
Commitment to perform	C
Ability to perform	Ab
Activity performed	A
Measurement and analysis	M
Verifying implementation	V

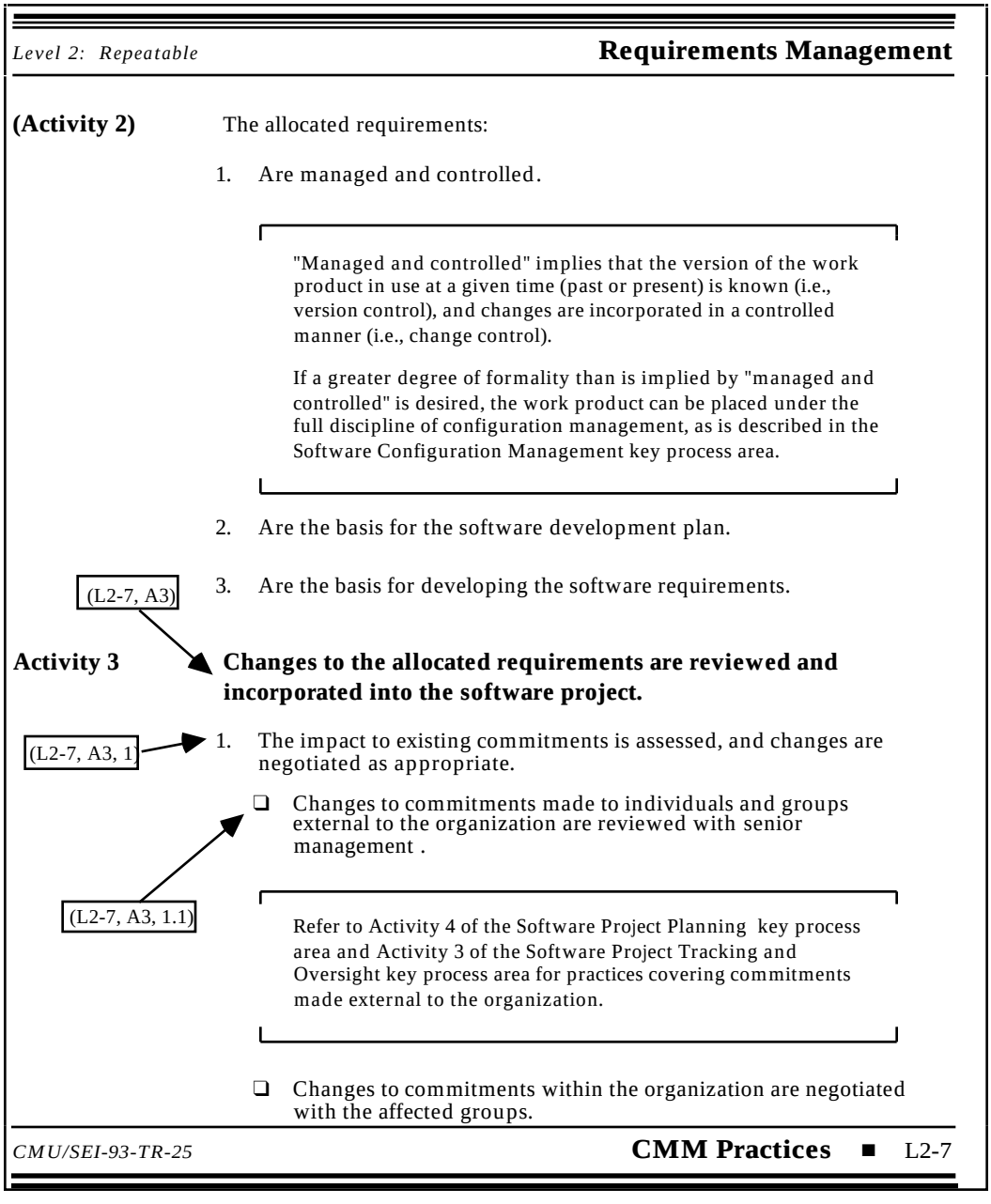
Note: These abbreviations are always followed by a number denoting the number associated with the key practice.

Example: Activity 3 of Requirements Management is found on page L2-7, so the CMM Reference text would be (L2-7, A3).

Continued on next page

Example: CMM page with SPF references

The following diagram shows a page from the CMM. Examples of CMM reference text are shown as boxed examples.



CMM Role Identification

Introduction

The CMM identifies many roles. This section describes how the SPF highlights the roles found in the CMM. This feature should help you use the SPF to determine the responsibilities of each role defined in the CMM.

Definition: Types of roles

The SPF defines roles as *active* or *passive* depending on the context given in the CMM. The following table provides the basis for defining a particular appearance of a role as active or passive.

IF the occurrence...	THEN the role is...	Example
refers to an activity the role participate in	Active	The **software quality assurance group** reviews and/or audits the...
indicates the existence of a role	Passive	A group that is responsible for coordinating and implementing ... exists.
is modifying a work product	Passive	Subcontractor's plans.

Identification: Active roles

The SPF uses **bold** typeface to indicate the occurrence of an active role.

Note: In the roles checklist, only the role being described is presented in bold typeface.

Identification: Passive roles

The SPF uses normal typeface for occurrences of passive roles.

Example

The following example illustrates the use of bold typeface in the SPF.

Example: The organization's activities for defect prevention are reviewed with **senior management** on a periodic basis. (L5-14, V1)

Entry and Exit Criteria

Definitions

Entry criteria are the conditions under which an activity can be started. Entry criteria often take the form of a simple or compound predicate about the state of a work product, role, or activity.

Example:

Input	State
Allocated requirements	are documented. (L2-3, C1, 1)

Exit criteria are the conditions under which an activity can be declared complete. Exit criteria often take the form of a simple or compound predicate about the state of an artifact, role, or activity.

Example:

Output	State
Project's software development plan	includes defect prevention activities. (L5-3, C2, 1)

Note

Many of the key process areas, once started, end when the project (or organization!) ends. For these processes, one way to evaluate whether exit criteria are being met by the process description is to answer the following question:

If the process was executed as described, would it result in the exit criteria being satisfied?

Types of criteria

Entry and exit criteria have each been partitioned into two types — input and output based and general. The major determinant for the type of criteria is *state* information. State refers to the status of a work product when entering (entry state) or exiting (exit state) a process.

Continued on next page

Entry and Exit Criteria, Continued

Description: Entry criteria

We used the following rule to determine whether entry criteria were input based or general.

Note: The examples are taken from the requirements management key process area.

IF the criteria contain state information about an...	THEN they are...	Example
input	input-based entry criteria	Input: Allocated requirements State: are documented.
activity or role	general entry criteria	The project follows a written organizational policy for managing the system requirements allocated to software.

Description: Exit criteria

We used the following rule to determine whether exit criteria were output-based or general.

Note: The examples are taken from the requirements management key process area.

IF the criteria contain state information about an...	THEN they are...	Example
input	general exit criteria	The allocated requirements are reviewed, and problems are resolved before the **software engineering group** commits to them.
output	output-based exit criteria	Output: Commitments resulting from the allocated requirements State: are negotiated with the **affected groups**.
activity or role	general exit criteria	The activities for managing the allocated requirements are reviewed with **senior management** on a periodic basis.

Translation Tables

Purpose

The purpose of the translation tables is to provide an organization with a tool to translate CMM terminology into their own terminology.

Rationale

Making the translation assumptions explicit has proven to be beneficial in practice. Experience has shown that there is rarely a one-to-one mapping of terminology, and there are usually "gray" areas that should be documented. There can also be different terminology within the same organization (e.g., projects or divisions within the same organization may use different terminology).

In this section

This section describes three types of translation tables.

Translation table	Page
Role translation table	Features-12
General term translation table	Features-13
Work product translation table	Features-14

Role translation table

Introduction In order to be widely applicable, the CMM uses roles that are not specific to one organizational structure. The role translation table provides the ability to map generic CMM roles to the roles found in your organization.

Location The role translation tables are located in Appendix C of the SPF.

When to use The role translation table is typically used first in any activity involving the SPF.

Use To use the role translation table, simply read the CMM role from the left column of the table and list the equivalent role(s) from your organization in the right column.

Guidance Completing the role translation table may be an iterative activity. For example, if you are addressing only one KPA, then you should only complete the table for the roles identified in that KPA.

Note: The roles checklist included in each KPA section of the SPF indicates the roles involved in a particular KPA.

Example The following table provides an excerpted example of a role translation table.

CMM Role	Your Organization's Role(s)
Affected groups or other affected groups	*SQA* *SCM* *Marketing* *Sales* *Technical staff* *Testing department* *And so on...*
Project manager	*Project leader*
Project software manager	*Project leader*
Senior management	*Senior management steering committee*
Software engineering process group	*SEPG*
Senior manager	*CEO*
Software engineering staff	*Technical staff*

General Term Translation Table

Introduction

Since the CMM is broadly applicable, it is unavoidable that some terms will need to be further defined for each organization. The general term translation tables are a tool for translating general terms used by the CMM into organization–specific terminology.

Location

The general term translation tables are located in Appendix D of the SPF.

When to use

The general term translation table is used early in any activity involving the SPF, typically after performing role translations.

Use

To use the general term translation table, simply read the CMM general term from the left column of the table and list the equivalent term from your organization in the right column.

Example

The following table provides an excerpted example of a general term translation table.

CMM General Terms	Your Organization's Terms
Product	*Deliverable*
Project	*Project*
Software product	*CSCI/CSCU*
Software project	*Software task*
System	*Product*

Work Product Translation Table

Purpose

The work product translation tables provide the ability to translate CMM names for work products into your organization's terminology.

Note

There are two types of work product translation tables. They are:

- input translation tables, and
- output translation tables.

Location

The work product translation tables are embedded as part of the input and output checklists for each key process area.

When to use

Work product translation tables should be completed when the process inputs and outputs are being addressed.

Use

Use the following procedure for completing the work product translation tables.

Step	Action
1	Read the CMM work product from the input or output column of the checklist, and list the equivalent organization work product(s) in the "Org. Input" (for inputs) or "Org. Output" (for outputs) column in the checklist.
2	Place a reference to the organization's process documentation for that work product in the references column of the SPF.
3	Repeat steps 1 and 2 for the rest of the table.

Example

The following table provides an excerpted example of an input translation table from the requirements management process translating CMM inputs into a fictitious organization's inputs. Output translations would result in similar results.

√	Input	Org. Input	References
✔	Statement of Work. (L2-14, Ab1) [Refer to Level 2 Standards for additional information regarding a statement of work.]	*SOW*	*DID 1000.5*
✔	Allocated requirements. (L2-18, A6, 1.4) [Refer to Level 2 Standards for additional information regarding allocated requirements.]	*SRS* *IRS*	*DID 1000.6*

User References

Introduction

In addition to tracing process documentation back to the CMM, it is also important for organizations to trace from the SPF to their process documentation. This section describes the feature that provides this capability.

Expected use

User references are used to:

- Identify the location of the organizational process documentation that addresses a process element in the SPF.
- Indicate the suggested location of the organizational process documentation that should address a process element in the SPF that is not currently being addressed by the organization.
- Provide traceability from organizational process documentation to the SPF, and therefore, to the CMM.

Continued on next page

Example

Consider the following scenario:

A user is reviewing an organizational document against the SPF and wants traceability (from the SPF to the organizational document). The user places a reference to the organizational document in the "References" column (e.g., chapter, section, page, paragraph) of the SPF. Abbreviations are used since blank space is limited, and there are numerous reference boxes to fill in.

In the example below, "V1" is an abbreviation for "Volume 1"; "V2" is an abbreviation for "Volume 2"; and "S" is an abbreviation for "Section." In this example, the numbers allow traceability to the exact page and subsection of the hypothetical organizational document.

SCM Process - Exit Criteria, Continued

Output-based Exit Criteria, continued

The table below describes the states that outputs must satisfy to exit the software configuration management process, continued from the previous page.

↓	Output	State	References
	SCM plan	☑ development is coordinated or implemented by the **SCM group**. (L2-75, Ab2, 2)	*V1 S2.3.6*
		☑ distribution is coordinated or implemented by the **SCM group**. (L2-75, Ab2, 2)	*V1 S2.3.6*
		❑ maintenance is coordinated or implemented by the **SCM group**. (L2-75, Ab2, 2)	*V1 S2.3.6*
		☑ is prepared for each software project according to a documented procedure. (L2-76, A1)	*V2 S1.1*
		☑ is developed in the early stages of, and in parallel with, overall project planning. (L2-76, A1, 1)	*V2 S1.2*
		☑ is reviewed by the **affected groups**. (L2-77, A1, 2)	*V2 S1.3*
		☑ is managed and controlled. (L2-77, A1, 3)	*V2 S1.4*
		❑ is documented. (L2-77, A2)	*V2 S1.5*
		❑ is approved. (L2-77, A2)	*V2 S1.6*
		❑ is used as the basis for performing the SCM activities. (L2-77, A2)	*V2 S1.7*

Continued on next page

References to unchecked items

Notice that there can be references to items in the checklist that are not checked. These references can be used as pointers to areas of the organizational document that can be improved.

Example: The previous checklist contains several items that are not satisfied. The references serve as pointers to the location in the organizational process documentation where improvements might be made in the future.

Chapter 3. How to Use the Software Process Framework

Overview

Chapter purpose	The purpose of this chapter is to provide guidance on how to use the Software Process Framework (SPF).
Before you begin	Before reading this section, you will want to become familiar with the features of the SPF. Please refer to Chapter 2, Features of the SPF, for further information.
Assumptions	The audience using the SPF is expected to be experienced in software process definition and improvement and familiar with the concepts and terminology of the CMM (e.g., software engineering process groups, process engineers, process action teams, software quality assurance groups, etc).
Evolution of this chapter	This chapter contains guidance for using the SPF to analyze and review software processes. Additional data are currently being collected and future versions of this document will provide additional guidance.

Using the SPF to Analyze and Review Software Processes

Introduction

Many organizations develop baselines of their current software processes. After the baseline is developed, it is useful to be able to analyze it for consistency with the CMM.

This section provides guidance for analyzing and reviewing existing process documentation for consistency with the CMM.

Before you begin

Before you begin this procedure, you should identify the scope of the process document you are analyzing or reviewing. For example, the scope of your document could be:

- an entire process document,
- organizational policies,
- organization standards,
- the software project planning KPA, or
- the recommended training for level 4.

Suggestion

It is helpful to make photocopies of the appropriate material from the SPF prior to beginning this procedure (i.e., keep a good master!). For example, if you were reviewing organizational policies against those recommended at level 2, then you would make copies of the SPF level 2 policy checklists.

What you need

To complete this procedure, you will need:

- Role translation tables.
- General term translation tables.
- The appropriate checklists from the SPF, depending on the scope selected.
- Work product translation tables (optional).
- The process documentation to be analyzed or reviewed.

Continued on next page

Procedure Use this procedure to analyze and review process documentation.

Step	Action
1	Use the role translation table to translate CMM roles into your organization's roles. (See "Role Translation Table" in chapter 2 and Appendix C for blank tables.)
2	Use the general term translation table to translate CMM general terms into organizational terminology. (See "General Term Translation Tables" in chapter 2 and Appendix D for templates.)
3	Use the work product translation tables to translate the CMM work products into organizational work products. (See "Work Product Translation Tables" in chapter 2 and the input and output checklists in the appropriate KPA section of the SPF)
4	Select an item from the SPF checklist that has not been analyzed or reviewed. **IF:** the item is *satisfied* (i.e., your organization's process description addresses the item being considered) **THEN:** check the checkbox next to the item. (See chapter 2 for guidance on completing the checklists) record the reference to the organizational process document **IF:** the item is *not satisfied* (i.e., your organization's process description does not address the item being considered) **THEN:** do not check the checkbox next to the item. record the reference of where in the process document the item probably should be addressed, if possible. (This is helpful for improving the document or process being evaluated.) **IF:** the item *does not apply to your organization* (e.g., if your organization doesn't subcontract out software, then items related to software subcontractors probably do not apply to your organization) **THEN:** mark N/A in the checkbox next to item. if possible, record the rationale (or pointer to the rationale) in the user reference column.
5	**IF:** there are more items in the SPF checklist to analyze or review **THEN:** go to step 4. **ELSE:** the analysis or review is complete.

Continued on next page

Results

When the analysis or review is completed, you will have:

- Completed checklists of the CMM recommendations that are satisfied and unsatisfied.
- A list of CMM recommendations that do not apply to your organization, with (if recorded) rationale of why they do not.

Next steps

If all CMM criteria are satisfied, then the process document is consistent with the CMM.

Caution: Do not interpret this as implying a particular maturity rating. The SPF is a measure of consistency of process documentation. Other factors such as actual practice are not measured by the SPF.

CMM recommendations that are not satisfied, and have no rationale for why they are not, become a starting point for process improvement efforts.

Chapter 4. Repeatable Level (Level 2)

Overview

Introduction This chapter contains the checklists for level 2 of the CMM.

In this chapter This chapter contains the following sections:

Section Title	Page
Level 2 Policy Checklists	L2-Policy-1
Level 2 Standards Checklists	L2-Standards-1
Level 2 Process Checklists	L2-Process-1
Level 2 Procedure Checklists	L2-Procedures-1
Level 2 Summary	L2-Summary-1

Level 2 Policy Checklists

Overview

Introduction

This section describes the explicit policies found in the Capability Maturity Model at maturity level 2.

Purpose

The purpose of the policy checklists is to provide:

- Guidance in identifying which policies are recommended by the CMM at level 2.
- Criteria that an organization can use to evaluate its software policies to determine if they are consistent with the CMM at level 2.
- Information that can be used to develop software policies so that they are consistent with the CMM at level 2.

Checklist description

Each checklist contains two subsections: the KPA policies and the KPA goals. The table below describes these two subsections of a policy checklist.

Subsection	Description
Policy checklist	This subsection contains criteria that the organizational policy can be evaluated against. These criteria must be addressed by organizational policy to be consistent with the CMM.
Policy goals	This subsection is a reminder to policy designers and evaluators to keep in mind the KPA goals when developing the policies for each KPA. The goals can be thought of as the results of implementing an effective policy.

In this section

This section covers the following policies:

Policies	See Page
Requirements management policy	L2-Policy-2
Software project planning policy	L2-Policy-3
Software project tracking and oversight policy	L2-Policy-4
Software subcontract management policy	L2-Policy-5
Software quality assurance policy	L2-Policy-6
Software configuration management policy	L2-Policy-7

Requirements Management (RM) Policy

RM policy checklist

The project follows a written organizational policy for managing the system requirements allocated to software (L2-2, C1). This policy typically specifies that:

√	Description	References
	The allocated requirements are documented. (L2-3, C1, 1)	
	The allocated requirements are reviewed by: (L2-3, C1, 2) ❑ the **software managers**, and ❑ other **affected groups**.	
	The software plans, work products, and activities are changed to be consistent with changes to the allocated requirements. (L2-3, C1, 3)	

RM policy goals

Implementation of an effective requirements management policy has the following results:

√	Results of Effectively Implementing RM Policy	References
	System requirements allocated to software are controlled to establish a baseline for software engineering and management use. (L2-2, G1)	
	Software plans, products, and activities are kept consistent with the system requirements allocated to software. (L2-2, G2)	

Software Project Planning (SPP) Policy

SPP policy checklist

The project follows a written organizational policy for planning a software project (L2-12, C2). This policy typically specifies that:

√	Description	References
	The system requirements allocated to software are used as the basis for planning the software project. (L2-12, C2, 1)	
	The software project's commitments are negotiated between: (L2-12, C2, 2) ❑ the **project manager**, ❑ the **project software manager**, and ❑ the other **software managers**.	
	Involvement of other **engineering groups** in the software activities is negotiated with these groups and is documented. (L2-13, C2, 3)	
	Affected groups review the project's: (L2-13, C2, 4) ❑ software size estimates, ❑ effort and cost estimates, ❑ schedules, and ❑ other commitments.	
	Senior management reviews all software project commitments made to individuals and groups external to the organization. (L2-13, C2, 5)	
	The project's software development plan is managed and controlled. (L2-13, C2, 6)	

SPP policy goals

Implementation of an effective software project planning policy has the following results:

√	Results of Effectively Implementing SPP Policy	References
	Software estimates are documented for use in planning and tracking the software project. (L2-12, G1)	
	Software project activities and commitments are planned and documented. (L2-12, G2)	
	Affected groups and individuals agree to their commitments related to the software project. (L2-12, G3)	

Software Project Tracking and Oversight (SPTO) Policy

SPTO policy checklist

The project follows a written organizational policy for managing the software project (L2-30, C2). This policy typically specifies that:

√	Description	References
	A documented software development plan is used and maintained as the basis for tracking the software project. (L2-30, C2, 1)	
	The **project manager** is kept informed of the software project's status and issues. (L2-30, C2, 2)	
	Corrective actions are taken when the software plan is not being achieved, either by adjusting performance or by adjusting the plans. (L2-30, C2, 3)	
	Changes to the software commitments are made with the involvement and agreement of the **affected groups**. (L2-30, C2, 4)	
	Senior management reviews all commitment changes and new software project commitments made to individuals and groups external to the organization. (L2-31, C2, 5)	

SPTO policy goals

Implementation of an effective software project tracking and oversight policy has the following results:

√	Results of Effectively Implementing SPTO Policy	References
	Actual results and performances are tracked against the software plans. (L2-30, G1)	
	Corrective actions are taken and managed to closure when actual results and performance deviate significantly from the software plans. (L2-30, G2)	
	Changes to software commitments are agreed to by the affected groups and individuals. (L2-30, G3)	

Software Subcontract Management (SSM) Policy

SSM policy checklist

The project follows a written organizational policy for managing the software subcontract (L2-44, C1). This policy typically specifies that:

√	Description	References
	Documented standards and procedures are used in selecting software subcontractors and managing the software subcontracts. (L2-45, C1, 1)	
	The contractual agreements form the basis for managing the subcontract. (L2-45, C1, 2)	
	Changes to the subcontract are made with the involvement and agreement of both the **prime contractor** and the **subcontractor**. (L2-45, C1, 3)	

SSM policy goals

Implementation of an effective software subcontract management policy has the following results:

√	Results of Effectively Implementing SSM Policy	References
	The prime contractor selects qualified software subcontractors. (L2-44, G1)	
	The prime contractor and the software subcontractor agree to their commitments to each other. (L2-44, G2)	
	The prime contractor and the software subcontractor maintain ongoing communications. (L2-44, G3)	
	The prime contractor tracks the software subcontractor's actual results and performance against its commitments. (L2-44, G4)	

Software Quality Assurance (SQA) Policy

SQA policy checklist

The project follows a written organizational policy for implementing software quality assurance (L2-60, C1). This policy typically specifies that:

√	Description	References
	The SQA function is in place on all software projects. (L2-60, C1, 1)	
	The **SQA group** has a reporting channel to senior management that is independent of: (L2-61, C1, 2) ❑ the project manager, ❑ the project's software engineering group, and ❑ other software-related groups.	
	Senior management periodically reviews the SQA activities and results. (L2-61, C1, 3)	

SQA policy goals

Implementation of an effective software quality assurance policy has the following results:

√	Results of Effectively Implementing SQA Policy	References
	Software quality assurance activities are planned. (L2-60, G1)	
	Adherence of software products and activities to applicable standards, procedures, and requirements is verified objectively. (L2-60, G2)	
	Affected groups and individuals are informed of software quality assurance activities and results. (L2-60, G3)	
	Noncompliance issues that cannot be resolved within the software project are addressed by **senior management**. (L2-60, G4)	

Software Configuration Management (SCM) Policy

SCM policy checklist

The project follows a written organizational policy for implementing software configuration management (L2-72, C1). This policy typically specifies that:

√	Description	References
	Responsibility for SCM for each project is explicitly assigned. (L2-72, C1, 1)	
	SCM is implemented throughout the project's life cycle. (L2-72, C1, 2)	
	SCM is implemented for externally deliverable software products, designated internal software work products, and designated support tools used inside the project (e.g., compilers). (L2-72, C1, 3)	
	The projects establish or have access to a repository for storing configuration items/units and the associated SCM records. (L2-72, C1, 4)	
	The software baselines and SCM activities are audited on a periodic basis. (L2-73, C1, 5)	

SCM policy goals

Implementation of an effective software configuration management policy has the following results:

√	Results of Effectively Implementing SCM Policy	References
	Software configuration management activities are planned. (L2-72, G1)	
	Selected software work products are identified, controlled, and available. (L2-72, G2)	
	Changes to identified software work products are controlled. (L2-72, G3)	
	Affected groups and individuals are informed of the status and content of software baselines. (L2-72, G4)	

Level 2 Standards Checklists

Overview

Introduction

This section describes the recommended content of selected work products in the CMM at maturity level 2.

Definition

A *standard checklist* describes the content of a work product as recommended by the CMM.

Purpose

The purpose of the standards checklists is to provide:

- Guidance in identifying the contents of standard work products that are recommended by the CMM at level 2.
- Criteria that an organization can use to evaluate its software standards to determine if they are consistent with the CMM at level 2.
- Information that can be used to develop software standards that are consistent with the CMM at level 2.

What the standards checklists are not

The standards checklists contain only what is recommended by the CMM, and *are not complete standards in themselves.* For example, the standard for the software development plan (SDP) contains only content recommended by the CMM. Other sources for the content of a SDP should also be considered, such as ANSI/IEEE Std 1058.1-1987, DOD-STD-2167, DI-MCCR-80030, etc.

In this section

This section covers the following standards:

Standard	KPA	See Page
Allocated requirements	RM	L2-Standards-2
Statement of work	SPP	L2-Standards-3
Software development plan	SPP	L2-Standards-4
Contractual agreement	SSM	L2-Standards-5
Software quality assurance plan	SQA	L2-Standards-6
Software configuration management plan	SCM	L2-Standards-7

Note: There are no recommended standards for the software project tracking and oversight kpa.

Allocated Requirements

Standard checklist

The following table contains what the CMM describes as the recommended content of allocated requirements:

√	Recommended Content
	Nontechnical requirements (i.e., the agreements, conditions, and/or contractual terms) that affect and determine the activities of the software project. (L2-4, Ab2, 1)
	Technical requirements for the software. (L2-4, Ab2, 2)
	Acceptance criteria that will be used to validate that the software products satisfy the allocated requirements. (L2-4, Ab2, 3)

Statement of Work

Standard checklist

The following table contains what the CMM describes as the recommended content of the statement of work:

√	Recommended Content
	Scope of the work. (L2-14, Ab1, 1.1)
	Technical goals and objectives. (L2-14, Ab1, 1.2)
	Identification of customers and end users. (L2-14, Ab1, 1.3)
	Imposed standards. (L2-14, Ab1, 1.4)
	Assigned responsibilities. (L2-14, Ab1, 1.5)
	Cost and schedule constraints and goals. (L2-15, Ab1, 1.6)
	Dependencies between the software project and other organizations. (L2-15, Ab1, 1.7)
	Resource constraints and goals. (L2-15, Ab1, 1.8)
	Other constraints and goals for development and/or maintenance. (L2-15, Ab1, 1.9)

Software Development Plan

Standard checklist

The following table contains what the CMM describes as the recommended content of the software development plan:

√	Recommended Content
	Software project's purpose, scope, goals, and objectives. (L2-19, A7, 1)
	Selection of a software life cycle. (L2-19, A7, 2)
	Identification of the selected procedures, methods, and standards for developing and/or maintaining the software. (L2-20, A7, 3)
	Identification of software work products to be developed. (L2-20, A7, 4)
	Size estimates of the software work products and any changes to the software work products. (L2-20, A7, 5)
	Estimates of the software project's effort and costs. (L2-20, A7, 6)
	Estimated use of critical computer resources. (L2-20, A7, 7)
	Software project schedules, including identification of milestones and reviews. (L2-20, A7, 8)
	Identification and assessment of the project's software risks. (L2-20, A7, 9)
	Plans for the project's software engineering facilities and support tools. (L2-20, A7, 10)

Contractual Agreement

Standard checklist

The following table contains what the CMM describes as the recommended content of the contractual agreement between the prime contractor and the software subcontractor:

√	Recommended Content
	Terms and conditions. (L2-50, A3, 1)
	Statement of work. (L2-50, A3, 2)
	Requirements for the products to be developed. (L2-50, A3, 3)
	List of dependencies between the subcontractor and the prime contractor. (L2-50, A3, 4)
	Subcontracted products to be delivered to the prime contractor. (L2-50, A3, 5)
	Conditions under which revisions to products are to be submitted. (L2-50, A3, 6)
	Acceptance procedures and acceptance criteria to be used in evaluating the subcontracted products before they are accepted by the prime contractor. (L2-50, A3, 7)
	Procedures and evaluation criteria to be used by the prime contractor to monitor and evaluate the subcontractor's performance. (L2-51, A3, 8)

Software Quality Assurance Plan

Standard checklist

The following table contains what the CMM describes as the recommended content of the software quality assurance plan:

√	Recommended Content
	Responsibilities and authority of the SQA group. (L2-64, A2, 1)
	Resource requirements for the SQA group (including staff, tools, and facilities). (L2-64, A2, 2)
	Schedule and funding of the project's SQA group activities. (L2-64, A2, 3)
	The SQA group's participation in establishing the software development plan, standards, and procedures for the project. (L2-65, A2, 4)
	Evaluations to be performed by the SQA group. (L2-65, A2, 5)
	Audits and reviews to be conducted by the SQA group. (L2-65, A2, 6)
	Project standards and procedures used as the basis for the SQA group's reviews and audits. (L2-65, A2, 7)
	Procedures for documenting and tracking noncompliance issues to closure. (L2-65, A2, 8)
	Documentation that the SQA group is required to produce. (L2-65, A2, 9)
	Method and frequency of providing feedback to the software engineering group and other software-related groups on SQA activities. (L2-65, A2, 10)

Software Configuration Management Plan

Standard checklist

The following table contains what the CMM describes as the recommended content of the software configuration management plan:

√	Recommended Content
	SCM activities to be performed, the schedule of activities, the assigned responsibilities, and the resources required (including staff, tools, and computer facilities). (L2-77, A2, 1)
	SCM requirements and activities to be performed by the **software engineering group** and other **software-related groups**. (L2-77, A2, 2)

Level 2 Process Checklists

Overview

Section purpose

The purpose of the process checklists is to provide:

- Guidance in identifying which processes are required by the CMM at level 2.
- Criteria that an organization can use to evaluate its software processes to determine if they are consistent with the CMM at level 2.
- Information that can be used to develop software processes that are consistent with the CMM at level 2.

In this section

This section contains checklists for the following key process areas:

Key Process Area	See Page
Requirements Management	L2-Process-3
Software Project Planning	L2-Process-23
Software Project Tracking & Oversight	L2-Process-59
Software Subcontract Management	L2-Process-97
Software Quality Assurance	L2-Process-129
Software Configuration Management	L2-Process-155

Requirements Management (RM) Process

RM Process - Overview

RM process purpose

The purpose of Requirements Management is to establish a common understanding between the customer and the software project of the customer's requirements that will be addressed by the software project. (L2-1)

RM process description

Requirements Management involves establishing and maintaining an agreement with the customer on the requirements for the software project. This agreement is referred to as the "system requirements allocated to the software." The "customer" may be interpreted as the system engineering group, the marketing group, another internal organization, or an external customer. The agreement covers both the technical and nontechnical (e.g., delivery dates) requirements. The agreement forms the basis for estimating, planning, performing, and tracking the software project's activities throughout the software life cycle.

The allocation of the system requirements to software, hardware, and other system components (e.g., humans) may be performed by a group external to the software engineering group (e.g., the system engineering group), and the software engineering group may have no direct control of this allocation. Within the constraints of the project, the software engineering group takes appropriate steps to ensure that the system requirements allocated to software, which they are responsible for addressing, are documented and controlled.

To achieve this control, the software engineering group reviews the initial and revised system requirements allocated to software to resolve issues before they are incorporated into the software project. Whenever the system requirements allocated to software are changed, the affected software plans, work products, and activities are adjusted to remain consistent with the updated requirements. (L2-1)

Continued on next page

Section overview

The table below contains a description and the location of each checklist for this key process area.

Checklist	Description	Page
Roles	List of roles participating in process activities.	L2-Process-5
Entry Criteria	Description of when the process can start.	L2-Process-8
Inputs	Description of the work products used by the process.	L2-Process-9
Activities	Description of the activities of the process.	L2-Process-10
Outputs	Description of the work products produced by the process.	L2-Process-12
Exit Criteria	Description of when the process is complete.	L2-Process-13
Reviews and Audits	List of reviews and audits.	L2-Process-16
Work Products Managed and Controlled	List of work products to be managed and controlled.	L2-Process-18
Measurements	Description of process measurements.	L2-Process-19
Documented Procedures	List of the activities to be completed according to a documented procedure.	L2-Process-20
Training	List of training.	L2-Process-21
Tools	List of tools.	L2-Process-22

RM Process - Roles

Roles

The table below lists the roles and the activities in which they participate in the requirements management process.

√	Role	Activities Participated in...	Reference
	Affected groups	❑ The allocated requirements are reviewed by: (L2-3, C1, 2) ❑ the **software managers**, and ❑ other **affected groups**. ❑ Commitments resulting from the allocated requirements are negotiated with the **affected groups**. (L2-6, A1, 4) ❑ Changes to commitments within the organization are negotiated with the **affected groups**. (L2-7, A3, 1.2) ❑ Changes that need to be made to the software plans, work products, and activities resulting from changes to the allocated requirements are: (L2-8, A3, 2) ❑ identified, ❑ evaluated, ❑ assessed for risk, ❑ documented, ❑ planned, ❑ communicated to the **affected groups and individuals**, and ❑ tracked to completion. ❑ Changes to commitments resulting from changes to the allocated requirements are negotiated with the **affected groups**. (L2-10, V3, 3)	

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RM Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the requirements management process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	(Affected) individuals	❑ **Individuals** who have experience and expertise in the application domain and in software engineering are assigned to manage the allocated requirements. (L2-5, Ab3, 1) ❑ Changes that need to be made to the software plans, work products, and activities resulting from changes to the allocated requirements are: (L2-8, A3, 2) ❑ identified, ❑ evaluated, ❑ assessed for risk, ❑ documented, ❑ planned, ❑ communicated to the **affected** groups and **individuals**, and ❑ tracked to completion.	
	Group responsible for analyzing and allocating system requirements	Any allocated requirements identified as having potential problems are reviewed with the **group responsible for analyzing and allocating system requirements**, and necessary changes are made. (L2-6, A1, 3)	
	Individuals and groups external to the organization	Changes to commitments made to **individuals and groups external to the organization** are reviewed with senior management. (L2-7, A3, 1.1)	
	Project manager	The activities for managing the allocated requirements are reviewed with the **project manager** on both a periodic and event-driven basis. (L2-9, V2)	

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RM Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the requirements management process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Senior management	❑ Changes to commitments made to **individuals and groups external to the organization** are reviewed with **senior management**. (L2-7, A3, 1.1) ❑ The activities for managing the allocated requirements are reviewed with **senior management** on a periodic basis. (L2-9, V1)	
	Software engineering group	❑ Members of the **software engineering group** and other **software-related groups** are trained to perform their requirements management activities. (L2-5, Ab4) ❑ The **software engineering group** reviews the allocated requirements before they are incorporated into the software project. (L2-5, A1) ❑ The **software engineering group** uses the allocated requirements as the basis for software plans, work products, and activities. (L2-6, A2) ❑ The allocated requirements are reviewed, and problems are resolved before the **software engineering group** commits to them. (L2-10, V3, 1)	
	Software manager	The allocated requirements are reviewed by: (L2-3, C1, 2) ❑ the **software managers**, and ❑ other affected groups.	
	Software-related groups	Members of the software engineering group and other **software-related groups** are trained to perform their requirements management activities. (L2-5, Ab4)	
	SQA group	The **software quality assurance group** reviews and/or audits the activities and work products for managing the allocated requirements and reports results. (L2-9, V3)	

RM Process - Entry Criteria

Input-based entry criteria

The CMM recommends that inputs satisfy the states described in the table below before entering the requirements management process.

√	Input	State	References
	Allocated requirements	are documented. (L2-3, C1, 1)	

General entry criteria

The CMM recommends that the conditions described in the table below be satisfied before entering the requirements management process.

√	Condition	References
	The project follows a written organizational policy for managing the system requirements allocated to software. (L2-2, C1) [Refer to Level 2 Policies for additional information regarding RM policy.]	
	For each project, responsibility is established for analyzing the system requirements and allocating them to hardware, software, and other system components. (L2-3, Ab1) This responsibility covers: ❑ Managing and documenting the system requirements and their allocation throughout the project's life. ❑ Effecting changes to the system requirements and their allocation.	
	Adequate resources and funding are provided for managing the allocated requirements. (L2-5, Ab3)	
	Individuals who have experience and expertise in the application domain and in software engineering are assigned to manage the allocated requirements. (L2-5, Ab3, 1)	
	Tools to support the activities for managing requirements are made available. (L2-5, Ab3, 2)	
	Members of the **software engineering group** and other **software-related groups** are trained to perform their requirements management activities. (L2-5, Ab4)	

RM Process - Inputs

Inputs

The table below lists the recommended inputs to the requirements management process.

√	Input	Org. Input	References
	Allocated requirements. (L2-2, C1) [Refer to Level 2 Standards for additional information regarding allocated requirements.]		
	Changes to the allocated requirements. (L2-4, Ab1, 2)		
	Changes to the system requirements. (L2-4, Ab1, 2)		
	Existing commitments. (L2-7, A3, 1)		
	Software activities. (L2-3, C1, 3)		
	Software plans. (L2-3, C1, 3)		
	Software work products. (L2-3, C1, 3)		
	System requirements. (L2-3, Ab1)		

RM Process - Activities

Activities

The table below lists the recommended activities for the requirements management process.

√	Activities	References
	The **software engineering group** reviews allocated requirements before they are incorporated into the software project. (L2-5, A1) [Refer to RM Process Reviews and Audits for additional information.]	
	Commitments resulting from the allocated requirements are negotiated with the **affected groups**. (L2-6, A1,4)	
	The **software engineering group** uses the allocated requirements as the basis for software plans, work products, and activities. (L2-6, A2)	
	Changes to the allocated requirements are reviewed and incorporated into the software project. (L2-7, A3) ❑ The impact to existing commitments is assessed and changes are negotiated as appropriate. ❑ Changes to commitments made to **individuals and groups external to the organization** are reviewed with **senior management**. ❑ Changes to commitments within the organization are negotiated with the **affected groups**. ❑ Changes that need to be made to the software plans, work products, and activities resulting from changes to the allocated requirements are: ❑ identified, ❑ evaluated, ❑ assessed for risk, ❑ documented, ❑ planned, ❑ communicated to the **affected groups and individuals**, and ❑ tracked to completion.	
	Measurements are made and used to determine the status of the activities for managing the allocated requirements. (L2-8, M1)	
	The activities for managing requirements are reviewed with **senior management** on a periodic basis. (L2-9, V1)	

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RM Process - Activities, Continued

Activities, continued

The table below lists the recommended activities for the requirements management process, continued from the previous page.

√	Activities	References
	The activities for managing the allocated requirements are reviewed with the **project manager** on both a periodic and event-driven basis. (L2-9, V2)	
	The **software quality assurance group** reviews and/or audits the activities and work products for managing the allocated requirements and reports the results. (L2-9, V3) [Refer to RM Process Reviews and Audits for additional information.]	

RM Process - Outputs

Outputs

The table below lists the recommended outputs produced by the requirements management process.

√	Output	Org. Output	References
	Allocated requirements. (L2-5, A1)		
	Changes that need to be made to the software plans, work products, and activities resulting from changes to the allocated requirements. (L2-8, A3, 2)		
	Changes to allocated requirements. (L2-7, A3)		
	Changes to commitments made to **individuals and groups external to the organization**. (L2-7, A3, 1.1)		
	Changes to commitments within the organization. (L2-7, A3, 1.2)		
	Commitments resulting from the allocated requirements. (L2-6, A1, 4)		
	Impact to existing commitments. (L2-7, A3, 1)		
	Measurements. (L2-8, M1)		
	Software activities. (L2-10, V3, 2)		
	Software plans. (L2-10, V3, 2)		
	Software requirements. (L2-7, A2, 3)		
	Software work products. (L2-10, V3, 2)		

RM Process - Exit Criteria

Output-based exit criteria

The CMM recommends that outputs satisfy the states described in the table below to exit the requirements management process.

√	Output	State	References

	Allocated requirements	❑ are documented. (L2-3, C1, 1)
		❑ are reviewed by: (L2-3, C1, 2)
		  ❑ the **software managers**, and
		  ❑ other **affected groups**.
		❑ (that are incomplete and missing) are identified. (L2-5, A1, 1)
		❑ are reviewed to determine whether they are: (L2-6, A1, 2)
		  ❑ feasible and appropriate to implement in software,
		  ❑ clearly and properly stated,
		  ❑ consistent with each other, and
		  ❑ testable.
		❑ identified as having potential problems are reviewed with the **group responsible for analyzing and allocating system requirements**, and necessary changes are made. (L2-6, A1, 3)
		❑ are managed and controlled. (L2-7, A2, 1)
		❑ are the basis for the software development plan. (L2-7, A2, 2)
		❑ are the basis for developing the software requirements. (L2-7, A2, 3)
		❑ are reviewed, and problems are resolved before the **software engineering group** commits to them. (L2-10, V3, 1)	

	Changes to allocated requirements	❑ are reviewed. (L2-7, A3) ❑ are incorporated into the software project. (L2-7, A3)	

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RM Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the requirements management process, continued from the previous page.

√	Output	State	References
	Changes to commitments resulting from changes to the allocated requirements	are negotiated with the **affected groups**. (L2-10, V3, 3)	
	Changes to commitments made to **individuals** and **groups external to the organization**	are reviewed with **senior management**. (L2-7, A3, 1.1)	
	Changes to commitments within the organization	are negotiated with the **affected groups**. (L2-7, A3, 1.2)	
	Changes that need to be made to the software plans, work products, and activities resulting from changes to the allocated requirements	are: (L2-8, A3, 2) ❑ identified, ❑ evaluated, ❑ assessed for risk, ❑ documented, ❑ planned, ❑ communicated to the **affected groups** and **individuals**, and ❑ tracked to completion.	
	Commitments resulting from the allocated requirements	are negotiated with the **affected groups**. (L2-6, A1, 4)	
	Impact to existing commitments (resulting from changes to the allocated requirements)	is assessed. (L2-7, A3, 1)	
	Measurements (to determine the status of the activities for managing the allocated requirements)	❑ are made. (L2-8, M1) ❑ are used. (L2-8, M1)	

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RM Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the requirements management process, continued from the previous page.

√	Output	State	References
	Software plans	❑ are changed to be consistent with changes to the allocated requirements. (L2-3, C1, 3) ❑ are appropriately revised when the allocated requirements change. (L2-10, V3, 2)	
	Software work products	❑ are changed to be consistent with changes to the allocated requirements. (L2-3, C1, 3) ❑ are appropriately revised when the allocated requirements change. (L2-10, V3, 2)	

General exit criteria

The CMM recommends that the conditions described in the table below be satisfied to exit the requirement management process.

√	Condition	References
	The activities for managing the allocated requirements are reviewed with **senior management** on a periodic basis. (L2-9, V1)	
	The activities for managing the allocated requirements are reviewed with the **project manager** on both a periodic and event-driven basis. (L2-9, V2)	
	The **software quality assurance group** reviews and/or audits the activities and work products for managing the allocated requirements and reports the results. (L2-9, V3)	
	The allocated requirements are reviewed, and problems are resolved before the **software engineering group** commits to them. (L2-10, V3, 1)	

RM Process - Reviews and Audits

Reviews and audits

The table below lists the recommended reviews and audits for the requirements management process.

√	Review or Audit	Review Participants	References
	Allocated requirements are reviewed by: (L2-3, C1, 2) ❑ the **software managers**, and ❑ other **affected groups**.	**Software managers** **Affected groups**	
	The **software engineering group** reviews allocated requirements before they are incorporated into the software project. (L2-5, A1) ❑ Incomplete and missing allocated requirements are identified. ❑ The allocated requirements are reviewed to determine whether they are: ❑ feasible and appropriate to implement in software, ❑ clearly and properly stated, ❑ consistent with each other, and ❑ testable. ❑ Any allocated requirements identified as having potential problems are reviewed with the **group responsible for analyzing and allocating system requirements**, and necessary changes are made.	**Software engineering group** **Group responsible for analyzing and allocating system requirements**	
	Changes to the allocated requirements are reviewed and incorporated into the software project. (L2-7, A3)	**Not specified in CMM**	
	Changes to commitments made to **individuals and groups external to the organization** are reviewed with **senior management**. (L2-7, A3, 1.1)	**Senior management**	

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RM Process - Reviews and Audits, Continued

Reviews and audits, continued

The table below lists the recommended reviews and audits for the requirements management process, continued from the previous page.

√	Review or Audit	Review Participants	References
	The activities for managing requirements are reviewed with **senior management** on a periodic basis. (L2-9, V1)	**Senior management**	
	The activities for managing the allocated requirements are reviewed with the **project manager** on both a periodic and event-driven basis. (L2-9, V2)	**Project manager**	
	The **software quality assurance group** reviews and/or audits the activities and work products for managing the allocated requirements and reports the results. (L2-9, V3) At a minimum, these reviews and/or audits verify that: ❑ The allocated requirements are reviewed, and problems are resolved before the **software engineering group** commits to them. ❑ The software plans, work products, and activities are appropriately revised when the allocated requirements change. ❑ Changes to commitments resulting from changes to the allocated requirements are negotiated with the **affected groups**.	**SQA group** **Software engineering group** **Affected groups**	

RM Process - Work Products Managed and Controlled

Work products managed and controlled

The table below lists the work products that are recommended to be managed and controlled during the requirements management process.

√	Work Products Managed and Controlled	References
	Allocated requirements. (L2-7, A2, 1)	

RM Process - Measurements

Measurements

The table below describes the recommended measurements for the requirements management process.

√	Measurements	References
	Measurements are made and used to determine the status of the activities for managing the allocated requirements. (L2-8, M1) Examples of measurements include: ❑ Status of each of the allocated requirements. ❑ Change activity for the allocated requirements. ❑ Cumulative number of changes to the allocated requirements, including total number of changes proposed, open, approved, and incorporated into the system baseline.	

RM Process - Documented Procedures

Documented procedures	The CMM does not recommend that any activities be performed according to a documented procedure for the requirements management process.

RM Process - Training

Training

The table below lists the training recommended for the requirements management process.

√	Training	References
	Members of the **software engineering group** and other **software-related groups** are trained to perform their requirements management activities. (L2-5, Ab4)	

RM Process - Tools

Tools

The table below lists the tools recommended for the requirements management process.

√	Tools	References
	Tools to support the activities for managing requirements. (L2-5, Ab3, 2) Examples of support tools include: ❑ spreadsheet programs, ❑ tools for configuration management, ❑ tools for traceability, and ❑ tools for test management.	

Software Project Planning (SPP) Process

SPP Process - Overview

SPP process purpose

The purpose of Software Project Planning is to establish reasonable plans for performing the software engineering and for managing the software project. (L2-11)

SPP process description

Software Project Planning involves developing estimates for the work to be performed, establishing the necessary commitments, and defining the plan to perform the work.

The software planning begins with a statement of the work to be performed and other constraints and goals that define and bound the software project (those established by the practices of the Requirements Management key process area). The software planning process includes steps to estimate the size of the software work products and the resources needed, produce a schedule, identify and assess software risks, and negotiate commitments. Iterating through these steps may be necessary to establish the plan for the software project (i.e., the software development plan).

This plan provides the basis for performing and managing the software project's activities and addresses the commitments to the software project's customer according to the resources, constraints, and capabilities of the software project. (L2-11)

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Section overview

The table below contains a description and the location of each checklist for this key process area.

Checklist	Description	Page
Roles	List of roles participating in process activities.	L2-Process-25
Entry Criteria	Description of when the process can start.	L2-Process-34
Inputs	Description of the work products used by the process.	L2-Process-36
Activities	Description of the activities of the process.	L2-Process-37
Outputs	Description of the work products produced by the process.	L2-Process-40
Exit Criteria	Description of when the process is complete.	L2-Process-42
Reviews and Audits	List of reviews and audits.	L2-Process-50
Work Products Managed and Controlled	List of work products to be managed and controlled.	L2-Process-53
Measurements	Description of process measurements.	L2-Process-54
Documented Procedures	List of the activities to be completed according to a documented procedure.	L2-Process-55
Training	List of training.	L2-Process-56
Tools	List of tools.	L2-Process-57

SPP Process - Roles

Roles

The table below lists the roles and the activities in which they participate in the software project planning process.

√	Role	Activities Participated in...	Reference
	Affected groups	❑ **Affected groups** review the software project's: (L2-13, C2, 4) ❑ software size estimates, ❑ effort and cost estimates, ❑ schedules, and ❑ other commitments. ❑ The statement of work is reviewed by: (L2-15, Ab1, 2) ❑ the project manager, ❑ the project software manager, ❑ the other software managers, and ❑ other **affected groups**. ❑ The software engineering group participates with other **affected groups** in the overall project planning throughout the project's life. (L2-17, A3) ❑ The software development plan is reviewed by: (L2-19, A6, 4) ❑ the project manager, ❑ the project software manager, ❑ the other software managers, and ❑ other **affected groups**. ❑ The plans for the project's software engineering facilities and support tools are reviewed by all **affected groups**. (L2-25, A14, 3) ❑ A summary report from each review with senior management is prepared and distributed to the **affected groups** and individuals. (L2-26, V1, 5)	
Role continues on the next page			

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SPP Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the software project planning process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Affected groups, continued	❑ The activities for software project planning are reviewed with the project manager on both a periodic and event-driven basis. (L2-26, V2) ❑ **Affected groups** are represented. ❑ A summary report from each review with the project manager is prepared and distributed to the **affected groups** and individuals. (L2-27, V2, 7)	
	Affected individuals	❑ A summary report from each review with senior management is prepared and distributed to the **affected** groups and **individuals**. (L2-26, V1, 5) ❑ A summary report from each review with the project manager is prepared and distributed to the **affected** groups and **individuals**. (L2-27, V2, 7)	
	Engineering groups	❑ Involvement of other **engineering groups** in the software activities is negotiated with these groups and is documented. (L2-13, C2, 3) ❑ Plans for software-related groups and other **engineering groups** involved in the activities of the software engineering group are negotiated with those groups, the support efforts are budgeted, and the agreements are documented. (L2-18, A6, 2) ❑ Plans for involvement of the software engineering group in the activities of other software-related groups and other **engineering groups** are negotiated with those groups, the support efforts are budgeted, and the agreements are documented. (L2-19, A6, 3)	

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SPP Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the software project planning process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Individuals	❑ Where feasible, experienced **individuals,** who have expertise in the application domain of the software project being planned, are available to develop the software development plan. (L2-16, Ab3, 1) ❑ The software managers, software engineers, and other **individuals** involved in the software project planning are trained in the software estimating and planning procedures applicable to their areas of responsibility. (L2-16, Ab4)	
	Individuals and groups external to the organization	❑ Senior management reviews all software project commitments made to **individuals and groups external to the organization**. (L2-13, C2, 5) ❑ Software project commitments made to **individuals and groups external to the organization** are reviewed with senior management according to a documented procedure. (L2-17, A4)	

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SPP Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the software project planning process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Project manager	❑ The software project's commitments are negotiated between: (L2-12, C2, 2) ❑ the **project manager**, ❑ the project software manager, and ❑ the other software managers. ❑ The statement of work is reviewed by: (L2-15, Ab1, 2) ❑ the **project manager**, ❑ the project software manager, ❑ the other software managers, and ❑ other affected groups. ❑ The software development plan is reviewed by: (L2-19, A6, 4) ❑ the **project manager**, ❑ the project software manager, ❑ the other software managers, and ❑ other affected groups. ❑ The activities for software project planning are reviewed with the **project manager** on both a periodic and event-driven basis. (L2-26, V2)	

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SPP Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the software project planning process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Project software manager	❑ A **project software manager** is designated to be responsible for negotiating commitments and developing the project's software development plan. (L2-12, C1) ❑ The software project's commitments are negotiated between: (L2-12, C2, 2) ❑ the project manager, ❑ the **project software manager**, and ❑ the other software managers. ❑ The statement of work is reviewed by: (L2-15, Ab1, 2) ❑ the project manager, ❑ the **project software manager**, ❑ the other software managers, and ❑ other affected groups. ❑ The **project software manager**, directly or by delegation, coordinates the project's software planning. (L2-15, Ab2, 1) ❑ The software development plan is reviewed by: (L2-19, A6, 4) ❑ the project manager, ❑ the **project software manager**, ❑ the other software managers, and ❑ other affected groups.	

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SPP Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the software project planning process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Senior management	❑ **Senior management** reviews all software project commitments made to individuals and groups external to the organization. (L2-13, C2, 5) ❑ Software project commitments made to individuals and groups external to the organization are reviewed with **senior management** according to a documented procedure. (L2-17, A4) ❑ The activities for software project planning are reviewed with **senior management** on a periodic basis. (L2-26, V1)	

	Software engineering group	❑ The **software engineering group** participates on the project proposal team. (L2-16, A1)
		❑ The **software engineering group** is involved in: (L2-17, A1, 1)
		  ❑ proposal preparation and submission,
		  ❑ clarification discussions and submissions, and
		  ❑ negotiations of changes to commitments that affect the software project.
		❑ The **software engineering group** reviews the project's proposed commitments. (L2-17, A1, 2)	

Role continues on the next page			

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SPP Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the software project planning process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Software engineering group, continued	❑ The **software engineering group** participates with other affected groups in the overall project planning throughout the project's life. (L2-17, A3) ❑ The **software engineering group** reviews the project-level plans. (L2-17, A3, 1) ❑ Plans for software-related groups and other engineering groups involved in the activities of the **software engineering group** are negotiated with those groups, the support efforts are budgeted, and the agreements are documented. (L2-18, A6, 2) ❑ Plans for involvement of the **software engineering group** in the activities of other software-related groups and other engineering groups are negotiated with those groups, the support efforts are budgeted, and the agreements are documented. (L2-19, A6, 3)	
	Software engineers	The software managers, **software engineers**, and other individuals involved in the software project planning are trained in software estimating and planning procedures applicable to their areas of responsibility. (L2-16, Ab4)	

Continued on next page

SPP Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the software project planning process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Software manager	❑ The software project's commitments are negotiated between: (L2-12, C2, 2) ❑ the project manager, ❑ the project software manager, and ❑ the other **software managers**. ❑ The statement of work is reviewed by: (L2-15, Ab1, 2) ❑ the project manager, ❑ the project software manager, ❑ the other **software managers**, and ❑ other affected groups. ❑ Responsibilities for the software work products and activities are partitioned and assigned to **software managers** in a traceable, accountable manner. (L2-15, Ab2, 2) ❑ The **software managers**, software engineers, and other individuals involved in the software project planning are trained in software estimating and planning procedures applicable to their areas of responsibility. (L2-16, Ab4) ❑ The software development plan is reviewed by: (L2-19, A6, 4) ❑ the project manager, ❑ the project software manager, ❑ the other **software managers**, and ❑ other affected groups.	

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SPP Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the software project planning process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Software-related groups	❑ Plans for **software-related groups** and other engineering groups involved in the activities of the software engineering group are negotiated with those groups, the support efforts are budgeted, and the agreements are documented. (L2-18, A6, 2) ❑ Plans for involvement of the software engineering group in the activities of other **software-related groups** and other engineering groups are negotiated with those groups, the support efforts are budgeted, and the agreements are documented. (L2-19, A6, 3)	
	SQA group	The **software quality assurance group** reviews and/or audits the activities and work products for software project planning and reports the results. (L2-27, V3)	

SPP Process - Entry Criteria

Input-based entry criteria

The CMM recommends that inputs satisfy the states described in the table below before entering the software project planning process.

√	Input	State	References
	Cost data	❑ are from the organization's projects when possible. (L2-22, A10, 2.1) ❑ take into account the effort and significant costs that go into making the software work products. (L2-22, A10, 2.2)	
	Historical data	are used where available. (L2-21, A9, 3)	
	Productivity data	❑ are from the organization's projects when possible. (L2-22, A10, 2.1) ❑ take into account the effort and significant costs that go into making the software work products. (L2-22, A10, 2.2)	

	Statement of work	❑ is documented. (L2-14, Ab1)
		❑ is approved. (L2-14, Ab1)
		❑ exists for the software project. (L2-14, Ab1)
		❑ is reviewed by: (L2-15, Ab1, 2)
		  ❑ the **project manager**,
		  ❑ the **project software manager**,
		  ❑ the other **software managers**, and
		  ❑ other **affected groups**.
		❑ is managed and controlled. (L2-15, Ab1, 3)	

SPP Process - Entry Criteria, Continued

General entry criteria

The CMM recommends that the conditions described in the table below be satisfied before entering the software project planning process.

√	Condition	References
	A **project software manager** is designated to be responsible for negotiating commitments and developing the project's software development plan. (L2-12, C1)	
	The project follows a written organizational policy for planning a software project. (L2-12, C2) [Refer to Level 2 Policies for additional information regarding SPP policy.]	
	Responsibilities for developing the software development plan are assigned. (L2-15, Ab2)	
	Responsibilities for the software work products and activities are partitioned and assigned to **software managers** in a traceable, accountable manner. (L2-15, Ab2, 2)	
	Adequate resources and funding are provided for planning the software project. (L2-16, Ab3)	
	Where feasible, experienced **individuals** who have expertise in the application domain of the software project being planned are available to develop the software development plan. (L2-16, Ab3, 1)	
	Tools to support the software project planning activities are made available. (L2-16, Ab3, 2)	
	The **software managers**, **software engineers**, and other **individuals** involved in the software project planning are trained in the software estimating and planning procedures applicable to their areas of responsibility. (L2-16, Ab4)	
	Software project planning is initiated in the early stages of, and in parallel with, the overall project planning. (L2-17, A2)	

SPP Process - Inputs

Inputs

The table below lists the recommended inputs to the software project planning process.

√	Input	Org. Input	References
	Allocated requirements. (L2-18, A6, 1.4) [Refer to Level 2 Standards for additional information regarding allocated requirements.]		
	Cost data. (L2-22, A10, 2.1)		
	Customer's standards. (L2-18, A6, 1.1)		
	Historical data (where available). (L2-21, A9, 3)		
	Productivity data (historical and/or current). (L2-22, A10, 2)		
	Project proposal. (L2-16, A1)		
	Project's standards. (L2-18, A6, 1.2)		
	Proposed commitments. (L2-17, A1, 2)		
	Statement of work. (L2-14, Ab1) [Refer to Level 2 Standards for additional information regarding a statement of work.]		

SPP Process - Activities

Activities

The table below lists the recommended activities for the software project planning process.

√	Activities	References
	The **software engineering group** participates on the project proposal team. (L2-16, A1) ❑ The **software engineering group** is involved in: (L2-17, A1, 1) ❑ proposal preparation and submission, ❑ clarification discussions and submissions, and ❑ negotiations of changes to commitments that affect the software project. ❑ The **software engineering group** reviews the project's proposed commitments. (L2-17, A1, 2)	
	The **software engineering group** reviews the project-level plans. (L2-17, A3, 1)	
	Software project commitments made to **individuals and groups external to the organization** are reviewed with **senior management** according to a documented procedure. (L2-17, A4)	
	A software life cycle with predefined stages of manageable size is identified or defined. (L2-17, A5)	
	The project's software development plan is developed according to a documented procedure. (L2-18, A6) [Refer to Level 2 Procedure Checklists for additional information.]	
	The plan for the software project is documented. (L2-19, A7)	
	Software work products that are needed to establish and maintain control of the software project are identified. (L2-20, A8)	
	Estimates for the size of the software work products (or changes to the size of software work products) are derived according to a documented procedure. (L2-21, A9) [Refer to Level 2 Procedure Checklists for additional information.]	
	Estimates for the software project's effort and costs are derived according to a documented procedure. (L2-22, A10) [Refer to Level 2 Procedure Checklists for additional information.]	

Continued on next page

SPP Process - Activities, Continued

Activities, continued

The table below lists the recommended activities for the software project planning process, continued from the previous page.

√	Activities	References
	Estimates for critical computer resources are derived according to a documented procedure. (L2-23, A11) [Refer to Level 2 Procedure Checklists for additional information.]	
	The project's software schedule is derived according to a documented procedure. (L2-23, A12) [Refer to Level 2 Procedure Checklists for additional information.]	
	The software risks associated with the cost, resource, schedule, and technical aspects of the project are identified, assessed, and documented. (L2-24, A13) ❑ The risks are analyzed and prioritized based on their potential impact to the project. ❑ Contingencies for the risks are identified.	
	Plans for the project's software engineering facilities and support tools are prepared. (L2-25, A14) ❑ Responsibilities are assigned and commitments are negotiated to procure or develop these facilities and support tools. (L2-25, A14, 2) ❑ The plans are reviewed by all **affected groups**. (L2-25, A14, 3)	
	Software planning data are recorded. (L2-25, A15) ❑ Information recorded includes the estimates and the associated information needed to reconstruct the estimates and assess their reasonableness. (L2-25, A15, 1)	
	Measurements are made and used to determine the status of the software planning activities. (L2-25, M1)	
	The activities for software project planning are reviewed with **senior management** on a periodic basis. (L2-26, V1) [Refer to SPP Process Reviews and Audits for additional information.]	

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SPP Process - Activities, Continued

Activities, continued

The table below lists the recommended activities for the software project planning process continued from the previous page.

√	Activities	References
	The activities for software project planning are reviewed with the **project manager** on both a periodic and event-driven basis. (L2-26, V2) [Refer to SPP Process Reviews and Audits for additional information.]	
	The **software quality assurance group** reviews and/or audits the activities and work products for software planning and reports the results. (L2-27, V3) [Refer to SPP Process Reviews and Audits for additional information.]	

SPP Process - Outputs

Outputs

The table below lists the recommended outputs produced by the software project planning process.

√	Output	Org. Outputs	References
	Action items resulting from reviews with **senior management**. (L2-26, V1, 4)		
	Action items resulting from reviews with the **project manager**. (L2-27, V2, 6)		
	Assumptions made in deriving the estimates for the software project's effort and costs. (L2-23, A10, 4)		
	Assumptions made in deriving the project's software schedule. (L2-24, A12, 5)		
	Contingencies for the risks associated with the cost, resource, schedule, and technical aspects of the project. (L2-24, A13, 2)		
	Distributions of effort, staffing, and cost estimates over the software life cycle. (L2-23, A10, 3.3)		
	Estimates for the project's critical computer resources. (L2-23, A11)		
	Estimates for the size of the software work products (or changes to the size of software work products). (L2-21, A9)		
	Estimates for the software project's effort and costs. (L2-22, A10)		
	Estimates of capacity requirements for the project's software engineering facilities and support tools. (L2-25, A14, 1)		
	Estimates of the critical computer resources for the project. (L2-23, A11, 3)		
	Measurements to determine the status of the software planning activities. (L2-25, M1)		
	Plans for involvement of the **software engineering group** in the activities of other **software-related groups** and other **engineering groups**. (L2-19, A6, 3)		
	Plans for **software-related groups** and other **engineering groups** involved in the activities of the **software engineering group**. (L2-18, A6, 2)		

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SPP Process - Outputs, Continued

Outputs, continued

The table below lists the recommended outputs produced by the software project planning process, continued from the previous page.

√	Output	Org. Outputs	References
	Plans for the project's software engineering facilities and support tools. (L2-25, A14)		
	Project's software development plan. (L2-15, Ab2) [Refer to Level 2 Standards for additional information regarding the software development plan.]		
	Project's software schedule. (L2-23, A12)		
	Size estimating assumptions. (L2-21, A9, 4)		
	Software life cycle. (L2-17, A5)		
	Software planning data. (L2-25, A15)		
	Software project commitments. (L2-17, A4)		
	Software risks associated with the cost, resource, schedule, and technical aspects of the project. (L2-24, A13)		
	Software work products that are needed to establish and maintain control of the software project. (L2-20, A8)		
	Sources and rationale for productivity data used for estimating the software project's effort and costs. (L2-22, A10, 2)		
	Summary report from each review with **senior management**. (L2-26, V1, 5)		
	Summary report from each review with the **project manager**. (L2-27, V2, 7)		
	Time phasing of activities. (L2-22, A10, 3.2)		

SPP Process - Exit Criteria

Output-based exit criteria

The CMM recommends that outputs satisfy the states described in the table below to exit the software project planning process.

√	Output	State	References
	Action items resulting from reviews with **senior management**	❑ are assigned. (L2-26, V1, 4) ❑ are reviewed. (L2-26, V1, 4) ❑ are tracked to closure. (L2-26, V1, 4)	
	Action items resulting from reviews with the **project manager**	❑ are assigned. (L2-27, V2, 6) ❑ are reviewed. (L2-27, V2, 6) ❑ are tracked to closure. (L2-27, V2, 6)	
	Assumptions made in deriving the estimates for the software project's costs	❑ are documented. (L2-23, A10, 4) ❑ are reviewed. (L2-23, A10, 4) ❑ are agreed to. (L2-23, A10, 4)	
	Assumptions made in deriving the estimates for the software project's effort	❑ are documented. (L2-23, A10, 4) ❑ are reviewed. (L2-23, A10, 4) ❑ are agreed to. (L2-23, A10, 4)	
	Assumptions made in deriving the (project's software) schedule	are documented. (L2-24, A12, 5)	
	Contingencies for the risks (associated with the cost, resource, schedule, and technical aspects of the project)	are identified. (L2-24, A13, 2)	
	Critical computer resources for the project	are identified. (L2-23, A11, 1)	
	Distributions of cost estimates over the software life cycle	are prepared. (L2-23, A10, 3.3)	
	Distributions of effort estimates over the software life cycle	are prepared. (L2-23, A10, 3.3)	

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Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the software project planning process, continued from the previous page.

√	Output	State	References
	Distributions of staffing estimates over the software life cycle	are prepared. (L2-23, A10, 3.3)	

	Estimates for the project's critical computer resources	❑ are derived according to a documented procedure. (L2-23, A11)
		❑ are related to the estimates of: (L2-23, A11, 2)
		  ❑ the size of the software work products,
		  ❑ the operational processing load, and
		  ❑ the communications traffic.
		❑ are documented. (L2-23, A11, 3)
		❑ are reviewed. (L2-23, A11, 3)
		❑ are agreed to. (L2-23, A11, 3)	

	Estimates for the size of the software work products (or changes to the size of software work products)	❑ are derived according to a documented procedure. (L2-21, A9) ❑ are made for all major software work products and activities. (L2-21, A9, 1) ❑ are documented. (L2-21, A9, 5) ❑ are reviewed. (L2-21, A9, 5) ❑ are agreed to. (L2-21, A9, 5)	

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Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the software project planning process, continued from the previous page.

√	Output	State	References
	Estimates for the software project's costs	❑ are derived according to a documented procedure. (L2-22, A10) ❑ are related to the size estimates of the software work products (or the size of the changes). (L2-22, A10, 1) ❑ are based on past experience. (L2-22, A10, 3)	
	Estimates for the software project's effort	❑ are derived according to a documented procedure. (L2-22, A10) ❑ are related to the size estimates of the software work products (or the size of the changes). (L2-22, A10, 1) ❑ are based on past experience. (L2-22, A10, 3)	
	Estimates of capacity requirements for (the project's software engineering) facilities and support tools	are based on the size estimates of the software work products and other characteristics. (L2-25, A14, 1)	
	Measurements (to determine the status of the software planning activities)	are made. (L2-25, M1) are used. (L2-25, M1)	
	Plans for involvement of the **software engineering group** in the activities of other **software-related groups** and other **engineering groups**	are negotiated with those groups, the support efforts are budgeted, and the agreements are documented. (L2-19, A6, 3)	

	Plans for **software-related groups** and other **engineering groups** involved in the activities of the **software engineering group**	are negotiated with those groups, the support efforts are budgeted, and the agreements are documented. (L2-18, A6, 2)	

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SPP Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the software project planning process, continued from the previous page.

√	Output	State	References
	Plans for the project's software engineering facilities and support tools	❑ are prepared. (L2-25, A14) ❑ are reviewed by all **affected groups**. (L2-25, A14, 3)	

	Project's software development plan	❑ is managed and controlled. (L2-13, C2, 6)
		❑ is developed according to a documented procedure. (L2-18, A6)
		❑ is based on and conforms to: (L2-18, A6, 1)
		  ❑ the customer's standards, as appropriate;
		  ❑ the project's standards;
		  ❑ the approved statement of work; and
		  ❑ the allocated requirements.
		❑ is reviewed by: (L2-19, A6, 4)
		  ❑ the **project manager**,
		  ❑ the **project software manager**,
		  ❑ the other **software managers**, and
		  ❑ other **affected groups**.
		❑ is documented. (L2-19, A7)	

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Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the software project planning process, continued from the previous page.

√	Output	State	References

	Project's software schedule	❑ is derived according to a documented procedure. (L2-23, A12)
		❑ is related to: (L2-24, A12, 1)
		  ❑ the size estimate of the software work products (or the size of changes), and
		  ❑ the software effort and costs.
		❑ is based on past experience. (L2-24, A12, 2)
		  ❑ Similar projects are used when possible.
		❑ accommodates the imposed milestone dates, critical dependency dates, and other constraints. (L2-24, A12, 3)
		❑ activities are of appropriate duration and the milestones are of appropriate time separation to support accuracy in progress measurement. (L2-24, A12, 4)
		❑ is documented. (L2-24, A12, 6)
		❑ is reviewed. (L2-24, A12, 6)
		❑ is agreed to. (L2-24, A12, 6)	

	Results (of **SQA group** reviews and/or audits of the activities and work products for software project planning)	are reported. (L2-27, V3)	
	Size estimating assumptions	are documented. (L2-21, A9, 4)	
	Software life cycle	❑ is identified or defined. (L2-17, A5) ❑ has predefined stages of manageable size. (L2-17, A5)	

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Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the software project planning process, continued from the previous page.

√	Output	State	References
	Software planning data	❑ are recorded. (L2-25, A15) ❑ Information recorded includes the estimates and the associated information needed to reconstruct the estimates and assess their reasonableness. (L2-25, A15, 1) ❑ are managed and controlled. (L2-25, A15, 2)	
	Software project's commitments	❑ are negotiated between: (L2-12, C2, 2) ❑ the **project manager,** ❑ the **project software manager,** and ❑ the other **software managers**. ❑ made to **individuals and groups external to the organization** are reviewed with **senior management** according to a documented procedure. (L-17, A4)	
	Software risks associated with the cost, resource, schedule, and technical aspects of the project	❑ are identified. (L2-24, A13) ❑ are assessed. (L2-24, A13) ❑ are documented. (L2-24, A13) ❑ are analyzed. (L2-24, A13, 1) ❑ are prioritized based on their potential impact to the project. (L2-24, A13, 1)	
	Software work products	are decomposed to the granularity needed to meet the estimating objectives. (L2-21, A9, 2)	

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Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the software project planning process, continued from the previous page.

√	Output	State	References
	Software work products that are needed to establish and maintain control of the software project	are identified. (L2-20, A8)	
	Sources for productivity data that are used to estimate the software project's effort and costs	are documented. (L2-22, A10, 2)	
	Rationale for productivity data that are used to estimate the software project's effort and costs	are documented. (L2-22, A10, 2)	
	Staffing estimates	are based on past experience. (L2-22, A10, 3)	
	Summary report from each meeting with **senior management**	❑ is prepared. (L2-26, V1, 5) ❑ is distributed to the **affected groups** and **individuals**. (L2-26, V1, 5)	
	Summary report from each meeting with the **project manager**	❑ is prepared. (L2-27, V2, 7) ❑ is distributed to the **affected groups** and **individuals**. (L2-27, V2, 7)	
	Time phasing of activities	is derived. (L2-22, A10, 3.2)	

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SPP Process - Exit Criteria, Continued

General exit criteria

The CMM recommends that the conditions described in the table below be satisfied to exit the software project planning process.

√	Condition	References
	The system requirements allocated to software are used as the basis for planning the software project. (L2-12, C2, 1)	
	Involvement of other **engineering groups** in the software activities is negotiated with these groups and is documented. (L2-13, C2, 3)	
	Affected groups review the project's: (L2-13, C2, 4) ❑ software size estimates, ❑ effort and cost estimates, ❑ schedules, and ❑ other commitments.	
	Senior management reviews all software project commitments made to **individuals and groups external to the organization**. (L2-13, C2, 5)	
	The **software engineering group** participates on the project proposal team. (L2-16, A1)	
	The **software engineering group** reviews the project's proposed commitments. (L2-17, A1, 2)	
	The **software engineering group** participates with other **affected groups** in the overall project planning throughout the project's life. (L2-17, A3)	
	The **software engineering group** reviews the project-level plans. (L2-17, A3, 1)	
	Productivity data (historical and/or current) are used for the estimates when available. (L2-22, A10, 2)	
	Responsibilities are assigned and commitments are negotiated to procure or develop the project's facilities and tools. (L2-25, A14, 2)	
	The activities for software project planning are reviewed with **senior management** on a periodic basis. (L2-26, V1)	
	The activities for software project planning are reviewed with the **project manager** on both a periodic and event-driven basis. (L2-26, V2)	
	The **software quality assurance group** reviews and/or audits the activities and work products for software project planning, and reports the results. (L2-27, V3)	

SPP Process - Reviews and Audits

Reviews and audits

The table below lists the recommended reviews and audits for the software project planning process.

√	Review or Audit	Review Participants	References
	Affected groups review the software project's: (L2-13, C2, 4) ❑ software size estimates, ❑ effort and cost estimates, ❑ schedules, and ❑ other commitments.	**Affected groups**	
	Senior management reviews all software project commitments made to **individuals and groups external to the organization**. (L2-13, C2, 5)	**Senior management**	
	The statement of work is reviewed by: (L2-15, Ab1, 2) ❑ the **project manager**, ❑ the **project software manager**, ❑ the other **software managers**, and ❑ other **affected groups**.	**Project manager** **Project software manager** **Software managers** **Affected groups**	
	The **software engineering group** reviews the project's proposed commitments. (L2-17, A1, 2)	**Software engineering group**	
	The **software engineering group** reviews the project-level plans. (L2-17, A3, 1)	**Software engineering group**	
	Software project commitments made to **individuals and groups external to the organization** are reviewed with **senior management**. (L2-17, A4)	**Senior management**	

	The software development plan is reviewed by: (L2-19, A6, 4) ❑ the **project manager**, ❑ the **project software manager**, ❑ the other **software managers**, and ❑ other **affected groups**.	**Project manager** **Project software manager** **Software managers** **Affected groups**	

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Reviews and audits, continued

The table below lists the recommended reviews and audits for the software project planning process, continued from the previous page.

√	Review or Audit	Review Participants	References
	Size estimates are documented, reviewed, and agreed to. (L2-21, A9, 5)	**Not specified in the CMM**	
	Estimates and the assumptions made in deriving the estimates are documented, reviewed, and agreed to. (L2-23, A10, 4)	**Not specified in the CMM**	
	Estimates of the critical computer resources are documented, reviewed, and agreed to. (L2-23, A11, 3)	**Not specified in the CMM**	
	The software schedule is documented, reviewed, and agreed to. (L2-24, A12, 6)	**Not specified in the CMM**	
	The plans for the project's software engineering facilities and support tools are reviewed by all **affected groups**. (L2-25, A14, 3)	**Affected groups**	
	The activities for software project planning are reviewed with **senior management** on a periodic basis. (L2-26, V1) ❑ The technical, cost, staffing, and schedule performance is reviewed. ❑ Conflicts and issues not resolvable at lower levels are addressed. ❑ Software project risks are addressed. ❑ Action items are assigned, reviewed, and tracked to closure. ❑ A summary report from each meeting is prepared and distributed to the **affected groups** and **individuals**.	**Senior management** **Affected groups and individuals**	

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Reviews and audits, continued

The table below lists the recommended reviews and audits for the software project planning process, continued from the previous page.

√	Review or Audit	Review Participants	References
	The activities for software project planning are reviewed with the **project manager** on both a periodic and event-driven basis. (L2-26, V2) ❑ **Affected groups** are represented. ❑ Status and current results of the software project planning activities are reviewed against the software project's statement of work and allocated requirements. ❑ Dependencies between groups are addressed. ❑ Conflicts and issues not resolvable at lower levels are addressed. ❑ Software project risks are reviewed. ❑ Action items are assigned, reviewed, and tracked to closure. ❑ A summary report from each meeting is prepared and distributed to the **affected groups** and individuals.	**Project manager** **Affected groups**	
	The **software quality assurance group** reviews and/or audits the activities and work products for software project planning and reports the results. (L2-27, V3) At a minimum, the reviews and/or audits verify: ❑ The activities for software estimating and planning. ❑ The activities for reviewing and making project commitments. ❑ The activities for preparing the software development plan. ❑ The standards used for preparing the software development plan. ❑ The content of the software development plan.	**SQA group**	

SPP Process - Work Products Managed and Controlled

Work products managed and controlled

The table below lists the work products recommended to be managed and controlled during the software project planning process.

√	Work Products Managed and Controlled	References
	Project's software development plan. (L2-13, C2, 6)	
	Statement of work. (L2-15, Ab1, 3)	
	Software planning data. (L2-25, A15, 2)	

SPP Process - Measurements

Measurements

The table below lists the measurements recommended for the software project planning process.

√	Measurements	References
	Software planning data. (L2-25, A15) ❑ Information recorded includes the estimates and the associated information needed to reconstruct the estimates and assess their reasonableness. (L2-25, A15, 1)	
	Measurements are made and used to determine the status of the software planning activities. (L2-25, M1) Examples of measurements include: ❑ Completions of milestones for the software project planning activities compared to the plan. ❑ Work completed, effort expended, and funds expended in the software project planning activities compared to the plan.	

SPP Process - Documented Procedures

Documented procedures

The table below lists the activities for the software project planning process recommended to be performed according to a documented procedure.

√	Documented procedures	References
	Software project commitments made to **individuals and groups external to the organization** are reviewed with **senior management** according to a documented procedure. (L2-17, A4)	
	The project's software development plan is developed according to a documented procedure. (L2-18, A6) [Refer to Level 2 Procedure Checklists for additional information.]	
	Estimates for the size of the software work products (or changes to the size of software work products) are derived according to a documented procedure. (L2-21, A9) [Refer to Level 2 Procedure Checklists for additional information.]	
	Estimates for the software project's effort and costs are derived according to a documented procedure. (L2-22, A10) [Refer to Level 2 Procedure Checklists for additional information.]	
	Estimates for the project's critical computer resources are derived according to a documented procedure. (L2-23, A11) [Refer to Level 2 Procedure Checklists for additional information.]	
	The project's software schedule is derived according to a documented procedure. (L2-23, A12) [Refer to Level 2 Procedure Checklists for additional information.]	

SPP Process - Training

Training

The table below lists the training recommended for the software project planning process.

√	Training	References
	The **software managers**, **software engineers**, and other **individuals** involved in the software project planning are trained in the software estimating and planning procedures applicable to their areas of responsibility. (L2-16, Ab4)	

SPP Process - Tools

Tools

The table below lists the tools recommended for the software project planning process.

√	Tools	References
	Tools to support software project planning activities. (L2-16, Ab3, 2) Examples of support tools include: ❑ spreadsheet programs, ❑ estimating models, and ❑ project planning and scheduling programs.	

Software Project Tracking and Oversight (SPTO) Process

SPTO Process - Overview

SPTO process purpose

The purpose of Software Project Tracking and Oversight is to provide adequate visibility into actual progress so that management can take effective actions when the software project's performance deviates significantly from the software plans. (L2-29)

SPTO process description

Software Project Tracking and Oversight involves tracking and reviewing the software accomplishments and results against documented estimates, commitments, and plans, and adjusting these plans based on the actual accomplishments and results.

A documented plan for the software project (i.e., the software development plan, as described in the Software Project Planning key process area) is used as the basis for tracking the software activities, communicating status, and revising plans. Software activities are monitored by the management. Progress is primarily determined by comparing the actual software size, effort, cost, and schedule to the plan when selected software work products are completed and at selected milestones. When it is determined that the software project's plans are not being met, corrective actions are taken. These actions may include revising the software development plan to reflect the actual accomplishments and replanning the remaining work or taking actions to improve the performance. (L2-29)

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Section overview

The table below contains a description and the location of each checklist for this key process area.

Checklist	Description	Page
Roles	List of roles participating in process activities.	L2-Process-61
Entry Criteria	Description of when the process can start.	L2-Process-68
Inputs	Description of the work products used by the process.	L2-Process-70
Activities	Description of the activities of the process.	L2-Process-71
Outputs	Description of the work products produced by the process.	L2-Process-75
Exit Criteria	Description of when the process is complete.	L2-Process-79
Reviews and Audits	List of reviews and audits.	L2-Process-88
Work Products Managed and Controlled	List of work products to be managed and controlled.	L2-Process-92
Measurements	Description of process measurements.	L2-Process-93
Documented Procedures	List of the activities to be completed according to a documented procedure.	L2-Process-94
Training	List of training.	L2-Process-95
Tools	List of tools.	L2-Process-96

SPTO Process - Roles

Roles

The table below lists the roles and the activities in which they participate in the software project tracking and oversight process.

√	Role	Activities Participated in...	Reference
	Affected groups	❑ Changes to the software commitments are made with the involvement and agreement of the **affected groups**. (L2-30, C2, 4) ❑ Changes in size estimates of the software work products that affect software commitments are negotiated with the **affected groups** and are documented. (L2-36, A5, 5) ❑ Changes in staffing and other software costs that affect software commitments are negotiated with the **affected groups** and are documented. (L2-36, A6, 4) ❑ Changes in estimates of critical computer resources that affect software commitments are negotiated with the **affected groups** and are documented. (L2-37, A7, 2) ❑ Software schedule revisions that affect software commitments are negotiated with the **affected groups** and are documented. (L2-37, A8, 3) ❑ Formal reviews to address the accomplishments and results of the software project are conducted at selected project milestones according to a documented procedure. (L2-39, A13) These reviews: ❑ Are conducted with the customer, end user, and **affected groups** within the organization, as appropriate. (L2-39, A13, 2) ❑ A summary status report from each review (meeting) with senior management is prepared and distributed to the **affected groups**. (L2-40, V1, 5)	
Role continues on the next page			

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Roles, continued

The table below lists the roles and the activities in which they participate in the software project tracking and oversight process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Affected groups, continued	❑ The activities for software project tracking and oversight are reviewed with the project manager on both a periodic and event-driven basis. (L2-41, V2) ❑ **Affected groups** are represented. (L2-41, V2, 1) ❑ A summary status report from each (review meeting) with the project manager is prepared and distributed to the **affected groups**. (L2-41, V2, 8)	
	Customer	❑ Formal reviews to address the accomplishments and results of the software project are conducted at selected project milestones according to a documented procedure. (L2-39, A13) These reviews: ❑ Are conducted with the **customer**, end user, and affected groups within the organization, as appropriate. (L2-39, A13, 2)	
	End user	❑ Formal reviews to address the accomplishments and results of the software project are conducted at selected project milestones according to a documented procedure. (L2-39, A13) These reviews: ❑ Are conducted with the customer, **end user**, and affected groups within the organization, as appropriate. (L2-39, A13, 2)	

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SPTO Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the software project tracking and oversight process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	First-line software managers	❑ **First-line software managers** receive orientation in the technical aspects of the software project. (L2-32, Ab5) ❑ Members of the software engineering group report their technical status to their **first-line manager** on a regular basis. (L2-37, A9, 1) ❑ The software engineering group conducts periodic internal reviews to track technical progress, plans, performance, and issues against the software development plan. (L2-38, A12) These reviews are conducted between: ❑ The **first-line software managers** and their software task leaders. ❑ The project software manager, **first-line software managers**, and other software managers, as appropriate.	
	Individuals and groups external to the organization	❑ Senior management reviews all commitment changes and new software project commitments made to **individuals and groups external to the organization.** (L2-31, C2, 5) ❑ Software project commitments and changes to commitments made to **individuals and groups external to the organization** are reviewed with senior management according to a documented procedure. (L2-35, A3)	

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Roles, continued

The table below lists the roles and the activities in which they participate in the software project tracking and oversight process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Project manager	❑ The **project manager** is kept informed of the software project's status and issues. (L2-30, C2, 2) ❑ High-risk areas associated with cost, resource, schedule, and technical aspects of the project are reviewed with the **project manager** on a regular basis. (L2-38, A10, 2) ❑ The activities for software project tracking and oversight are reviewed with the **project manager** on both a periodic and event-driven basis. (L2-41, V2)	
	Project software manager	❑ A **project software manager** is designated to be responsible for the project's software activities and results. (L2-30, C1) ❑ The **project software manager** explicitly assigns responsibility for software work products and activities. (L2-31, Ab2) ❑ The software engineering group conducts periodic internal reviews to track technical progress, plans, performance, and issues against the software development plan. (L2-38, A12) These reviews are conducted between: ❑ The first-line software managers and their software task leaders. ❑ The **project software manager**, first-line software managers, and other software managers, as appropriate.	

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SPTO Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the software project tracking and oversight process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Senior management	❑ **Senior management** reviews all commitment changes and new software project commitments made to individuals and groups external to the organization. (L2-31, C2, 5) ❑ Software project commitments and changes to commitments made to individuals and groups external to the organization are reviewed with **senior management** according to a documented procedure. (L2-35, A3) ❑ The activities for software project tracking and oversight are reviewed with **senior management** on a periodic basis. (L2-40, V1)	
	Software engineering group	❑ Approved changes to commitments that affect the software project are communicated to the members of the **software engineering group** and other software-related groups. (L2-35, A4) ❑ Members of the **software engineering group** report their technical status to their first-line manager on a regular basis. (L2-37, A9, 1) ❑ The **software engineering group** conducts periodic internal reviews to track technical progress, plans, performance, and issues against the software development plan. (L2-38, A12)	

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Roles, continued

The table below lists the roles and the activities in which they participate in the software project tracking and oversight process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Software manager	❑ The **software managers** and the software task leaders are assigned specific responsibilities for tracking the software project. (L2-32, Ab3, 1) ❑ The **software managers** are trained in managing the technical and personnel aspects of the software project. (L2-32, Ab4) ❑ The **s**oftware engineering group conducts periodic internal reviews to track technical progress, plans, performance, and issues against the software development plan. (L2-38, A12) These reviews are conducted between: ❑ The first-line software managers and their software task leaders. ❑ The project software manager, first-line software managers, and other **software managers**, as appropriate. ❑ Formal review to address the accomplishments and results of the software project are conducted at selected project milestones according to a documented procedure. (L2-39, A13) These reviews: ❑ Use materials that are reviewed and approved by the responsible **software managers**. (L2-39, A13, 3)	

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SPTO Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the software project tracking and oversight process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Software-related groups	Approved changes to commitments that affect the software project are communicated to the members of the software engineering group and other **software-related groups**. (L2-35, A4)	
	SQA group	The **software quality assurance group** reviews and/or audits the activities and work products for software project tracking and oversight and reports the results. (L2-41, V3)	
	Software task leaders	❑ The software managers and the **software task leaders** are assigned specific responsibilities for tracking the software project. (L2-32, Ab3, 1) ❑ The software engineering group conducts periodic internal reviews to track technical progress, plans, performance, and issues against the software development plan. (L2-38, A12) These reviews are conducted between: ❑ The first-line software managers and their **software task leaders**. ❑ The project software manager, first-line software managers, and other software managers, as appropriate.	

SPTO Process - Entry Criteria

Input-based entry criteria

The CMM recommends that inputs satisfy the states described in the table below before entering the software project tracking and oversight process.

√	Input	State	References
	Software development plan (for the software project)	❑ is documented. (L2-31, Ab1) ❑ is approved. (L2-31, Ab1)	

General entry criteria

The CMM recommends that the conditions described in the table below be satisfied before entering the software project tracking and oversight process.

√	Condition	References
	A **project software manager** is designated to be responsible for the project's software activities and results. (L2-30, C1)	
	The project follows a written organizational policy for managing the software project. (L2-30, C2) [Refer to Level 2 Policies for additional information regarding SPTO policy.]	
	A software development plan for the software project is documented and approved. (L2-31, Ab1)	
	The **project software manager** explicitly assigns responsibility for software work products and activities. (L2-31, Ab2) The assigned responsibilities cover: ❑ The software work products to be developed or services to be provided. ❑ The effort and cost for these software activities. ❑ The schedule for these software activities. ❑ The budget for these software activities.	
	Adequate resources and funding are provided for tracking the software project. (L2-32, Ab3)	
	The **software managers** and the **software task leaders** are assigned specific responsibilities for tracking the software project. (L2-32, Ab3, 1)	
	Tools to support software tracking are made available. (L2-32, Ab3, 2)	

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SPTO Process - Entry Criteria, Continued

General entry criteria, continued

The CMM recommends that the conditions described in the table below be satisfied before entering the software project tracking and oversight process, continued from the previous page.

√	Condition	References
	The **software managers** are trained in managing the technical and personnel aspects of the software project. (L2-32, Ab4)	
	First-line software managers receive orientation in the technical aspects of the software project. (L2-32, Ab5)	

SPTO Process - Inputs

Inputs

The table below lists the recommended inputs to the software project tracking and oversight process.

√	Input	Org. Input	References
	Changes to commitments. (L2-34, A2, 2)		
	Changes to the software development plan. (L2-34, A2, 1)		
	New software project commitments. (L2-34, A2, 2)		
	Refinements to the software development plan. (L2-34, A2, 1)		
	Software commitments. (L2-36, A5, 5)		
	Software development plan. (L2-30, C1) [Refer to Level 2 Standards for additional information regarding a software development plan.]		
	Software planning data. (L2-38, A11, 3)		

SPTO Process - Activities

Activities

The table below lists the recommended activities for the software project tracking and oversight process.

√	Activities	References
	A documented software development plan is used for tracking the software activities and communicating status. (L2-33, A1) ❑ This software development plan is updated as the work progresses to reflect accomplishments, particularly when milestones are completed. (L2-33, A1, 1)	
	The project's software development plan is revised according to a documented procedure. (L2-33, A2) [Refer to Level 2 Procedure Checklists for additional information.]	
	Software project commitments and changes to commitments made to **individuals and groups external to the organization** are reviewed with **senior management** according to a documented procedure. (L2-35, A3)	
	Approved changes to commitments that affect the software project are communicated to the members of the **software engineering group** and other **software-related groups**. (L2-35, A4)	
	The size of the software work products (or size of the changes to the software work products) are tracked, and corrective actions are taken as necessary. (L2-35, A5) ❑ Sizes for all major software work products (or the size of the changes) are tracked. ❑ Actual size of code (generated, fully tested, and delivered) is compared to the estimates documented in the software development plan. ❑ Actual units of delivered documentation are compared to the estimates documented in the software development plan. ❑ Overall projected size of the software work products (estimates combined with actuals) is refined, monitored, and adjusted on a regular basis. ❑ Changes in size estimates of the software work products that affect software commitments are negotiated with the **affected groups** and are documented.	

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Activities, continued

The table below lists the recommended activities for the software project tracking and oversight process, continued from the previous page.

√	Activities	References
	The project's software effort and costs are tracked, and corrective actions are taken as necessary. (L2-36, A6) ❑ Actual expenditures of effort and costs over time and against work completed are compared to the estimates documented in the software development plan to identify potential overruns and underruns. ❑ Software costs are tracked and compared to the estimates documented in the software development plan. ❑ Effort and staffing are compared to the estimates documented in the software development plan. ❑ Changes in staffing and other software costs that affect software commitments are negotiated with the **affected groups** and are documented.	
	The project's critical computer resources are tracked, and corrective actions are taken as necessary. (L2-36, A7) ❑ The actual and projected use of the project's critical computer resources are tracked and compared to the estimates for each major software component as documented in the software development plan. ❑ Changes in estimates of critical computer resources that affect software commitments are negotiated with the **affected groups** and are documented.	
	The project's software schedule is tracked, and corrective actions are taken as necessary. (L2-37, A8) ❑ Actual completion of software activities, milestones, and other commitments is compared against the software development plan. ❑ Effects of late and early completion of software activities, milestones, and other commitments are evaluated for impacts on future activities and milestones. ❑ Software schedule revisions that affect software commitments are negotiated with the **affected groups** and are documented.	

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Activities, continued

The table below lists the recommended activities for the software project tracking and oversight process, continued from the previous page.

√	Activities	References
	Software engineering technical activities are tracked, and corrective actions are taken as necessary. (L2-37, A9) ❑ Members of the **software engineering group** report their technical status to their **first-line manager** on a regular basis. ❑ Software release contents for successive builds are compared to the plans documented in the software development plan. ❑ Problems identified in any of the software work products are reported and documented. ❑ Problem reports are tracked to closure.	
	The software risks associated with cost, resource, schedule, and technical aspects of the project are tracked. (L2-37, A10) ❑ The priorities of the risks and the contingencies for the risks are adjusted as additional information becomes available. ❑ High-risk areas are reviewed with the **project manager** on a regular basis.	
	Actual measurement data and replanning data for the software project are recorded. (L2-38, A11) ❑ Information recorded includes the estimates and associated information needed to reconstruct the estimates and verify their reasonableness. ❑ The software replanning data are managed and controlled. ❑ The software planning data, replanning data, and the actual measurement data are archived for use by ongoing and future projects.	
	The **software engineering group** conducts periodic internal reviews to track technical progress, plans, performance, and issues against the software development plan. (L2-38, A12) [Refer to SPTO Process Reviews and Audits for additional information.]	

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Activities, continued

The table below lists the recommended activities for the software project tracking and oversight process, continued from the previous page.

√	Activities	References
	Formal reviews to address the accomplishments and results of the software project are conducted at selected project milestones according to a documented procedure. (L2-39, A13) [Refer to SPTO Process Reviews and Audits for additional information.]	
	Measurements are made and used to determine the status of the software tracking and oversight activities. (L2-39, M1)	
	The activities for software project tracking and oversight are reviewed with **senior management** on a periodic basis. (L2-40, V1) [Refer to SPTO Process Reviews and Audits for additional information.]	
	The activities for software project tracking and oversight are reviewed with the **project manager** on both a periodic and event-driven basis. (L2-41, V2) [Refer to SPTO Process Reviews and Audits for additional information.]	
	The **software quality assurance group** reviews and/or audits the activities and work products for software project tracking and oversight and reports the results. (L2-41, V3) [Refer to SPTO Process Reviews and Audits for additional information.]	

SPTO Process - Outputs

Outputs

The table below lists the recommended outputs produced by the software project tracking and oversight process.

√	Output	Org. Output	References
	Action items (from reviews with **senior management**). (L2-40, V1, 4)		
	Action items (from reviews with the **project manager**). (L2-41, V2, 7)		
	Actual completion of milestones. (L2-37, A8, 1)		
	Actual completion of other (software) commitments. (L2-37, A8, 1)		
	Actual completion of software activities. (L2-37, A8, 1)		
	Actual expenditures of costs over time and against work completed. (L2-36, A6, 1)		
	Actual expenditures of effort over time and against work completed. (L2-36, A6, 1)		
	Actual measurement data for the software project. (L2-38, A11)		
	Actual replanning data for the software project. (L2-38, A11)		
	Actual size of code (generated, fully tested, and delivered). (L2-35, A5, 2)		
	Actual units of delivered documentation. (L2-35, A5, 3)		
	Actual use of the project's critical computer resources. (L2-36, A7, 1)		
	Approved changes to commitments that affect the software project. (L2-35, A4)		
	Changes in estimates of critical computer resources that affect software commitments. (L2-37, A7, 2)		
	Changes in size estimates of the software work products that affect software commitments. (L2-36, A5, 5)		
	Changes in staffing and other software costs that affect software commitments. (L2-36, A6, 4)		

	Changes to commitments made to **individuals and groups external to the organization**. (L2-35, A3)		

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SPTO Process - Outputs, Continued

Outputs, continued

The table below lists the recommended outputs produced by the software project tracking and oversight process, continued from the previous page.

√	Output	Org. Output	References
	Changes to the software commitments. (L2-31, C2, 5)		
	Conflicts and issues (not resolvable at lower levels). (L2-40, V1, 2)		
	Contingencies for the (software) risks. (L2-38, A10, 1)		
	Corrective actions (taken when the software plan is not being achieved). (L2-30, C2, 3)		
	Current estimates and actual use of critical computer resources. (L2-41, V2, 3)		
	Effects of late and early completion of software activities, milestones, and other commitments. (L2-37, A8, 2)		
	Effort and staffing. (L2-36, A6, 3)		
	High-risk areas. (L2-38, A10, 2)		
	Measurements (to determine the status of the software tracking and oversight activities). (L2-39, M1)		
	New software project commitments made to individuals and groups external to the organization. (L2-31, C2, 5)		
	Overall projected size of the software work products (estimates combined with actuals). (L2-35, A5, 4)		
	Performance (cost). (L2-40, V1, 1)		
	Performance (schedule). (L2-40, V1, 1)		
	Performance (staffing). (L2-40, V1, 1)		
	Performance (technical). (L2-40, V1, 1)		
	Priorities of the (software) risks. (L2-38, A10, 1)		
	Problem reports. (L2-37, A9, 4)		
	Problems identified in any of the software work products. (L2-37, A9, 3)		
	Projected use of the project's critical computer resources. (L2-36, A7, 1)		

	Project's critical computer resources. (L2-36, A7)		

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SPTO Process - Outputs, Continued

Outputs, continued

The table below lists the recommended outputs produced by the software project tracking and oversight process, continued from the previous page.

√	Output	Org. Output	References
	Project's software costs. (L2-36, A6)		
	Project's software effort. (L2-36, A6)		
	Project's software schedule. (L2-37, A8)		
	Results of **SQA group** reviews and/or audits of the activities and work products for software project tracking and oversight. (L2-41, V3)		
	Size of the changes to the software work products. (L2-35, A5)		
	Size of the software work products. (L2-35, A5)		
	Sizes for all major software work products. (L2-35, A5, 1)		
	Sizes of the changes to all major software work products. (L2-35, A5, 1)		
	Software costs. (L2-36, A6, 2)		
	Software development plan. (L2-33, A2)		
	Software planning data. (L2-38, A11, 3)		
	Software project commitments made to **individuals and groups external to the organization**. (L2-35, A3)		
	Software project risks. L2-40, V1, 3)		
	Software project's status and issues. (L2-30, C2, 2)		
	Software release contents for successive builds. (L2-37, A9, 2)		
	Software risks associated with cost aspects of the project. (L2-37, A10)		
	Software risks associated with resource aspects of the project. (L2-37, A10)		
	Software risks associated with schedule aspects of the project. (L2-37, A10)		
	Software risks associated with technical aspects of the project. (L2-37, A10)		

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SPTO Process - Outputs, Continued

Outputs, continued

The table below lists the recommended outputs produced by the software project tracking and oversight process, continued from the previous page.

√	Output	Org. Output	References
	Software schedule revisions that affect software commitments. (L2-37, A8, 3)		
	Status of software activities. (L2-33, A1)		
	Summary report from each review of activities for software project tracking and oversight with the **project manager.** (L2-41, V2, 8)		
	Summary status report from each periodic review of activities for software project tracking and oversight with **senior management.** (L2-40, V1, 5)		

SPTO Process - Exit Criteria

Output-based exit criteria

The CMM recommends that outputs satisfy the states described in the table below to exit the software project tracking and oversight process.

√	Output	State	References
	Action items (from reviews with **senior management**)	❑ are assigned. (L2-40, V1, 4) ❑ are reviewed. (L2-40, V1, 4) ❑ are tracked to closure. (L2-40, V1, 4)	
	Action items (from reviews with the **project manager**)	❑ are assigned. (L2-41, V2, 7) ❑ are reviewed. (L2-41, V2, 7) ❑ are tracked to closure. (L2-41, V2, 7)	
	Actual completion of milestones	is compared against the software development plan. (L2-37, A8, 1)	
	Actual completion of other (software) commitments	is compared against the software development plan. (L2-37, A8, 1)	
	Actual completion of software activities	is compared against the software development plan. (L2-37, A8, 1)	
	Actual expenditures of costs over time and against work completed	are compared to the estimates documented in the software development plan to identify potential overruns and underruns. (L2-36, A6, 1)	
	Actual expenditures of effort over time and against work completed	are compared to the estimates documented in the software development plan to identify potential overruns and underruns. (L2-36, A6, 1)	
	Actual measurement data for the software project	❑ are recorded. (L2-38, A11) ❑ include in the information recorded the estimates and associated information needed to reconstruct the estimates and verify their reasonableness. (L2-38, A11, 1) ❑ are archived for use by ongoing and future projects. (L2-38, A11, 3)	

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SPTO Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the software project tracking and oversight process, continued from the previous page.

√	Output	State	References
	Actual replanning data for the software project	❑ are recorded. (L2-38, A11) ❑ include in the information recorded the estimates and associated information needed to reconstruct the estimates and verify their reasonableness. (L2-38, A11, 1) ❑ are managed and controlled. (L2-38, A11, 2) ❑ are archived for use by ongoing and future projects. (L2-38, A11, 3)	
	Actual size of code (generated, fully tested, and delivered)	is compared to the estimates documented in the software development plan. (L2-35, A5, 2)	
	Actual units of delivered documentation	are compared to the estimates documented in the software development plan. (L2-35, A5, 3)	
	Actual use of the project's critical computer resources	❑ is tracked. (L2-36, A7, 1) ❑ is compared to the estimates for each major software component as documented in the software development plan. (L2-36, A7, 1)	
	Approved changes to commitments that affect the software project	are communicated to the members of the **software engineering group** and other **software-related groups**. (L2-35, A4)	
	Changes in estimates of critical computer resources that affect software commitments	❑ are negotiated with the **affected groups**. (L2-37, A7, 2) ❑ are documented. (L2-37, A7, 2)	

	Changes in size estimates of the software work products that affect software commitments	❑ are negotiated with the **affected groups**. (L2-36, A5, 5) ❑ are documented. (L2-36, A5, 5)	

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Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the software project tracking and oversight process, continued from the previous page.

√	Output	State	References
	Changes in staffing and other software costs that affect software commitments	❑ are negotiated with the **affected groups**. (L2-36, A6, 4) ❑ are documented. (L2-36, A6, 4)	
	Changes to commitments made to **individuals and groups external to the organization**	are reviewed with **senior management** according to a documented procedure. (L2-35, A3)	
	Changes to the software commitments	are made with the involvement and agreement of the **affected groups**. (L2-30, C2, 4)	
	Conflicts and issues (not resolvable at lower levels)	❑ are addressed (during reviews with **senior management**). L2-40, V1, 2) ❑ are addressed (during reviews with the **project manager**). (L2-41, V2, 2). (L2-40, V1, 5)	
	Contingencies for the (software) risks	are adjusted as additional information becomes available. (L2-38, A10, 1)	
	Corrective actions	are taken when the software plan is not being achieved, either by adjusting performance or by adjusting the plans. (L2-30, C2, 3)	
	Effects of late and early completion of software activities, milestones, and other commitments	are evaluated for impacts on future activities and milestones. (L2-37, A8, 2)	
	Effort and staffing	are compared to the estimates documented in the software development plan. (L2-36, A6, 3)	
	High-risk areas	are reviewed with the **project manager** on a regular basis. (L2-38, A10, 1)	

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SPTO Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the software project tracking and oversight process, continued from the previous page.

√	Output	State	References
	Measurements (to determine the status of the software tracking and oversight activities)	❑ are made. (L2-39, M1) ❑ are used. (L2-39, M1)	
	Overall projected size of the software work products (estimates combined with actuals)	is refined, monitored, and adjusted on a regular basis. (L2-35, A5, 4)	
	Performance (cost)	❑ is reviewed (during reviews with **senior management**). L2-40, V1, 1) ❑ is reviewed against the software development plan (during reviews with the **project manager**). (L2-41, V2, 2)	
	Performance (schedule)	❑ is reviewed (during reviews with **senior management**). L2-40, V1, 1) ❑ is reviewed against the software development plan (during reviews with the **project manager**). (L2-41, V2, 2)	
	Performance (staffing)	❑ is reviewed (during reviews with **senior management**). L2-40, V1, 1) ❑ is reviewed against the software development plan (during reviews with the **project manager**). (L2-41, V2, 2)	
	Performance (technical)	❑ is reviewed (during reviews with **senior management**). L2-40, V1, 1) ❑ is reviewed against the software development plan (during reviews with the **project manager**). (L2-41, V2, 2)	

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SPTO Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the software project tracking and oversight process, continued from the previous page.

√	Output	State	References
	Priorities of the (software) risks	are adjusted as additional information becomes available. (L2-38, A10, 1)	
	Problem reports	are tracked to closure. (L2-37, A9, 4)	
	Problems identified in any of the software work products	❑ are reported. (L2-37, A9, 3) ❑ are documented. (L2-37, A9, 3)	
	Project's critical computer resources	are tracked, and corrective actions are taken as necessary. (L2-36, A7)	
	Project's software costs	are tracked, and corrective actions are taken as necessary. (L2-36, A6)	
	Project's software effort	is tracked, and corrective actions are taken as necessary. (L2-36, A6)	
	Project's software schedule	is tracked, and corrective actions are taken as necessary. (L2-37, A8)	
	Projected use of the project's critical computer resources	❑ is tracked. (L2-36, A7, 1) ❑ is compared to the estimates for each major software component as documented in the software development plan. (L2-36, A7, 1)	
	Results of **SQA group** reviews and/or audits of the activities and work products for software project tracking and oversight	are reported. (L2-41, V3)	
	Size of the changes to the software work products	is tracked, and corrective actions are taken as necessary. (L2-35, A5)	
	Size of the software work products	is tracked, and corrective actions are taken as necessary. (L2-35, A5)	
	Sizes for all major software work products	are tracked, and corrective actions are taken as necessary. (L2-35, A5, A1)	

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SPTO Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the software project tracking and oversight process, continued from the previous page.

√	Output	State	References
	Sizes of the changes to all major software work products	are tracked, and corrective actions are taken as necessary. (L2-35, A5, A1)	
	Software costs	❑ are tracked. (L2-36, A6, 2) ❑ are compared to the estimates documented in the software development plan. (L2-36, A6, 2)	

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SPTO Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the software project tracking and oversight process, continued from the previous page.

√	Output	State	References

	Software development plan	❑ is documented. (L2-33, A1)
		❑ is used for tracking the software activities and communicating status. (L2-33, A1)
		❑ is updated as the work progresses to reflect accomplishments, particularly when milestones are completed. (L2-33, A1, 1)
		❑ is readily available to: (L2-33, A1, 2)
		  ❑ the software engineering group (including all subgroups, such as software design),
		  ❑ the software managers,
		  ❑ the project manager,
		  ❑ senior management, and
		  ❑ other affected groups.
		❑ is revised according to a documented procedure. (L2-33, A2)
		❑ is revised, as appropriate, to incorporate plan refinements and incorporate plan changes, particularly when plans change significantly. (L2-34, A2, 1)
		❑ is updated to incorporate all new software project commitments and changes to commitments. (L2-34, A2, 2)
		❑ is reviewed at each revision. (L2-34, A2, 3)
		❑ is managed and controlled. (L2-34, A2, 4)	

	Software planning data	are archived for use by ongoing and future projects. (L2-38, A11, 3)	

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Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the software project tracking and oversight process, continued from the previous page.

√	Output	State	References
	Software project commitments made to **individuals and groups external to the organization**	are reviewed with **senior management** according to a documented procedure. (L2-35, A3)	
	Software project risks	❑ are addressed (during reviews with **senior management**). L2-40, V1, 3) ❑ are addressed (during reviews with the **project manager**). (L2-41, V2, 6). (L2-40, V1, 5)	
	Software release contents for successive builds	are compared to the plans documented in the software development plan. (L2-37, A9, 2)	
	Software risks associated with cost aspects of the project	are tracked. (L2-37, A10)	
	Software risks associated with resource aspects of the project	are tracked. (L2-37, A10)	
	Software risks associated with schedule aspects of the project	are tracked. (L2-37, A10)	
	Software risks associated with technical aspects of the project	are tracked. (L2-37, A10)	
	Software schedule revisions that affect software commitments	❑ are negotiated with the **affected groups**. (L2-37, A8, 3) ❑ are documented. (L2-37, A8, 3)	
	Summary status report (from each review with **senior management**)	❑ is prepared. (L2-40, V1, 5) ❑ is distributed to the **affected groups**. (L2-40, V1, 5)	

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SPTO Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the software project tracking and oversight process, continued from the previous page.

√	Output	State	References
	Summary status report (from each review with the **project manager**)	❑ is prepared. (L2-41, V2, 8) ❑ is distributed to the **affected groups**. (L2-41, V2, 8)	

General exit criteria

The CMM recommends that the conditions described in the table below be satisfied to exit the software project tracking and oversight process.

√	Condition	References
	The **project manager** is kept informed of the software project's status and issues. (L2-30, C2, 2)	
	Senior management reviews all commitment changes and new software project commitments made to **individuals and groups external to the organization**. (L2-31, C2, 5)	
	Software engineering technical activities are tracked, and corrective actions are taken as necessary. (L2-37, A9)	
	Members of the **software engineering group** report their technical status to their **first-line manager** on a regular basis. (L2-37, A9, 1)	
	The **software engineering group** conducts periodic internal reviews to track technical progress, plans, performance, and issues against the software development plan. (L2-38, A12)	
	Formal reviews to address the accomplishments and results of the software project are conducted at selected project milestones according to a documented procedure. (L2-39, A13)	
	The activities for software project tracking and oversight are reviewed with **senior management** on a periodic basis. (L2-40, V1)	
	The activities for software project tracking and oversight are reviewed with the **project manager** on both a periodic and event-driven basis. (L2-41, V2)	
	The **software quality assurance group** reviews and/or audits the activities and work products for software project tracking and oversight and reports the results. (L2-41, V3)	

SPTO Process - Reviews and Audits

Reviews and audits

The table below lists the recommended reviews and audits for the software project tracking and oversight process.

√	Review or Audit	Review Participants	References
	Senior management reviews all commitment changes and new software project commitments made to individuals and groups external to the organization. (L2-31, C2, 5)	**Senior management**	
	The software development plan is reviewed at each revision. (L2-34, A2, 3)	**Not specified in CMM**	
	Software project commitments and changes to commitments made to **individuals and groups external to the organization** are reviewed with **senior management** according to a documented procedure. (L2-35, A3)	**Senior management**	
	High-risk areas are reviewed with the **project manager** on a regular basis. (L2-38, A10, 2)	**Project manager**	
	The **software engineering group** conducts periodic internal reviews to track technical progress, plans, performance, and issues against the software development plan. (L2-38, A12) These reviews are conducted between: ❑ The **first-line software managers** and their **software task leaders**. ❑ The **project software manager, first-line software managers,** and other **software managers**, as appropriate.	**Software engineering group** **First-line software managers** **Project software manager** **Software managers** **Software task leaders**	

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Reviews and audits, continued

The table below lists the recommended reviews and audits for the software project tracking and oversight process, continued from the previous page.

√	Review or Audit	Review Participants	References
	Formal reviews to address the accomplishments and results of the software project are conducted at selected project milestones according to a documented procedure. (L2-39, A13) These reviews: ❑ Are planned to occur at meaningful points in the software project's schedule, such as the beginning or completion of selected stages. ❑ Are conducted with the **customer**, **end user**, and **affected groups** within the organization, as appropriate. ❑ Use materials that are reviewed and approved by the responsible **software managers**. ❑ Address the commitments, plans, and status of the software activities. ❑ Result in the identification and documentation of significant issues, action items, and decisions. ❑ Address the software project risks. ❑ Result in the refinement of the software development plan as necessary.	**Customer** **End user** **Software managers** **Affected groups**	

	The activities for software project tracking and oversight are reviewed with **senior management** on a periodic basis. (L2-40, V1) ❑ The technical, cost, staffing, and schedule performance are reviewed. ❑ Conflicts and issues not resolvable at lower levels are addressed. ❑ Software project risks are addressed. ❑ Action items are assigned, reviewed, and tracked to closure. ❑ A summary status report from each meeting is prepared and distributed to the **affected groups**.	**Senior management** **Affected groups**	

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Reviews and audits, continued

The table below lists the recommended reviews and audits for the software project tracking and oversight process, continued from the previous page.

√	Review or Audit	Review Participants	References
	The activities for software project tracking and oversight are reviewed with the **project manager** on both a periodic and event-driven basis. (L2-41, V2) ❑ **Affected groups** are represented. ❑ The technical, cost, staffing, and schedule performance is reviewed against the software development plan. ❑ Use of critical computer resources is reviewed; current estimates and actual use of these critical computer resources are reported against the original estimates. ❑ Dependencies between groups are addressed. ❑ Conflicts and issues not resolvable at lower levels are addressed. ❑ Software project risks are addressed. ❑ Action items are assigned, reviewed, and tracked to closure. ❑ A summary report from each meeting is prepared and distributed to the **affected groups**.	**Project manager** **Affected groups**	

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Reviews and audits, continued

The table below lists the recommended reviews and audits for the software project tracking and oversight process, continued from the previous page.

√	Review or Audit	Review Participants	References
	The **software quality assurance group** reviews and/or audits the activities and work products for software project tracking and oversight and reports the results. (L2-41, V3) At a minimum, the reviews and/or audits verify: ❑ The activities for reviewing and revising commitments. ❑ The activities for revising the software development plan. ❑ The content of the revised software development plan. ❑ The activities for tracking the software project's cost, schedule, risks, technical and design constraints, and functionality and performance. ❑ The activities for conducting the planned technical and management reviews.	**SQA group**	

SPTO Process - Work Products Managed and Controlled

Work products managed and controlled

The table below lists the work products recommended to be managed and controlled during the software project tracking and oversight process.

√	Work Products Managed and Controlled	References
	Software development plan. (L2-34, A2, 4)	
	Software replanning data. (L2-38, A11, 2)	

SPTO Process - Measurements

Measurements

The table below lists the measurements recommended for the software project tracking and oversight process.

√	Measurements	References
	Actual measurement data for the software project. (L2-38, A11)	
	Replanning data for the software project. (L2-38, A11)	
	Measurements to determine the status of the software tracking and oversight activities. (L2-39, M1) Examples of measurements include: ❑ Effort and other resources expended in performing the tracking and oversight activities. ❑ Change activity for the software development plan, which includes changes to size estimates of the software work products, software cost estimates, critical computer resources estimates, and schedule.	

SPTO Process - Documented Procedures

Documented procedures

The table below lists the activities for the software process tracking and oversight process recommended to be performed according to a documented procedure.

√	Documented procedures	References
	The project's software development plan is revised according to a documented procedure. (L2-33, A2) [Refer to Level 2 Procedure Checklists for additional information.]	
	Software project commitments and changes to commitments made to **individuals and groups external to the organization** are reviewed with **senior management** according to a documented procedure. (L2-35, A3)	
	Formal reviews to address the accomplishments and results of the software project are conducted at selected project milestones according to a documented procedure. (L2-39, A13)	

SPTO Process - Training

Training

The table below lists the training recommended for the software project tracking and oversight process.

√	Training	References
	The **software managers** are trained in managing the technical and personnel aspects of the software project. (L2-32, Ab4)	
	First-line software managers receive orientation in the technical aspects of the software project. (L2-32, Ab5)	

SPTO Process - Tools

Tools

The table below lists the tools recommended for the software project tracking and oversight process.

√	Tools	References
	Tools to support software tracking. (L2-32, Ab3, 2) Examples of support tools include: ❑ spreadsheet programs, and ❑ project planning/scheduling programs.	

Software Subcontract Management (SSM) Process

SSM Process - Overview

SSM process purpose

The purpose of Software Subcontract Management is to select qualified software subcontractors and manage them effectively. (L2-43)

SSM process description

Software Subcontract Management involves selecting a software subcontractor, establishing commitments with the subcontractor, and tracking and reviewing the subcontractor's performance and results. These practices cover the management of a software (only) subcontract, as well as the management of the software component of a subcontract that includes software, hardware, and possibly other system components.

The subcontractor is selected based on its ability to perform the work. Many factors contribute to the decision to subcontract a portion of the prime contractor's work. Subcontractors may be selected based on strategic business alliances, as well as technical considerations. The practices of this key process area address the traditional acquisition process associated with subcontracting a defined portion of the work to another organization.

When subcontracting, a documented agreement covering the technical and nontechnical (e.g., delivery dates) requirements is established and is used as the basis for managing the subcontract. The work to be done by the subcontractor and the plans for the work are documented. The standards that are to be followed by the subcontractor are compatible with the prime contractor's standards.

The software planning, tracking, and oversight activities for the subcontracted work are performed by the subcontractor. The prime contractor ensures that these planning, tracking, and oversight activities are performed appropriately and that the software products delivered by the subcontractor satisfy their acceptance criteria. The prime contractor works with the subcontractor to manage their product and process interfaces. (L2-43)

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Section overview

The table below contains a description and the location of each checklist for this key process area.

Checklist	Description	Page
Roles	List of roles participating in process activities.	L2-Process-99
Entry Criteria	Description of when the process can start.	L2-Process-106
Inputs	Description of the work products used by the process.	L2-Process-107
Activities	Description of the activities of the process.	L2-Process-109
Outputs	Description of the work products produced by the process.	L2-Process-111
Exit Criteria	Description of when the process is complete.	L2-Process-113
Reviews and Audits	List of reviews and audits.	L2-Process-119
Work Products Managed and Controlled	List of work products to be managed and controlled.	L2-Process-124
Measurements	Description of process measurements.	L2-Process-125
Documented Procedures	List of the activities to be completed according to a documented procedure.	L2-Process-126
Training	List of training.	L2-Process-127
Tools	List of tools.	L2-Process-128

SSM Process - Roles

Roles

The table below lists the roles and the activities in which they participate in the software subcontract management process.

√	Role	Activities Participated in...	Reference
	Affected groups (parties)	❑ Changes to the software subcontractor's statement of work, subcontract terms and conditions, and other commitments are resolved according to a documented procedure. (L2-51, A6) ❑ This procedure typically specifies that all **affected groups** of both the prime contractor and the subcontractor are involved. ❑ The subcontract manager is responsible for coordinating the technical scope of work to be subcontracted and the terms and conditions of the subcontract with the **affected parties**. (L2-45, C2, 2)	
	Customers	The subcontractor is provided with visibility of the needs and desires of the product's **customers** and end users, as appropriate. (L2-52, A7, 1)	
	End users	The subcontractor is provided with visibility of the needs and desires of the product's customers and **end users**, as appropriate. (L2-52, A7, 1)	

	Individuals	❑ The subcontract manager is knowledgeable and experienced in software engineering or has **individuals** assigned who have that knowledge and experience. (L2-45, C2, 1) ❑ Software managers and other **individuals** are assigned specific responsibilities for managing the subcontract. (L2-46, Ab1, 1) ❑ Software managers and other **individuals** who are involved in establishing and managing the software subcontract are trained to perform these activities. (L2-46, Ab2) ❑ Software managers and other **individuals** who are involved in managing the software subcontract receive orientation in the technical aspects of the subcontract. (L2-46, Ab3)	

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Roles, continued

The table below lists the roles and the activities in which they participate in the software subcontract management process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Prime contractor	❑ Changes to the subcontract are made with the involvement and agreement of both the **prime contractor** and the subcontractor. (L2-45, C1, 3) ❑ The contractual agreement between the **prime contractor** and the software subcontractor is used as the basis for managing the subcontract. (L2-50,A3) ❑ A documented subcontractor's software development plan is reviewed and approved by the **prime contractor**. (L2-51, A4) ❑ Critical dependencies and commitments between the **prime contractor** and the subcontractor are addressed. (L2-52, A7, 5) ❑ Subcontractor commitments to the **prime contractor** and prime contractor commitments to the subcontractor are both reviewed. ❑ The **prime contractor** and the subcontractor coordinate their activities on matters relating to software configuration management to ensure that the subcontractor's products can be readily integrated or incorporated into the project environment of the **prime contractor**. (L2-54, A11, 2) ❑ The **prime contractor** conducts acceptance testing as part of the delivery of the subcontractor's software products according to a documented procedure. (L2-55, A12) ❑ The acceptance procedures and acceptance criteria for each product are defined, reviewed, and approved by both the **prime contractor** and the subcontractor prior to the acceptance test. (L2-55, A12, 1)	

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SSM Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the software subcontract management process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Prime contractor's SCM group	The **prime contractor's software configuration management group** monitors the subcontractor's activities for software configuration management according to a documented procedure. (L2-54, A11)	
	Prime contractor's SQA group or **SQA group**	❑ The **prime contractor's software quality assurance group** monitors the subcontractor's software quality assurance activities according to a documented procedure. (L2-53, A10) ❑ The **prime contractor's software quality assurance group** spot checks the subcontractor's software engineering activities and products. (L2-54, A10, 2.1) ❑ The **prime contractor's software quality assurance group** audits the subcontractor's software quality assurance records, as appropriate. (L2-54, A10, 2.2) ❑ The **software quality assurance group** reviews and/or audits the activities and work products for managing the software subcontract and reports the results. (L2-57, V3)	
	Prime contractor's management	The **prime contractor's management** conducts periodic status/coordination reviews with the software subcontractor's management. (L2-51, A7)	
	Project manager	The activities for managing the software subcontract are reviewed with the **project manager** on both a periodic and event-driven basis. (L2-56, V2)	

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Roles, continued

The table below lists the roles and the activities in which they participate in the software subcontract management process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Senior management	The activities for managing the software subcontract are reviewed with **senior management** on a periodic basis. (L2-56, V1)	
	Software managers	❑ **Software managers** and other individuals are assigned specific responsibilities for managing the subcontract. (L2-46, Ab1, 1) ❑ **Software managers** and other individuals who are involved in establishing and managing the software subcontract are trained to perform these activities. (L2-46, Ab2) ❑ **Software managers** and other individuals who are involved in managing the software subcontract receive orientation in the technical aspects of the subcontract. (L2-46, Ab3)	
	Software sub-contractor's management	The prime contractor's management conducts periodic status/coordination reviews with the **software subcontractor's management**. (L2-51, A7)	
	Subcontract bidder	The software subcontractor is selected, based on an evaluation of the **subcontract bidders'** ability to perform the work, according to a documented procedure. (L2-49, A2)	

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SSM Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the software subcontract management process, continued from the previous page.

√	Role	Activities Participated in...	Reference

	Subcontract manager	❑ A **subcontract manager** is designated to be responsible for establishing and managing the software subcontract. (L2-45, C2)
		❑ The **subcontract manager** is knowledgeable and experienced in software engineering or has individuals assigned who have that knowledge and experience. (L2-45, C2, 1)
		❑ The **subcontract manager** is responsible for coordinating the technical scope of work to be subcontracted and the terms and conditions of the subcontract with the affected parties. (L2-45, C2, 2)
		❑ The **subcontract manager** is responsible for: (L2-45, C2, 3)
		  ❑ selecting the software subcontractor,
		  ❑ managing the software subcontract, and
		  ❑ arranging for the post-subcontract support of the subcontracted products.	

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Roles, continued

The table below lists the roles and the activities in which they participate in the software subcontract management process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Software subcontractor	❑ Changes to the subcontract are made with the involvement and agreement of both the prime contractor and the **subcontractor**. (L2-45, C1, 3) ❑ The **software subcontractor** is selected, based on an evaluation of the subcontract bidders' ability to perform the work, according to a documented procedure. (L2-49, A2) ❑ The contractual agreement between the prime contractor and the **software subcontractor** is used as the basis for managing the subcontract. (L2-50, A3) ❑ The **subcontractor** is provided with visibility of the needs and desires of the product's customers and end users, as appropriate. (L2-52, A7, 1) ❑ Critical dependencies and commitments between the prime contractor and the **subcontractor** are addressed. (L2-52, A7, 5) ❑ Subcontractor commitments to the prime contractor and prime contractor commitments to the **subcontractor** are both reviewed. ❑ Periodic technical reviews and interchanges are held with the **software subcontractor**. (L2-52, A8) ❑ The prime contractor and the **subcontractor** coordinate their activities on matters relating to software configuration management to ensure that the subcontractor's products can be readily integrated or incorporated into the project environment of the prime contractor. (L2-54, A11, 2)	
Role continues on the next page			

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SSM Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the software subcontract management process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Software subcontractor, continued	❑ The acceptance procedures and acceptance criteria for each product are defined, reviewed, and approved by both the prime contractor and the **subcontractor** prior to the test. (L2-55, A12, 1) ❑ The software subcontractor's performance is evaluated on a periodic basis, and the evaluation is reviewed with the **subcontractor**. (L2-55, A13)	
	Software subcontractor groups	Critical dependencies and commitments between the subcontractor's software engineering group and other **subcontractor groups** are addressed. (L2-52, A7, 4)	
	Software subcontractor's software engineering group	Critical dependencies and commitments between the **subcontractor's software engineering group** and other subcontractor groups are addressed. (L2-52, A7, 4)	

SSM Process - Entry Criteria

Input-based entry criteria

There are no input-based entry criteria in the software subcontract management process.

General entry criteria

The CMM recommends that the conditions described in the table below be satisfied before entering the software subcontract management process.

√	Condition	References
	The project follows a written organizational policy for managing the software subcontract. (L2-44, C1) [Refer to Level 2 Policies for additional information regarding SSM policy.]	
	A **subcontract manager** is designated to be responsible for establishing and managing the software subcontract. (L2-45, C2)	
	The **subcontract manager** is knowledgeable and experienced in software engineering or has individuals assigned who have that knowledge and experience. (L2-45, C2, 1)	
	Adequate resources and funding are provided for selecting the **software subcontractor** and managing the subcontract. (L2-46, Ab1)	
	Software managers and other **individuals** are assigned specific responsibilities for managing the subcontract. (L2-46, Ab1, 1)	
	Tools to support managing the subcontract are made available. (L2-46, Ab1, 2)	
	Software managers and other **individuals** who are involved in establishing and managing the software subcontract are trained to perform these activities. (L2-46, Ab2)	
	Software managers and other **individuals** who are involved in managing the software subcontract receive orientation in the technical aspects of the subcontract. (L2-46, Ab3)	

SSM Process - Inputs

Inputs

The table below lists the recommended inputs to the software subcontract management process.

√	Input	Org. Input	References
	Acceptance procedures and acceptance criteria for each product. (L2-55, A12, 1)		
	Computer resources designated as critical for the project. (L2-52, A7, 3)		
	Conflicts and issues not resolvable by the subcontractor. (L2-52, A7, 8)		
	Critical dependencies and commitments between the **prime contractor** and the **subcontractor**. (L2-52, A7, 5)		
	Critical dependencies and commitments between the **subcontractor's software engineering group** and other **subcontractor groups**. (L2-52, A7, 4)		
	Needs and desires of the product's **customers** and **end users**. (L2-52, A7, 1)		
	Prior performance records on similar work, if available. (L2-49, A2, 2)		
	Project risks involving the subcontractor's work. (L2-52, A7, 7)		
	Project's software development plan. (L2-47, A1, 2.4)		
	Project's software requirements. (L2-47, A1, 2.3)		
	Project's standards and procedures. (L2-47, A1, 2.5)		
	Project's statement of work. (L2-47, A1, 2.1) [Refer to Level 2 Standards for additional information regarding a statement of work.]		
	Project's system requirements allocated to software. (L2-47, A1, 2.2) [Refer to Level 2 Standards for additional information regarding system requirements allocated to software.]		
	Proposals submitted for the planned subcontract. (L2-49, A2, 1)		
	Subcontracted products. (L2-45, C2, 3.3)		

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SSM Process - Inputs, Continued

Inputs, continued

The table below lists the recommended inputs to the software subcontract management process, continued from the previous page.

√	Input	Org. Input	References
	Subcontractor's cost performance. (L2-52, A7, 2)		
	Subcontractor's plans. (L2-54, A10, 1)		
	Subcontractor's procedures. (L2-54, A10, 1)		
	Subcontractor's products. (L2-54, A10, 2.1)		
	Subcontractor's resources. (L2-54, A10, 1)		
	Subcontractor's schedule performance. (L2-52, A7, 2)		
	Subcontractor's software baseline library. (L2-54, A11, 3)		
	Subcontractor's software engineering accomplishments and results. (L2-53, A9)		
	Subcontractor's SQA records. (L2-54, A10, 2.2)		
	Subcontractor's staffing performance. (L2-52, A7, 2)		
	Subcontractor's standards. (L2-54, A10, 1)		
	Subcontractor's technical performance. (L2-52, A7, 2)		
	Technical and nontechnical characteristics of the project. (L2-47, A1, 1)		

SSM Process - Activities

Activities

The table below lists the recommended activities for the software subcontract management process.

√	Activities	References
	The work to be subcontracted is defined and planned according to a documented procedure. (L2-47, A1) [Refer to Level 2 Procedure Checklists for additional information.]	
	The **software subcontractor** is selected based on an evaluation of the subcontract bidders' ability to perform the work, according to a documented procedure. (L2-49, A2) [Refer to Level 2 Procedure Checklists for additional information.]	
	The contractual agreement between the **prime contractor** and the **software subcontractor** is used as the basis for managing the subcontract. (L2-50, A3) [Refer to SPF Standards for additional information regarding the contractual agreement.]	
	A documented subcontractor's software development plan is reviewed and approved by the **prime contractor**. (L2-51, A4) [Refer to SSM Process Reviews and Audits for additional information.]	
	A documented and approved subcontractor's software development plan is used for tracking the software activities and communicating status. (L2-51, A5)	
	Changes to the software subcontractor's statement of work, subcontract terms and conditions, and other commitments are resolved according to a documented procedure. (L2-51, A6) [Refer to Level 2 Procedure Checklists for additional information.]	
	The **prime contractor's management** conducts periodic status/coordination reviews with the **software subcontractor's management**. (L2-51, A7) [Refer to SSM Process Reviews and Audits for additional information.]	
	Periodic technical reviews and interchanges are held with the **software subcontractor**. (L2-52, A8) [Refer to SSM Process Reviews and Audits for additional information.]	

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Activities, continued

The table below lists the recommended activities for the software subcontract management process, continued from the previous page.

√	Activities	References
	Formal reviews to address the subcontractor's software engineering accomplishments and results are conducted at selected milestones according to a documented procedure. (L2-53, A9) [Refer to Level 2 Procedure Checklists for additional information.]	
	The **prime contractor's software quality assurance group** monitors the subcontractor's software quality assurance activities according to a documented procedure. (L2-53, A10) [Refer to Level 2 Procedure Checklists for additional information.]	
	The **prime contractor's software configuration management group** monitors the subcontractor's activities for software configuration management according to a documented procedure. (L2-54, A11) [Refer to Level 2 Procedure Checklists for additional information.]	
	The **prime contractor** conducts acceptance testing as part of the delivery of the subcontractor's software products according to a documented procedure. (L2-55, A12) [Refer to Level 2 Procedure Checklists for additional information.]	
	The **software subcontractor's** performance is evaluated on a periodic basis, and the evaluation is reviewed with the **subcontractor**. (L2-55, A13)	
	Measurements are made and used to determine the status of the activities for managing the software subcontract. (L2-55, M1)	
	The activities for managing the software subcontract are reviewed with **senior management** on a periodic basis. (L2-56, V1)	
	The activities for managing the software subcontract are reviewed with the **project manager** on both a periodic and event-driven basis. (L2-56, V2)	

	The **software quality assurance group** reviews and/or audits the activities and work products for managing the software subcontract and reports the results. (L2-57, V3) [Refer to SSM Process Reviews and Audits for additional information.]	

SSM Process - Outputs

Outputs

The table below lists the recommended outputs produced by the software subcontract management process.

√	Output	Org. Output	References
	Acceptance criteria for each product. (L2-55, A12, 1)		
	Acceptance procedures for each product. (L2-55, A12, 1)		
	Action items resulting from periodic status/coordination reviews with the **software subcontractor's management**. (L2-52, A7, 9)		
	Action plan for any software product that does not pass its acceptance test. (L2-55, A12, 3)		
	Changes to the software subcontractor's statement of work. (L2-51, A6)		
	Changes to the subcontract terms and conditions. (L2-51, A6)		
	Changes to the subcontract. (L2-45, C1, 3)		
	Contractual agreements. (L2-45, C1, 2) [Refer to Level 2 Standards for additional information regarding contractual agreements.]		
	Evaluation of the subcontract bidders' ability to perform the work. (L2-49, A2)		
	Functions or subsystems to be subcontracted. (L2-47, A1, 1.1)		
	List of dependencies between the **subcontractor** and the **prime contractor**. (L2-50, A3, 4)		
	Measurements (to determine the status of the activities for managing the software subcontract). (L2-55, M1)		
	Nonconformance to the subcontract. (L2-52, A7, 6)		
	Plan for selecting a **subcontractor**. (L2-48, A1, 4)		
	Requirements for the products to be developed (by the **subcontractor**). (L2-50, A3, 3)		

Continued on next page

SSM Process - Outputs, Continued

Outputs, continued

The table below lists the recommended outputs produced by the software subcontract management process, continued from the previous page.

√	Output	Org. Output	References
	Results of the acceptance tests. (L2-55, A12, 2)		
	Significant issues, action items, and decisions resulting from formal reviews of the subcontractor's software engineering accomplishments. (L2-53, A9, 3)		
	Software products and activities to be subcontracted. (L2-47, A1, 1)		
	Software risks. (L2-53, A9, 4)		
	Specification of the software products and activities to be subcontracted. (L2-47, A1, 1.2)		
	Specification of work to be subcontracted. (L2-47, A1, 2)		
	Subcontract statement of work. (L2-47, A1, 3)		
	Subcontractor’s software development plan. (L2-51, A4)		
	Work to be subcontracted. (L2-47, A1)		

SSM Process - Exit Criteria

Output-based exit criteria

The CMM recommends that outputs satisfy the states described in the table below to exit the software subcontract management process.

√	Output	State	References
	Acceptance criteria for each product	❑ are defined by both the **prime contractor** and the **subcontractor** prior to acceptance testing. (L2-55, A12, 1) ❑ are reviewed by both the **prime contractor** and the **subcontractor** prior to acceptance testing. (L2-55, A12, 1) ❑ are approved by both the **prime contractor** and the **subcontractor** prior to acceptance testing. (L2-55, A12, 1)	
	Acceptance procedures for each product	❑ are defined by both the **prime contractor** and the **subcontractor** prior to acceptance testing. (L2-55, A12, 1) ❑ are reviewed by both the **prime contractor** and the **subcontractor** prior to acceptance testing. (L2-55, A12, 1) ❑ are approved by both the **prime contractor** and the **subcontractor** prior to acceptance testing. (L2-55, A12, 1)	
	Action items resulting from periodic status/coordination reviews with the software subcontractor's management	❑ are assigned. (L2-52, A7, 9) ❑ are reviewed. (L2-52, A7, 9) ❑ are tracked to closure. (L2-52, A7, 9)	

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SSM Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the software subcontract management process, continued from the previous page.

√	Output	State	References
	Action plan for any software product that does not pass its acceptance test	is established. (L2-55, A12, 3)	
	Changes to the software subcontractor's statement of work	are resolved according to a documented procedure. (L2-51, A6)	
	Changes to the software subcontract terms and conditions and other commitments	are resolved according to a documented procedure. (L2-51, A6)	
	Changes to the subcontract	are made with the involvement and agreement of both the **prime contractor** and the **subcontractor**. (L2-45, C1, 3)	
	Contractual agreement(s)	form the basis for managing the subcontract. (L2-45, C1, 2)	
	Functions or subsystems to be subcontracted	are selected to match the skills and capabilities of potential subcontractors. (L2-47, A1, 1.1)	
	Measurements (to determine the status of the activities for managing the software subcontract)	❑ are made. (L2-55, M1) ❑ are used. (L2-55, M1)	
	Nonconformance to the subcontract	is addressed. (L2-52, A7, 6)	
	Plan for selecting a subcontractor	❑ is prepared concurrent with the subcontract statement of work. (L2-48, A1, 4) ❑ is reviewed, as appropriate. (L2-48, A1, 4)	
	Results of the acceptance tests	are documented. (L2-55, A12, 2)	

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SSM Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the software subcontract management process, continued from the previous page.

√	Output	State	References
	Significant issues, action items, and decisions resulting from formal reviews of the subcontractor's software engineering accomplishments	❑ are identified. (L2-53, A9, 3) ❑ are documented. (L2-53, A9, 3)	
	Software products and activities to be subcontracted	are selected based on a balanced assessment of both technical and nontechnical characteristics of the project. (L2-47, A1, 1)	
	Specification of the software products and activities to be subcontracted	is determined based on a systematic analysis and appropriate partitioning of the system and software requirements. (L2-47, A1, 1.2)	
	Specification of work to be subcontracted	is derived from the project's: (L2-47, A1, 2) ❑ statement of work, ❑ system requirements allocated to software, ❑ software requirements, ❑ software development plan, and ❑ software standards and procedures.	
	Subcontract statement of work	is: (L2-47, A1, 3) ❑ prepared, ❑ reviewed, ❑ agreed to, ❑ revised when necessary, and ❑ managed and controlled.	

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SSM Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the software subcontract management process, continued from the previous page.

√	Output	State	References
	Subcontractor's software development plan	❑ is documented. (L2-51, A4) ❑ is reviewed and approved by the **prime contractor**. (L2-51, A4) ❑ covers (directly or by reference) the appropriate items from the prime contractor's software development plan. (L2-51, A4, 1) ❑ is used for tracking the software activities and communicating status. (L2-51, A5) ❑ is refined, as appropriate. (L2-53, A9, 5)	
	Work to be subcontracted	is defined and planned according to a documented procedure. (L2-47, A1)	

General exit criteria

The CMM recommends that the conditions described in the table below be satisfied to exit the software subcontract management process.

√	Condition	References
	Documented standards and procedures are used in selecting **software subcontractors** and managing the software subcontracts. (L2-45, C1, 1)	
	The **software subcontractor** is selected based on an evaluation of the subcontract bidders' ability to perform the work, according to a documented procedure. (L2-49, A2)	

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General exit criteria, continued

The CMM recommends that the conditions described in the table below be satisfied to exit the software subcontract management process, continued from the previous page.

√	Condition	References
	The **prime contractor's management** conducts periodic status/coordination reviews with the **software subcontractor's management**. (L2-51, A7) ❑ The **subcontractor** is provided with visibility of the needs and desires of the product's **customers** and **end users**, as appropriate. ❑ The subcontractor's technical, cost, staffing, and schedule performance is reviewed against the subcontractor's software development plan. ❑ Computer resources designated as critical for the project are reviewed; the subcontractor's contribution to the current estimates are tracked and compared to the estimates for each software component as documented in the subcontractor's software development plan. ❑ Critical dependencies and commitments between the **subcontractor's software engineering group** and other **subcontractor groups** are addressed. ❑ Critical dependencies and commitments between the **prime contractor** and the **subcontractor** are addressed. ❑ Subcontractor commitments to the **prime contractor** and prime contractor commitments to the **subcontractor** are both reviewed. ❑ Nonconformance to the subcontract is addressed. ❑ Project risks involving the subcontractor's work are addressed. ❑ Conflicts and issues not resolvable internally by the **subcontractor** are addressed. ❑ Action items are assigned, reviewed, and tracked to closure.	
	Periodic technical reviews and interchanges are held with the **software subcontractor**. (L2-52, A8)	
	Formal reviews to address the subcontractor's software engineering accomplishments and results are conducted at selected milestones according to a documented procedure. (L2-53, A9)	

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SSM Process - Exit Criteria, Continued

General exit criteria, continued

The CMM recommends that the conditions described in the table below be satisfied to exit the software subcontract management process, continued from the previous page.

√	Condition	References
	The **prime contractor's software quality assurance group** monitors the subcontractor's software quality assurance activities according to a documented procedure. (L2-53, A10)	
	The **prime contractor's software configuration management group** monitors the subcontractor's activities for software configuration management according to a documented procedure. (L2-54, A11)	
	The **prime contractor** conducts acceptance testing as part of the delivery of the subcontractor's software products according to a documented procedure. (L2-55, A12)	
	The software subcontractor's performance is evaluated on a periodic basis, and the evaluation is reviewed with the **subcontractor**. (L2-55, A13)	
	The activities for managing the software subcontract are reviewed with **senior management** on a periodic basis. (L2-56, V1)	
	The activities for managing the software subcontract are reviewed with the **project manager** on both a periodic and event-driven basis. (L2-56, V2)	
	The **software quality assurance group** reviews and/or audits the activities and work products for managing the software subcontract and reports the results. (L2-57, V3)	

SSM Process - Reviews and Audits

Reviews and audits

The table below lists the recommended reviews and audits for the software subcontract management process.

√	Review or Audit	Review Participants	References
	A documented subcontractor's software development plan is reviewed and approved by the **prime contractor**. (L2-51, A4) ❑ This software development plan covers (directly or by reference) the appropriate items from the prime contractor's software development plan.	**Prime contractor**	
	The **prime contractor's management** conducts periodic status/coordination reviews with the **software subcontractor's management**. (L2-51, A7) ❑ The **subcontractor** is provided with visibility of the needs and desires of the product's **customers** and **end users**, as appropriate. ❑ The subcontractor's technical, cost, staffing, and schedule performance is reviewed against the subcontractor's software development plan. ❑ Computer resources designated as critical for the project are reviewed; the subcontractor's contribution to the current estimates are tracked and compared to the estimates for each software component as documented in the subcontractor's software development plan. ❑ Critical dependencies and commitments between the **subcontractor's software engineering group** and other **subcontractor groups** are addressed.	**Prime contractor's management** **Software sub-contractor's management** **Subcontractor** **Sub-contractor's software engineering group** **Subcontractor groups**	
	Review continues on the next page		

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Reviews and audits, continued

The table below lists the recommended reviews and audits for the software subcontract management process, continued from the previous page.

√	Review or Audit	Review Participants	References
	Review continued from previous page		
	❑ Critical dependencies and commitments between the **prime contractor** and the **subcontractor** are addressed. ❑ Subcontractor commitments to the **prime contractor** and prime contractor commitments to the **subcontractor** are both reviewed. ❑ Nonconformance to the subcontract is addressed. ❑ Project risks involving the subcontractor's work are addressed. ❑ Conflicts and issues not resolvable internally by the **subcontractor** are addressed. ❑ Action items are assigned, reviewed, and tracked to closure.	**Prime contractor** **Subcontractor**	
	Periodic technical reviews and interchanges are held with the **software subcontractor**. (L2-52, A8) These reviews: ❑ Provide the **subcontractor** with visibility of the customer's and end users' needs and desires, as appropriate. ❑ Monitor the subcontractor's technical activities. ❑ Verify that the subcontractor's interpretation and implementation of the technical requirements conform to the prime contractor's requirements. ❑ Verify that commitments are being met. ❑ Verify that technical issues are resolved in a timely manner.	**Software subcontractor** **Subcontractor**	

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Reviews and audits, continued

The table below lists the recommended reviews and audits for the software subcontract management process, continued from the previous page.

√	Review or Audit	Review Participants	References
	Formal reviews to address the subcontractor's software engineering accomplishments and results are conducted at selected milestones according to a documented procedure. (L53, A9) ❑ Reviews are preplanned and documented in the statement of work. (L53, A9, 1) ❑ Reviews address the subcontractor's commitments for, plans for, and status of the software activities. (L2-53, A9, 2)	**Not specified in CMM**	
	The **prime contractor's software quality assurance group** monitors the subcontractor's software quality assurance activities according to a documented procedure. (L2, 53, A10) ❑ The subcontractor's plans, resources, procedures, and standards for software quality assurance are periodically reviewed to ensure they are adequate to monitor the subcontractor's performance. (L2-54, A10, 1)	**Prime contractor's SQA group**	
	Regular reviews of the **subcontractor** are conducted to ensure the approved procedures and standards are being followed. (L2-54, A10, 2) ❑ The **prime contractor's software quality assurance group** spot checks the subcontractor's software engineering activities and products. ❑ The **prime contractor's software quality assurance group** audits the subcontractor's software quality assurance records, as appropriate.	**Subcontractor** **Prime contractor's SQA group**	

	The subcontractor's records of its software quality assurance activities are periodically audited to assess how well the software quality assurance plans, standards, and procedures are being followed. (L2-54, A10, 3)	**Prime contractor's SQA group**	

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SSM Process - Reviews and Audits, Continued

Reviews and audits, continued

The table below lists the recommended reviews and audits for the software subcontract management process, continued from the previous page.

√	Review or Audit	Review Participants	References
	The subcontractor's plans, resources, procedures, and standards for software configuration management are reviewed to ensure they are adequate. (L2-54, A11, 1)	**Prime contractor's SCM group**	
	The subcontractor's software baseline library is periodically audited to assess how well the standards and procedures for software configuration management are being followed and how effective they are in managing the software baseline. (L2-54, A11, 3)	**Prime contractor's SCM group**	
	The acceptance procedures and acceptance criteria for each product are defined, reviewed, and approved by both the **prime contractor** and the **subcontractor** prior to the test. (L2-55, A12, 1)	**Prime contractor** **Subcontractor**	
	The software subcontractor's performance is evaluated on a periodic basis, and the evaluation is reviewed with the **subcontractor**. (L2-55, A13)	**Subcontractor**	
	The activities for managing the software subcontract are reviewed with **senior management** on a periodic basis. (L2-56, V1)	**Senior management**	
	The activities for managing the software subcontract are reviewed with the **project manager** on both a periodic and event-driven basis. (L2-56, V2)	**Project manager**	

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Reviews and audits, continued

The table below lists the recommended reviews and audits for the software subcontract management process, continued from the previous page.

√	Review or Audit	Review Participants	References
	The **software quality assurance group** reviews and/or audits the activities and work products for managing the software subcontract and reports the results. (L2-57, V3) At a minimum, the reviews and/or audits verify: ❑ The activities for selecting the **subcontractor**. ❑ The activities for managing the software subcontract. ❑ The activities for coordinating configuration management activities of the **prime contractor** and **subcontractor**. ❑ The conduct of planned reviews with the **subcontractor**. ❑ The conduct of reviews that establish completion of key project milestones or stages for the subcontract. ❑ The acceptance process for the subcontractor's software products.	**SQA group**	

SSM Process - Work Products Managed and Controlled

Work products managed and controlled

The table below lists the work products recommended to be managed and controlled during the software subcontract management process.

√	Work Products Managed and Controlled	References
	Subcontract statement of work. (L2-48, A1, 3.5)	

SSM Process - Measurements

Measurements

The table below lists the measurements recommended for the software subcontract management process.

√	Measurements	References
	Measurements are made and used to determine the status of the activities for managing the software subcontract. (L2-55, M1) Examples of measurements include: ❑ Costs of the activities for managing the subcontract compared to the plan. ❑ Actual delivery dates for subcontracted products compared to the plan. ❑ Actual dates of prime contractor deliveries to the subcontractor compared to the plan.	

SSM Process - Documented Procedures

Documented procedures

The table below lists the activities for the software subcontract management process recommended to be performed according to a documented procedure.

√	Documented Procedure(s)	References
	The work to be subcontracted is defined and planned according to a documented procedure. (L2-47, A1) [Refer to Level 2 Procedure Checklists for additional information.]	
	The software subcontractor is selected based on an evaluation of the subcontract bidders' ability to perform the work, according to a documented procedure. (L2-49, A2) [Refer to Level 2 Procedure Checklists for additional information.]	
	Changes to the software subcontractor's statement of work, subcontract terms and conditions, and other commitments are resolved according to a documented procedure. (L2-51, A6) [Refer to Level 2 Procedure Checklists for additional information.]	
	Formal reviews to address the subcontractor's software engineering accomplishments and results are conducted at selected milestones according to a documented procedure. (L2-53, A9) [Refer to Level 2 Procedure Checklists for additional information.]	
	The **prime contractor's software quality assurance group** monitors the subcontractor's software quality assurance activities according to a documented procedure. (L2-53, A10) [Refer to Level 2 Procedure Checklists for additional information.]	
	The **prime contractor's software configuration management group** monitors the subcontractor's activities for software configuration management according to a documented procedure. (L2-54, A11) [Refer to Level 2 Procedure Checklists for additional information.]	
	The **prime contractor** conducts acceptance testing as part of the delivery of the subcontractor's software products according to a documented procedure. (L2-55, A12) [Refer to Level 2 Procedure Checklists for additional information.]	

SSM Process - Training

Training

The table below lists the training recommended for the software subcontract management process.

√	Training	References
	Software managers and other **individuals** who are involved in establishing and managing the software subcontract are trained to perform these activities. (L2-46, Ab2)	
	Software managers and other **individuals** who are involved in managing the software subcontract receive orientation in the technical aspects of the subcontract. (L2-46, Ab3)	

SSM Process - Tools

Tools

The table below lists the tools recommended for the software subcontract management process.

√	Tools	References
	Tools to support managing the subcontract. (L2-46, Ab1, 2) Examples of support tools include: ❑ estimating models, ❑ spreadsheet programs, and ❑ project management and scheduling programs.	

Software Quality Assurance (SQA) Process

SQA Process - Overview

SQA process purpose

The purpose of Software Quality Assurance is to provide management with appropriate visibility into the process being used by the software project and of the products being built. (L2-59)

SQA process description

Software Quality Assurance involves reviewing and auditing the software products and activities to verify that they comply with the applicable procedures and standards and providing the software project and other appropriate managers with the results of these reviews and audits.

The software quality assurance group works with the software project during its early stages to establish plans, standards, and procedures that will add value to the software project and satisfy the constraints of the project and the organization's policies. By participating in establishing the plans, standards, and procedures, the software quality assurance group helps ensure they fit the project's needs and verifies that they will be usable for performing reviews and audits throughout the software life cycle. The software quality assurance group reviews project activities and audits software work products throughout the life cycle and provides management with visibility as to whether the software project is adhering to its established plans, standards, and procedures.

Compliance issues are first addressed within the software project and resolved there if possible. For issues not resolvable within the software project, the software quality assurance group escalates the issue to an appropriate level of management for resolution.

This key process area covers the practices for the group performing the software quality assurance function. The practices identifying the specific activities and work products that the software quality assurance group reviews and/or audits are generally contained in the Verifying Implementation common feature of the other key process areas. (L2-59)

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Section overview

The table below contains a description and the location of each checklist for this key process area.

Checklist	Description	Page
Roles	List of roles participating in process activities.	L2-Process-131
Entry Criteria	Description of when the process can start.	L2-Process-136
Inputs	Description of the work products used by the process.	L2-Process-137
Activities	Description of the activities of the process.	L2-Process-138
Outputs	Description of the work products produced by the process.	L2-Process-140
Exit Criteria	Description of when the process is complete.	L2-Process-142
Reviews and Audits	List of reviews and audits.	L2-Process-147
Work Products Managed and Controlled	List of work products to be managed and controlled.	L2-Process-149
Measurements	Description of process measurements.	L2-Process-150
Documented Procedures	List of the activities to be completed according to a documented procedure.	L2-Process-151
Training	List of training.	L2-Process-152
Tools	List of tools.	L2-Process-153

SQA Process - Roles

Roles

The table below lists the roles and the activities in which they participate in the software quality assurance process.

√	Role	Activities Participated in...	Reference
	Affected groups	The SQA plan is reviewed by the **affected groups** and individuals. (L2-63, A1, 2)	
	Affected individuals	The SQA plan is reviewed by the **affected** groups and **individuals**. (L2-63, A1, 2)	
	Customer	The deliverable software products are evaluated before they are delivered to the **customer**. (L2-66, A5, 1)	
	Customer's SQA personnel	The SQA group conducts periodic reviews of its activities and findings with the **customer's SQA personnel**, as appropriate. (L2-67, A8)	
	Experts independent of the SQA group	**Experts independent of the SQA group** periodically review the activities and software work products of the project's SQA group. (L2-69, V3)	
	Manager	❑ A **manager** is assigned specific responsibilities for the project's SQA activities. (L2-62, Ab2, 1) ❑ All **managers** in the SQA reporting chain to the senior manager are knowledgeable in the SQA role, responsibilities, and authority. (L2-62, Ab2, 2.1)	

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SQA Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the software quality assurance process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Project manager	❑ Deviations from the software development plan and the designated project standards and procedures are documented and resolved with the appropriate software task leaders, software managers, or **project manager**, where possible. (L2-67, A7, 1) ❑ Deviations from the software development plan and the designated project standards and procedures not resolvable with the software task leaders**,** software managers**,** or **project manager** are documented and presented to the senior manager designated to receive noncompliance items. (L2-67, A7, 2) ❑ The SQA activities are reviewed with the **project manager** on both a periodic and event-driven basis. (L2-69, V2)	
	Senior management	❑ **Senior management** periodically reviews the SQA activities and results. (L2-61, C1, 3) ❑ The SQA activities are reviewed with **senior management** on a periodic basis. (L2-68, V1)	

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SQA Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the software quality assurance process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Senior manager	❑ A **senior manager**, who is knowledgeable in the SQA role and has the authority to take appropriate oversight actions, is designated to receive and act on software noncompliance items. (L2-62, Ab2, 2) ❑ Deviations from the software development plan and the designated project standards and procedures not resolvable with the software task leaders**,** software managers**,** or project manager are documented and presented to the **senior manager** designated to receive noncompliance items. (L2-67, A7, 2) ❑ Noncompliance items presented to the **senior manager** are periodically reviewed until they are resolved. (L2-67, A7, 3)	
	Software engineering group	The SQA group periodically reports the results of its activities to the **software engineering group**. (L2-67, A6)	
	Software manager	❑ Deviations from the software development plan and the designated project standards and procedures are documented and resolved with the appropriate software task leaders, **software managers**, or project manager, where possible. (L2-67, A7, 1) ❑ Deviations from the software development plan and the designated project standards and procedures not resolvable with the software task leaders**, software managers,** or project manager are documented and presented to the senior manager designated to receive noncompliance items. (L2-67, A7, 2)	

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SQA Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the software quality assurance process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Software task leader	❑ Deviations from the software development plan and the designated project standards and procedures are documented and resolved with the appropriate **software task leaders**, software managers, or project manager, where possible. (L2-67, A7, 1) ❑ Deviations from the software development plan and the designated project standards and procedures not resolvable with the **software task leaders,** software managers**,** or project manager are documented and presented to the senior manager designated to receive noncompliance items. (L2-67, A7, 2)	
	SQA group	❑ Members of the **SQA group** are trained to perform their SQA activities. (L2-62, Ab3) ❑ The **SQA group's** activities are performed in accordance with the SQA plan. (L2-64, A2) ❑ The **SQA group** participates in the preparation and review of the project's software development plan, standards, and procedures. (L2-65, A3)	
	Role continues on next page		

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SQA Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the software quality assurance process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	SQA group, continued	❑ The **SQA group** provides consultation and review of the plans, standards, and procedures with regard to: (L2-66, A3, 1) ❑ compliance to organizational policy, ❑ compliance to externally imposed standards and requirements (e.g., standards imposed by the statement of work), ❑ standards that are appropriate for use by the project, ❑ topics that should be addressed in the software development plan, and ❑ other areas assigned by the project. ❑ The **SQA group** verifies that plans, standards, and procedures are in place and can be used to review and audit the software project. (L2-66, A3, 2) ❑ The **SQA group** reviews the software engineering activities to verify compliance. (L2-66, A4) ❑ The **SQA group** audits designated software work products to verify compliance. (L2-66, A5) ❑ The **SQA group** periodically reports the results of its activities to the software engineering group. (L2-67, A6) ❑ The **SQA group** conducts periodic reviews of its activities and findings with the customer's SQA personnel, as appropriate. (L2-67, A8)	

SQA Process - Entry Criteria

Input-based entry criteria

There are no input-based entry criteria in the software quality assurance process.

General entry criteria

The CMM recommends that the conditions described in the table below be satisfied before entering the software quality assurance process.

√	Condition	References
	The project follows a written organizational policy for implementing software quality assurance (SQA). (L2-60, C1) [Refer to Level 2 Policies for additional information regarding SQA policy.]	
	A group that is responsible for coordinating and implementing SQA for the project (i.e., the **SQA group**) exists. (L2-61, Ab1)	
	Adequate resources and funding are provided for performing the SQA activities. (L2-62, Ab2)	
	A **manager** is assigned specific responsibilities for the project's SQA activities. (L2-62, Ab2, 1)	
	A **senior manager**, who is knowledgeable in the SQA role and has the authority to take appropriate oversight actions, is designated to receive and act on software noncompliance items. (L2-62, Ab2, 2)	
	All **managers** in the SQA reporting chain to the **senior manager** are knowledgeable in the SQA role, responsibilities, and authority. (L2-62, Ab2, 2.1)	
	Tools to support the SQA activities are made available. (L2-62, Ab2, 3)	
	Members of the **SQA group** are trained to perform their SQA activities. (L2-62, Ab3)	
	The **members of the software project** receive orientation on the role, responsibilities, authority, and value of the SQA group. (L2-63, Ab4)	

SQA Process - Inputs

Inputs

The table below lists the recommended inputs to the software quality assurance process.

√	Input	Org. Input	References
	Deliverable software products. (L2-66, A5, 1)		
	Designated contractual requirements. (L2-66, A5, 2)		
	Designated procedures. (L2-66, A4, 1)		
	Designated software standards. (L2-66, A4, 1)		
	Designated software work products. (L2-66, A5)		
	Externally imposed requirements. (L2-66, A3, 1.2)		
	Externally imposed standards. (L2-66, A3, 1.2)		
	Project's procedures. (L2-65, A3)		
	Project's software development plan. (L2-65, A3)		
	Project's standards. (L2-65, A3)		
	Software work products. (L2-66, A5, 2)		
	SQA plan. (L2-64, A2)		

SQA Process - Activities

Activities

The table below lists the recommended activities for the software quality assurance process.

√	Activities	References
	A SQA plan is prepared for the software project according to a documented procedure. (L2-63, A1) [Refer to Level 2 Procedure Checklists for additional information.]	

	The **SQA group** participates in the preparation and review of the project's software development plan, standards, and procedures. (L2-65, A3)
	❑ The **SQA group** provides consultation and review of the plans, standards, and procedures with regard to:
	  ❑ compliance to organizational policy,
	  ❑ compliance to externally imposed standards and requirements (e.g., standards required by the statement of work),
	  ❑ standards that are appropriate for use by the project,
	  ❑ topics that should be addressed in the software development plan, and
	  ❑ other areas as assigned by the project.
	❑ The **SQA group** verifies that plans, standards, and procedures are in place and can be used to review and audit the software project.	

	The **SQA group** reviews the software engineering activities to verify compliance. (L2-66, A4) ❑ The activities are evaluated against the software development plan and the designated software standards and procedures. ❑ Deviations are identified, documented, and tracked to closure. ❑ Corrections are verified.	

	The **SQA group** audits designated software work products to verify compliance. (L2-66, A5) ❑ The deliverable software products are evaluated before they are delivered to the customer. ❑ The software work products are evaluated against the designated software standards, procedures, and contractual requirements. ❑ Deviations are identified, documented, and tracked to closure. ❑ Corrections are verified.	

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SQA Process - Activities, Continued

Activities, continued

The table below lists the recommended activities for the software quality assurance process, continued from the previous page.

√	Activities	References
	The **SQA group** periodically reports the results of its activities to the **software engineering group**. (L2-67, A6)	
	Deviations identified in the software activities and software work products are documented and handled according to a documented procedure. (L2-67, A7) [Refer to Level 2 Procedure Checklists for additional information.]	
	The **SQA group** conducts periodic reviews of its activities and findings with the **customer's SQA personnel**, as appropriate. (L2-67, A8)	
	Measurements are made and used to determine the cost and schedule status of the SQA activities. (L2-68, M1)	
	The SQA activities are reviewed with **senior management** on a periodic basis. (L2-68, V1)	
	The SQA activities are reviewed with the **project manager** on a periodic and event-driven basis. (L2-69, V2)	
	Experts independent of the SQA group periodically review the activities and software work products of the project's **SQA group**. (L2-69, V3)	

SQA Process - Outputs

Outputs

The table below lists the outputs produced by the software quality assurance process.

√	Output	Org. Output	References
	Corrections to deviations between the contractual requirements and the designated software work products. (L2-67, A5, 4)		
	Corrections to deviations between the designated software procedures and the designated software work products. (L2-67, A5, 4)		
	Corrections to deviations between the designated software procedures and the software engineering activities. (L2-66, A4, 3)		
	Corrections to deviations between the designated software standards and the designated software work products. (L2-67, A5, 4)		
	Corrections to deviations between the designated software standards and the software engineering activities. (L2-66, A4, 3)		
	Corrections to deviations between the software development plan and the software engineering activities. (L2-66, A4, 3)		
	Deviations between the contractual requirements and the designated software work products. (L2-67, A5, 3)		
	Deviations between the designated software procedures and the designated software work products. (L2-67, A5, 3)		
	Deviations between the designated software procedures and the software engineering activities. (L2-66 A4, 2)		
	Deviations between the designated software standards and the designated software work products. (L2-67, A5, 3)		
	Deviations between the designated software standards and the software engineering activities. (L2-66 A4, 2)		

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SQA Process - Outputs, Continued

Outputs, continued

The table below lists the outputs produced by the software quality assurance process, continued from the previous page.

√	Output	Org. Output	References
	Deviations between the software development plan and the software engineering activities. (L2-66 A4, 2)		
	Deviations from the designated project procedures. (L2-67, A7, 1)		
	Deviations from the designated project standards. (L2-67, A7, 1)		
	Deviations from the software development plan. (L2-67, A7, 1)		
	Deviations identified in the software activities. (L2-67, A7)		
	Deviations identified in the software work products. (L2-67, A7)		
	Documentation of noncompliance items. (L2-67, A7, 4)		
	Measurements (to determine the cost and schedule status of the SQA activities). (L2-68, M1)		
	Results of **SQA group** activities. (L2-67, A6)		
	Software noncompliance items. (L2-62, Ab2, 2)		
	Software work products of the **SQA group**. (L2-69, V3)		
	SQA findings. (L2-67, A8)		
	SQA plan. (L2-63, A1) [Refer to Level 2 Standards for additional information regarding a SQA plan.]		
	SQA results. (L2-61, C1, 3)		

SQA Process - Exit Criteria

Output-based exit criteria

The CMM recommends that outputs satisfy the states described in the table below to exit the software quality assurance process.

√	Output	State	References
	Corrections to deviations between the contractual requirements and the designated software work products	are identified. (L2-67, A5, 4)	
	Corrections to deviations between the designated software procedures and the designated software work products	are identified. (L2-67, A5, 4)	
	Corrections to deviations between the designated software procedures and the software engineering activities	are identified. (L2-66, A4, 3)	
	Corrections to deviations between the designated software standards and the designated software work products	are identified. (L2-67, A5, 4)	
	Corrections to deviations between the designated software standards and the software engineering activities	are identified. (L2-66, A4, 3)	
	Corrections to deviations between the software development plan and the software engineering activities	are identified. (L2-66, A4, 3)	

	Deviations between the contractual requirements and the designated software work products	❑ are identified. (L2-67, A5, 3) ❑ are documented. (L2-67, A5, 3) ❑ are tracked to closure. (L2-67, A5, 3)	

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SQA Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the software quality assurance process, continued from the previous page.

√	Output	State	References
	Deviations between the designated software procedures and the designated software work products	❑ are identified. (L2-67, A5, 3) ❑ are documented. (L2-67, A5, 3) ❑ are tracked to closure. (L2-67, A5, 3)	
	Deviations between the designated software procedures and the software engineering activities	❑ are identified. (L2-66, A4, 2) ❑ are documented. (L2-66, A4, 2) ❑ are tracked to closure. (L2-66, A4, 2)	
	Deviations between the designated software standards and the designated software work products	❑ are identified. (L2-67, A5, 3) ❑ are documented. (L2-67, A5, 3) ❑ are tracked to closure. (L2-67, A5, 3)	
	Deviations between the designated software standards and the software engineering activities	❑ are identified. (L2-66, A4, 2) ❑ are documented. (L2-66, A4, 2) ❑ are tracked to closure. (L2-66, A4, 2)	
	Deviations between the software development plan and the software engineering activities	❑ are identified. (L2-66, A4, 2) ❑ are documented. (L2-66, A4, 2) ❑ are tracked to closure. (L2-66, A4, 2)	
	Deviations from the designated project procedures	❑ are documented. (L2-67, A7, 1) ❑ are resolved with the appropriate **software task leaders**, **software managers**, or **project manager**, where possible. (L2-67, A7, 1) ❑ not resolvable with the **software task leaders**, **software managers**, or **project manager** are documented and presented to the **senior manager** designated to receive noncompliance items. (L2-67, A7, 2)	

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SQA Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the software quality assurance process, continued from the previous page.

√	Output	State	References
	Deviations from the designated project standards	❑ are documented. (L2-67, A7, 1) ❑ are resolved with the appropriate **software task leaders**, **software managers**, or **project manager**, where possible. (L2-67, A7, 1) ❑ not resolvable with the **software task leaders**, **software managers**, or **project manager** are documented and presented to the **senior manager** designated to receive noncompliance items. (L2-67, A7, 2)	
	Deviations from the software development plan	❑ are documented. (L2-67, A7, 1) ❑ are resolved with the appropriate **software task leaders**, **software managers**, or **project manager**, where possible. (L2-67, A7, 1) ❑ not resolvable with the **software task leaders**, **software managers**, or **project manager** are documented and presented to the **senior manager** designated to receive noncompliance items. (L2-67, A7, 2)	
	Deviations identified in the software activities	❑ are documented. (L2-67, A7) ❑ are handled according to a documented procedure. (L2-67, A7)	
	Deviations identified in the software work products	❑ are documented. (L2-67, A7) ❑ are handled according to a documented procedure. (L2-67, A7)	
	Measurements (to determine the cost and schedule status of the SQA activities)	❑ are made. (L2-68, M1) ❑ are used. (L2-68, M1)	

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SQA Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the software quality assurance process, continued from the previous page.

√	Output	State	References
	Noncompliance items (presented to the **senior manager**)	❑ are periodically reviewed until they are resolved. (L2-67, A7, 3) ❑ are documented. (L2-67, A7, 4) ❑ documentation is managed and controlled. (L2-67, A7, 4)	
	Results of **SQA group** activities	are periodically reported to the **software engineering group**. (L2-67, A6)	
	SQA plan	❑ is prepared for the software project according to a documented procedure. (L2-63, A1) ❑ is developed in the early stages of, and in parallel with, the overall project planning. (L2-63, A1, 1) ❑ is reviewed by the **affected groups** and **individuals**. (L2-63, A1, 2) ❑ is managed and controlled. (L2-64, A1, 3)	
	SQA results	are reviewed periodically by **senior management**. (L2-61, C1, 3)	

General exit criteria

The CMM recommends that the conditions described in the table below be satisfied to exit the software quality assurance process.

√	Condition	References
	The **SQA group**'s activities are performed in accordance with the SQA plan. (L2-64, A2)	

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SQA Process - Exit Criteria, Continued

General exit criteria, continued

The CMM recommends that the conditions described in the table below be satisfied to exit the software quality assurance process, continued from the previous page.

√	Condition	References
	The **SQA group** participates in the preparation and review of the project's software development plan, standards, and procedures. (L2-65, A3) ❑ The **SQA group** provides consultation and review of the plans, standards, and procedures with regard to: ❑ compliance to organizational policy, ❑ compliance to externally imposed standards and requirements (e.g., standards required by the statement of work), ❑ standards that are appropriate for use by the project, ❑ topics that should be addressed in the software development plan, and ❑ other areas as assigned by the project. ❑ The **SQA group** verifies that plans, standards, and procedures are in place and can be used to review and audit the software project.	
	The **SQA group** reviews the software engineering activities to verify compliance. (L2-66, A4)	
	The software engineering activities are evaluated against the software development plan and the designated software standards and procedures. (L2-66, A4, 1)	
	The **SQA group** audits designated software work products to verify compliance. (L2-66, A5) ❑ The deliverable software products are evaluated before they are delivered to the **customer**. ❑ The software work products are evaluated against the designated software standards, procedures, and contractual requirements.	
	The **SQA group** conducts periodic reviews of its activities and findings with the **customer's SQA personnel**, as appropriate. (L2-67, A8)	
	The SQA activities are reviewed with **senior management** on a periodic basis. (L2-68, V1)	
	The SQA activities are reviewed with the **project manager** on a periodic and event-driven basis. (L2-69, V2)	

	Experts independent of the SQA group periodically review the activities and software work products of the project's **SQA group**. (L2-69, V3)	

SQA Process - Reviews and Audits

Reviews and audits

The table below lists the recommended reviews and audits for the software quality assurance process.

√	Review or Audit	Review Participants	References
	Senior management periodically reviews the SQA activities and results. (L2-61, C1, 3)	**Senior management**	
	The SQA plan is reviewed by the **affected groups** and **individuals**. (L2-63, A1, 2)	**Affected groups** **Affected individuals**	
	The **SQA group** participates in the preparation and review of the project's software development plan, standards, and procedures. (L2-65, A3)	**SQA group**	
	The **SQA group** provides consultation and review of the plans, standards, and procedures with regard to: (L2-66, A3, 1) ❑ compliance to organizational policy, ❑ compliance to externally imposed standards and requirements (e.g., standards required by the statement of work), ❑ standards that are appropriate for use by the project, ❑ topics that should be addressed in the software development plan, and ❑ other areas as assigned by the project.	**SQA group**	
	The **SQA group** reviews the software engineering activities to verify compliance. (L2-66, A4)	**SQA group**	
	The **SQA group** audits designated software work products to verify compliance. (L2-66, A5)	**SQA group**	
	The **SQA group** conducts periodic reviews of its activities and findings with the **customer's SQA personnel**, as appropriate. (L2-67, A8)	**SQA group** **Customer's SQA personnel**	
	The SQA activities are reviewed with **senior management** on a periodic basis. (L2-68, V1)	**Senior management**	

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SQA Process - Reviews and Audits, Continued

Reviews and audits, continued

The table below lists the recommended reviews and audits for the software quality assurance process, continued from the previous page.

√	Review or Audit	Review Participants	References
	The SQA activities are reviewed with the **project manager** on both a periodic and event-driven basis. (L2-69, V2)	**Project manager**	
	Experts independent of the SQA group periodically review the activities and software work products of the project's **SQA group**. (L2-69, V3)	**Experts independent of the SQA group** **SQA group**	

SQA Process - Work Products Managed and Controlled

Work products managed and controlled

The table below lists the work products recommended to be managed and controlled during the software quality assurance process.

√	Work Products Managed and Controlled	References
	SQA plan. (L2-64, A1, 3)	
	Documentation of noncompliance items. (L2-67, A7, 4)	

SQA Process - Measurements

Measurements

The table below lists the measurements recommended for the software quality assurance process.

√	Measurements	References
	Measurements are made and used to determine the cost and schedule status of SQA activities. (L2-68, M1) Examples of measurements include: ❑ Completions of milestones for the SQA activities compared to the plan. ❑ Work completed, effort expended, and funds expended in the SQA activities compared to the plan. ❑ Numbers of product audits and activity reviews compared to the plan.	

SQA Process - Documented Procedures

Documented procedures

The table below lists the activities for the software quality assurance process recommended to be performed according to a documented procedure.

√	Documented procedures	References
	A SQA plan is prepared for the software project according to a documented procedure. (L2-63, A1) [Refer to Level 2 Procedure Checklists for additional information.]	
	Deviations identified in the software activities and software work products are documented and handled according to a documented procedure. (L2-67, A7) [Refer to Level 2 Procedure Checklists for additional information.]	

SQA Process - Training

Training

The table below lists the training recommended for the software quality assurance process.

√	Training	References
	Members of the **SQA group** are trained to perform their SQA activities. (L2-62, Ab3)	
	The members of the software project receive orientation on the role, responsibilities, authority, and value of the SQA group. (L2-63, Ab4)	

SQA Process - Tools

Tools

The table below lists the tools recommended for the software quality assurance process.

√	Tools	References
	Tools to support the SQA activities. (L2-62, Ab2, 3) Examples of support tools include: ❑ workstations, ❑ database programs, ❑ spreadsheet programs, and ❑ auditing tools.	

Software Configuration Management (SCM) Process

SCM Process - Overview

SCM process purpose

The purpose of Software Configuration Management is to establish and maintain the integrity of the products of the software project throughout the project's software life cycle. (L2-71)

SCM process description

Software Configuration Management involves identifying the configuration of the software (i.e., selected software work products and their descriptions) at given points in time, systematically controlling changes to the configuration, and maintaining the integrity and traceability of the configuration throughout the software life cycle. The work products placed under software configuration management include the software products that are delivered to the customer (e.g., the software requirements document and the code) and the items that are identified with or required to create these software products (e.g., the compiler).

A software baseline library is established containing the software baselines as they are developed. Changes to baselines and the release of software products built from the software baseline library are systematically controlled via the change control and configuration auditing functions of software configuration management.

This key process area covers the practices for performing the software configuration management function. The practices identifying specific configuration items/units are contained in the key process areas that describe the development and maintenance of each configuration item/unit. (L2-71)

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Section overview

The table below contains a description and the location of each checklist for this key process area.

Checklist	Description	Page
Roles	List of roles participating in process activities.	L2-Process-157
Entry Criteria	Description of when the process can start.	L2-Process-161
Inputs	Description of the work products used by the process.	L2-Process-162
Activities	Description of the activities of the process.	L2-Process-163
Outputs	Description of the work products produced by the process.	L2-Process-165
Exit Criteria	Description of when the process is complete.	L2-Process-166
Reviews and Audits	List of reviews and audits.	L2-Process-172
Work Products Managed and Controlled	List of work products to be managed and controlled.	L2-Process-174
Measurements	Description of process measurements.	L2-Process-175
Documented Procedures	List of the activities to be completed according to a documented procedure.	L2-Process-176
Training	List of training.	L2-Process-177
Tools	List of tools.	L2-Process-178

SCM Process - Roles

Roles

The table below lists the roles and the activities in which they participate in the software configuration management process.

√	Role	Activities Participated in...	Reference
	Affected groups	❑ The SCM plan is reviewed by the **affected groups**. ❑ The configuration management library system provides for the sharing and transfer of configuration items/units between the **affected groups** and between control levels within the library. (L2-78, A3, 3) ❑ Standard reports documenting the SCM activities and the contents of the software baseline are developed and made available to **affected groups** and individuals. (L2-81, A9)	
	Affected individuals	Standard reports documenting the SCM activities and the contents of the software baseline are developed and made available to **affected** groups and **individuals**. (L2-81, A9)	
	Manager	A **manager** is assigned specific responsibilities for SCM. (L2-75, Ab3, 1)	
	Person responsible for each configuration unit/item	The **person responsible for each configuration item/unit** (i.e., the owner, from a configuration management point of view) is identified. (L2-79, A4, 6)	
	Project manager	The SCM activities are reviewed with the **project manager** on both a periodic and event-driven basis. (L2-83, V2)	
	Project software manager	The results of software baseline audits are reported to the **project software manager**. (L2-82, A10, 6)	
	Senior management	The SCM activities are reviewed with **senior management** on a periodic basis. (L2-82, V1)	

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SCM Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the software configuration management process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Software configuration control board (SCCB)	❑ A board having the authority for managing the project's software baselines (i.e., a **software configuration control board - SCCB**) exists or is established. (L2-73, Ab1) The **SCCB**: ❑ Authorizes the establishment of software baselines and the identification of configuration items/units. ❑ Represents the interests of the project manager and all groups who may be affected by changes to the software baselines. ❑ Reviews and authorizes changes to the software baselines. ❑ Authorizes the creation of products from the software baseline library. ❑ Only configuration items/units that are approved by the **SCCB** are entered into the software baseline library. (L2-80, A6, 2)	

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SCM Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the software configuration management process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Software configuration management (SCM) group	❑ A group that is responsible for coordinating and implementing SCM for the project (i.e., the **SCM group**) exists. (L2-74, Ab2) The **SCM group** coordinates or implements: ❑ Creation and management of the project's software baseline library. ❑ Development, maintenance, and distribution of the SCM plans, standards, and procedures. ❑ The identification of the set of work products to be placed under SCM. ❑ Management of the access to the software baseline library. ❑ Updates of the software baselines. ❑ Creation of products from the software baseline library. ❑ Recording of SCM actions. ❑ Production and distribution of SCM reports. ❑ Members of the **SCM group** are trained in the objectives, procedures, and methods for performing their SCM activities. (L2-76, Ab4) ❑ The **SCM group** periodically audits software baselines to verify that they conform to the documentation that defines them. (L2-83, V3)	
	Software engineering group	Members of the **software engineering group** and other software-related groups are trained to perform their SCM activities. (L2-76, Ab5)	

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SCM Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the software configuration management process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Software-related groups	❑ Members of the software engineering group and other **software-related groups** are trained to perform their SCM activities. (L2-76, Ab5) ❑ The SCM plan covers the SCM requirements and activities to be performed by the software engineering group and other **software-related groups**. (L2-77, A2, 2)	
	SQA group	The **software quality assurance group** reviews and/or audits the activities and work products for SCM and reports the results. (L2-83, V4)	

SCM Process - Entry Criteria

Input-based entry criteria

The CMM recommends that inputs satisfy the states described in the table below before entering the software configuration management process.

√	Input	State	References
	Change requests for configuration items/units	are initiated according to a documented procedure. (L2-79, A5)	
	Problem reports for configuration items/units	are initiated according to a documented procedure. (L2-79, A5)	
	SCM plan	❑ is documented. (L2-77, A2) ❑ is approved. (L2-77, A2)	

General entry criteria

The CMM recommends that the conditions described in the table below be satisfied before entering the software configuration management process.

√	Condition	References
	The project follows a written organizational policy for implementing software configuration management (SCM). (L2-72, C1) [Refer to Level 2 Policies for additional information regarding SCM policy.]	
	Responsibility for SCM for each project is explicitly assigned. (L2-72, C1, 1)	
	A board having the authority for managing the project's software baselines (i.e., a software configuration control board - **SCCB**) exists or is established. (L2-73, Ab1)	
	A group that is responsible for coordinating and implementing SCM for the project (i.e., the **SCM group**) exists. (L2-74, Ab2)	
	Adequate resources and funding are provided for performing the SCM activities. (L2-75, Ab3)	
	A **manager** is assigned specific responsibilities for SCM. (L2-75, Ab3, 1)	
	Tools to support the SCM activities are made available. (L2-75, Ab3, 2)	
	Members of the **SCM group** are trained in the objectives, procedures, and methods for performing their SCM activities. (L2-76, Ab4)	

	Members of the **software engineering group** and other **software-related groups** are trained to perform their SCM activities. (L2-76, Ab5)	

SCM Process - Inputs

Inputs

The table below lists the recommended inputs to the software configuration management process.

√	Input	Org. Input	References
	Change requests for configuration items/units. (L2-79, A5)		
	Changes to baselines. (L2-80, A6)		
	Configuration items/units. (L2-78, A3, 2)		
	Designated internal software work products. (L2-72, C1, 3)		
	Designated support tools used inside the project. (L2-72, C1, 3)		
	Externally deliverable software products. (L2-72, C1, 3)		
	Problem reports for configuration items/units. (L2-79, A5)		
	SCM plan. (L2-77, A2) [Refer to Level 2 Standards for additional information regarding a SCM plan.]		
	Software baselines. (L2-73, C1, 5)		
	Software work products. (L2-78, A4)		
	Updates of the software baselines. (L2-75, Ab2, 5)		
	Work products to be placed under SCM. (L2-75, Ab2, 3)		

SCM Process - Activities

Activities

The table below lists the recommended activities for the software configuration management process.

√	Activities	References
	A SCM plan is prepared for each software project according to a documented procedure. (L2-76, A1) [Refer to Level 2 Procedure Checklists for additional information.]	
	A documented and approved SCM plan is used as the basis for performing the SCM activities. (L2-77, A2)	
	A configuration management library system is established as a repository for the software baselines. (L2-77, A3) [Refer to SCM Process Tools for additional information regarding a configuration management library system.]	
	The software work products to be placed under configuration management are identified. (L2-78, A4) ❑ The configuration items/units are selected based on documented criteria. ❑ The configuration items/units are assigned unique identifiers. ❑ The characteristics of each configuration item/unit are specified. ❑ The software baselines to which each configuration item/unit belongs are specified. ❑ The point in its development that each configuration item/unit is placed under configuration management is specified. ❑ The person responsible for each configuration item/unit (i.e., the owner, from a configuration management point of view) is identified.	
	Change requests and problem reports for all configuration items/units are initiated, recorded, reviewed, approved, and tracked according to a documented procedure. (L2-79, A5)	
	Changes to baselines are controlled according to a documented procedure. (L2-80, A6) [Refer to Level 2 Procedure Checklists for additional information.]	

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SCM Process - Activities, Continued

Activities, continued

The table below lists the recommended activities for the software configuration management process, continued from the previous page.

√	Activities	References
	Products from the software baseline library are created and their release is controlled according to a documented procedure. (L2-80, A7,) [Refer to Level 2 Procedure Checklists for additional information.]	
	The status of configuration items/units is recorded according to a documented procedure. (L2-80, A8) [Refer to Level 2 Procedure Checklists for additional information.]	
	Standard reports documenting the SCM activities and the contents of the software baseline are developed and made available to **affected groups** and **individuals**. (L2-81, A9)	
	Software baseline audits are conducted according to a documented procedure. (L2-81, A10) [Refer to Level 2 Procedure Checklists for additional information.]	
	Measurements are made and used to determine the status of the SCM activities. (L2-82, M1)	
	The SCM activities are reviewed with **senior management** on a periodic basis. (L2-82, V1)	
	The SCM activities are reviewed with the **project manager** on both a periodic and event-driven basis. (L2-83, V2)	
	The **SCM group** periodically audits software baselines to verify that they conform to the documentation that defines them. (L2-83, V3)	
	The **software quality assurance group** reviews and/or audits the activities and work products for SCM and reports the results. (L2-83, V4) [Refer to SCM Process Reviews and Audits for additional information.]	

SCM Process - Outputs

Outputs

The table below lists the recommended outputs produced by the software configuration management process.

√	Output	Org. Output	References
	Action items from the software baseline audit. (L2-82, A10, 7)		
	Archive versions of configuration items/units. (L2-78, A3, 5)		
	Changes to the software baselines. (L2-74, Ab1, 3)		
	Configuration items/units. (L2-73, Ab1, 1)		
	Current status and history (i.e., changes and other actions) of each configuration item/unit. (L2-81, A8, 2)		
	Measurements (to determine the status of the SCM activities). (L2-82, M1)		
	Products from the software baseline library. (L2-74, Ab1, 4)		
	Project's software baseline library (or repository). (L2-75, Ab2, 1)		
	Results of the software baseline audit. (L2-82, A10, 6)		
	Results of **SQA group** reviews and/or audits of the activities and work products for SCM. (L2-83, V4)		
	SCM plan. (L2-75, Ab2, 2)		
	SCM procedures. (L2-75, Ab2, 2)		
	SCM records. (L2-72, C1, 4)		
	SCM reports. (L2-75, Ab2, 8)		
	SCM standards. (L2-75, Ab2, 2)		
	Software baselines. (L2-73, Ab1)		
	Standard reports documenting the SCM activities and the contents of the software baseline. (L2-81, A9)		
	Work products to be placed under SCM. (L2-75, Ab2, 3)		

SCM Process - Exit Criteria

Output-based exit criteria

The CMM recommends that outputs satisfy the states described in the table below to exit the software configuration management process.

√	Output	State	References
	Action items from the software baseline audit	are tracked to closure. (L2-82, A10, 7)	
	Changes to the software baselines	❑ are reviewed by the **SCCB**. (L2-74, Ab1, 3) ❑ are authorized by the **SCCB**. (L2-74, Ab1, 3) ❑ are controlled according to a documented procedure. (L2-80, A6)	
	Configuration items/units	❑ identification is authorized by the **SCCB**. (L2-73, Ab1, 1) ❑ are selected based on documented criteria. (L2-79, A4, 1) ❑ are assigned unique identifiers. (L2-79, A4, 2) ❑ characteristics are specified. (L2-79, A4, 3) ❑ are checked in and out in a manner that maintains the correctness and integrity of the software baseline library. (L2-80, A6, 3) ❑ current status and history (i.e., changes and other actions) are maintained. (L2-81, A8, 2)	
	Configuration item's/unit's history (i.e., changes and other actions)	is maintained. (L2-81, A8, 2)	
	Configuration item's/unit's status	❑ is recorded according to a documented procedure. (L2-80, A8) ❑ is maintained. (L2-81, A8, 2)	

	Measurements (to determine the status of the SCM activities)	❑ are made. (L2-82, M1) ❑ are used. (L2-82, M1)	

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SCM Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the software configuration management process, continued from the previous page.

√	Output	State	References
	Products from the software baseline library	❑ are authorized to be created by the **SCCB**. (L2-74, Ab1, 4) ❑ creation is coordinated or implemented by the **SCM group**. (L2-75, Ab2, 6) ❑ are created and their release is controlled according to a documented procedure. (L2-80, A7) ❑ for both internal and external use, are built only from configuration items/units in the software baseline library. (L2-80, A7, 2)	
	Project's software baseline library (or repository)	❑ is established or is accessible to the projects for storing configuration items/units and the associated SCM records. (L2-72, C1, 4) ❑ creation is coordinated or implemented by the **SCM group**. (L2-75, Ab2, 1) ❑ management is coordinated or implemented by the **SCM group**. (L2-75, Ab2, 1) ❑ access management is coordinated or implemented by the **SCM group**. (L2-75, Ab2, 4) ❑ completeness of contents is verified. (L2-81, A10, 4) ❑ correctness of contents is verified. (L2-81, A10, 4)	
	Results of the software baseline audit	are reported to the **project software manager**. (L2-82, A10, 6)	

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SCM Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the software configuration management process, continued from the previous page.

√	Output	State	References
	Results of **SQA group** reviews and/or audits of the activities and work products for SCM	are reported. (L2-83, V4)	
	SCM plan	❑ development is coordinated or implemented by the **SCM group**. (L2-75, Ab2, 2) ❑ distribution is coordinated or implemented by the **SCM group**. (L2-75, Ab2, 2) ❑ maintenance is coordinated or implemented by the **SCM group**. (L2-75, Ab2, 2) ❑ is prepared for each software project according to a documented procedure. (L2-76, A1) ❑ is developed in the early stages of, and in parallel with, overall project planning. (L2-76, A1, 1) ❑ is reviewed by the **affected groups**. (L2-77, A1, 2) ❑ is managed and controlled. (L2-77, A1, 3) ❑ is documented. (L2-77, A2) ❑ is approved. (L2-77, A2) ❑ is used as the basis for performing the SCM activities. (L2-77, A2)	

	SCM procedures	❑ development is coordinated or implemented by the **SCM group**. (L2-75, Ab2, 2) ❑ distribution is coordinated or implemented by the **SCM group**. (L2-75, Ab2, 2) ❑ maintenance is coordinated or implemented by the **SCM group**. (L2-75, Ab2, 2)	

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SCM Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the software configuration management process, continued from the previous page.

√	Output	State	References
	SCM reports	❑ distribution is coordinated or implemented by the **SCM group**. (L2-75, Ab2, 8) ❑ production is coordinated or implemented by the **SCM group**. (L2-75, Ab2, 8)	
	SCM standards	❑ development is coordinated or implemented by the **SCM group**. (L2-75, Ab2, 2) ❑ distribution is coordinated or implemented by the **SCM group**. (L2-75, Ab2, 2) ❑ maintenance is coordinated or implemented by the **SCM group**. (L2-75, Ab2, 2)	
	Software baselines	❑ are authorized to be established by the **SCCB**. (L2-73, Ab1, 1) ❑ updates are coordinated or implemented by the **SCM group**. (L2-75, Ab2, 5) ❑ to which each configuration item/unit belongs are specified. (L2-79, A4, 4) ❑ integrity is assessed. (L2-81, A10, 2)	
	Standard reports documenting the SCM activities	❑ are developed. (L2-81, A9) ❑ are made available to **affected groups** and **individuals**. (L2-81, A9)	
	Standard reports documenting the contents of the software baseline	❑ are developed. (L2-81, A9) ❑ are made available to **affected groups** and **individuals**. (L2-81, A9)	
	Work products to be placed under SCM	❑ identification is coordinated or implemented by the **SCM group**. (L2-75, Ab2, 3) ❑ are identified. (L2-78, A4)	

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SCM Process - Exit Criteria, Continued

General exit criteria

The CMM recommends that the conditions described in the table below be satisfied to exit the software configuration management process.

√	Condition	References
	SCM is implemented throughout the project's life cycle. (L2-72, C1, 2)	
	SCM is implemented for externally deliverable software products, designated internal software work products, and designated support tools used inside the project (e.g., compilers). (L272, C1, 3)	
	The **SCM group** coordinates or implements the recording of SCM actions. (L2-75, Ab2, 7)	
	A configuration management library system is established as a repository for the software baselines. (L2-77, A3)	
	The point in its development that each configuration item/unit is placed under configuration management is specified. (L2-79, A4, 5)	
	The person responsible for each configuration item/unit (i.e., the owner, from a configuration management point of view) is identified. (L2-79, A4, 6)	
	Change requests and problem reports for all configuration items/units are initiated, recorded, reviewed, approved, and tracked according to a documented procedure. (L2-79, A5)	
	Reviews and/or regression tests are performed to ensure that changes have not caused unintended effects on the baseline. (L2-80, A6, 1)	
	Only configuration items/units that are approved by the **SCCB** are entered into the software baseline library. (L2-80, A6, 2)	
	The configuration management actions are recorded in sufficient detail so that the content and status of each configuration item/unit are known and previous versions can be recovered. (L2-81, A8, 1)	
	Software baseline audits are conducted according to a documented procedure. (L2-81, A10)	
	The SCM activities are reviewed with **senior management** on a periodic basis. (L2-82, V1)	
	The SCM activities are reviewed with the **project manager** on both a periodic and event-driven basis. (L2-83, V2)	

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SCM Process - Exit Criteria, Continued

General exit criteria, continued

The CMM recommends that the conditions described in the table below be satisfied to exit the software configuration management process, continued from the previous page.

√	Condition	References
	The **SCM group** periodically audits software baselines to verify that they conform to the documentation that defines them. (L2-83, V3)	
	The **software quality assurance group** reviews and/or audits the activities and work products for SCM and reports the results. (L2-83, V4)	

SCM Process - Reviews and Audits

Reviews and audits

The table below lists the recommended reviews and audits for the software configuration management process.

√	Review or Audit	Review Participants	References
	The software baselines and SCM activities are audited on a periodic basis. (L2-73, C1, 5)	**Not specified in CMM**	
	The **SCCB** reviews and authorizes changes to the software baselines. (L2-74, Ab1, 3)	**SCCB**	
	The SCM plan is reviewed by the **affected groups**. (L2-77, A1, 2)	**Affected groups**	
	Change requests and problem reports for all configuration items/units are initiated, recorded, reviewed, approved, and tracked according to a documented procedure. (L2-79, A5)	**Not specified in CMM**	
	Reviews and/or regression tests are performed to ensure that changes have not caused unintended effects on the baseline. (L2-80, A6, 1)	**Not specified in CMM**	
	Software baseline audits are conducted according to a documented procedure. (L2-81, A10)	**Not specified in CMM**	
	The SCM activities are reviewed with **senior management** on a periodic basis. (L2-82, V1)	**Senior management**	
	The SCM activities are reviewed with the **project manager** on both a periodic and event-driven basis. (L2-83, V2)	**Project manager**	
	The **SCM group** periodically audits software baselines to verify that they conform to the documentation that defines them. (L2-83, V3)	**SCM group**	

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SCM Process - Reviews and Audits, Continued

Reviews and audits, continued

The table below lists the recommended reviews and audits for the software configuration management process, continued from the previous page.

√	Review or Audit	Review Participants	References
	The **software quality assurance group** reviews and/or audits the activities and work products for SCM and reports the results. (L2-83, V4) At a minimum, the reviews and/or audits verify: ❑ Compliance with the SCM standards and procedures by: ❑ the **SCM group**, ❑ the **SCCB**, ❑ the **software engineering group**, and ❑ other **software-related groups**. ❑ Occurrence of periodic baseline audits.	**SQA group**	

SCM Process - Work Products Managed and Controlled

Work products managed and controlled

The table below lists the work products recommended to be managed and controlled during the configuration management process.

√	Work Products Managed and Controlled	References
	SCM plan. (L2-77, A1, 3)	

SCM Process - Measurements

Measurements

The table below lists the measurements recommended for the software configuration management process.

√	Measurements	References
	Measurements are made and used to determine the status of the SCM activities. (L2-82, M1) Examples of measurements include: ❑ Number of change requests processed per unit time. ❑ Completions of milestones for the SCM activities compared to the plan. ❑ Work completed, effort expended, and funds expended in the SCM activities.	

SCM Process - Documented Procedures

Documented procedures

The table below lists the activities for the software configuration management process recommended to be performed according to a documented procedure.

√	Documented procedures	References
	A SCM plan is prepared for each software project according to a documented procedure. (L2-76, A1) [Refer to Level 2 Procedure Checklists for additional information.]	
	Change requests and problem reports for all configuration items/units are initiated, recorded, reviewed, approved, and tracked according to a documented procedure. (L2-79, A5)	
	Changes to baselines are controlled according to a documented procedure. (L2-80, A6) [Refer to Level 2 Procedure Checklists for additional information.]	
	Products from the software baseline library are created and their release is controlled according to a documented procedure. (L2-80, A7) [Refer to Level 2 Procedure Checklists for additional information.]	
	The status of configuration items/units is recorded according to a documented procedure. (L2-80, A8) [Refer to Level 2 Procedure Checklists for additional information.]	
	Software baseline audits are conducted according to a documented procedure. (L2-81, A10) [Refer to Level 2 Procedure Checklists for additional information.]	

SCM Process - Training

Training

The table below lists the training recommended for the software configuration management process.

√	Training	References
	Members of the **SCM group** are trained in the objectives, procedures, and methods for performing their SCM activities. (L2-76, Ab4)	
	Members of the **software engineering group** and other **software-related groups** are trained to perform their SCM activities. (L2-76, Ab5)	

SCM Process - Tools

Tools

The table below lists the tools recommended for the software configuration management process.

√	Tools	References
	Tools to support the SCM activities. (L2-75, Ab3, 2) Examples of support tools include: ❑ workstations, ❑ database programs, and ❑ configuration management tools.	
	A configuration management library system is established as a repository for the software baselines. (L2-77, A3) This library system: ❑ Supports multiple control levels of SCM. ❑ Provides for the storage and retrieval of configuration items/units. ❑ Provides for the sharing and transfer of configuration items/units between the **affected groups** and between control levels within the library. ❑ Helps in the use of product standards for configuration items/units. ❑ Provides for the storage and recovery of archive versions of configuration items/units. ❑ Helps to ensure correct creation of products from the software baseline library. ❑ Provides for the storage, update, and retrieval of SCM records. ❑ Supports production of SCM reports. ❑ Provides for the maintenance of the library structure and contents.	

Level 2 Procedure Checklists

Overview

Introduction

This section describes all the explicit documented procedures recommended in the Capability Maturity Model for maturity level 2.

Purpose

The purpose of the procedure checklists is to provide:

- Guidance in identifying which procedures are recommended by the CMM at level 2.
- Criteria that an organization can use to evaluate its software procedures to determine if those procedures are consistent with the CMM at level 2.
- Information that can be used to develop software procedures that are consistent with the CMM at level 2.

In this section

This section covers the following documented procedures:

CMM Level 2 Procedures	See Page
Requirements management procedures	L2-Procedures-2
Software project planning procedures	L2-Procedures-3
Software project tracking & oversight procedures	L2-Procedures-6
Software subcontract management procedures	L2-Procedures-7
Software quality assurance procedures	L2-Procedures-11
Software configuration management procedures	L2-Procedures-12

Requirements Management (RM) Procedures

Documented procedures	There are no recommended documented procedures for the requirements management process.

Software Project Planning (SPP) Procedures

Documented procedures

The table below lists the recommended documented procedures for the software project planning process.

√	Documented Procedures	References
	Software project commitments made to individuals and groups external to the organization are reviewed with **senior management** according to a documented procedure. (L2-17, A4)	
	The project's software development plan is developed according to a documented procedure. (L2-18, A6) This procedure typically specifies that: ❑ The software development plan is based on and conforms to: ❑ the customer's standards, as appropriate; ❑ the project's standards; ❑ the approved statement of work; and ❑ the allocated requirements. ❑ Plans for **software-related groups** and other **engineering groups** involved in the activities of the **software engineering group** are negotiated with those groups, the support efforts are budgeted, and the agreements are documented. ❑ Plans for involvement of the **software engineering group** in the activities of other **software-related groups** and other **engineering groups** are negotiated with those groups, the support efforts are budgeted, and the agreements are documented. ❑ The software development plan is reviewed by: ❑ the **project manager**, ❑ the **project software manager**, ❑ the other **software managers**, and ❑ other **affected groups**. ❑ The software development plan is managed and controlled.	

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Documented procedures, continued

The table below lists the recommended documented procedures for the software project planning process, continued from the previous page.

√	Documented Procedures	References
	Estimates for the size of the software work products (or changes to the size of software work products) are derived according to a documented procedure. (L2-21, A9) This procedure typically specifies that: ❑ Size estimates are made for all major software work products and activities. ❑ Software work products are decomposed to the granularity needed to meet the estimating objectives. ❑ Historical data are used where available. ❑ Size estimating assumptions are documented. ❑ Size estimates are documented, reviewed, and agreed to.	
	Estimates for the software project's effort and costs are derived according to a documented procedure. (L2-22, A10) This procedure typically specifies that: ❑ Estimates for the software project's effort and costs are related to the size estimates of the software work products (or the size of the changes). ❑ Productivity data (historical and/or current) are used for the estimates when available; sources and rationale for these data are documented. ❑ The productivity and cost data are from the organization's projects when possible. ❑ The productivity and cost data take into account the effort and significant costs that go into making the software work products. ❑ Effort, staffing, and cost estimates are based on past experience. ❑ Similar projects should be used when possible. ❑ Time phasing of activities is derived. ❑ Distributions of the effort, staffing, and cost estimates over the software life cycle are prepared. ❑ Estimates and the assumptions made in deriving the estimates are documented, reviewed, and agreed to.	

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Documented procedures, continued

The table below lists the recommended documented procedures for the software project planning process, continued from the previous page.

√	Documented Procedures	References
	Estimates for the project's critical computer resources are derived according to a documented procedure. (L2-23, A11) This procedure typically specifies that: ❑ Critical computer resources for the project are identified. ❑ Estimates for the critical computer resources are related to the estimates of: ❑ The size of the software work products. ❑ The operational processing load. ❑ The communications traffic. ❑ Estimates of the critical computer resources are documented, reviewed, and agreed to.	
	The project's software schedule is derived according to a documented procedure. (L2-23, A12) This procedure typically specifies that: ❑ The software schedule is related to: ❑ The size estimate of the software work products (or the size of changes). ❑ The software effort and costs. ❑ The software schedule is based on past experience. ❑ Similar projects are used when possible. ❑ The software schedule accommodates the imposed milestone dates, critical dependency dates, and other constraints. ❑ The software schedule activities are of appropriate duration and the milestones are of appropriate time separation to support accuracy in progress measurement. ❑ Assumptions made in deriving the schedule are documented. ❑ The software schedule is documented, reviewed, and agreed to.	

Software Project Tracking & Oversight (SPTO) Procedures

Documented procedures

The table below lists the recommended documented procedures for the software project tracking and oversight process.

√	Documented Procedures	References
	The project's software development plan is revised according to a documented procedure. (L2-33, A2) This procedure typically specifies that: ❑ The software development plan is revised, as appropriate, to incorporate plan refinements and incorporate plan changes, particularly when plans change significantly. ❑ The software development plan is updated to incorporate all new software project commitments and changes to commitments. ❑ The software development plan is reviewed at each revision. ❑ The software development plan is managed and controlled.	
	Software project commitments and changes to commitments made to individuals and groups external to the organization are reviewed with **senior management** according to a documented procedure. (L2-35, A3)	
	Formal reviews to address the accomplishments and results of the software project are conducted at selected project milestones according to a documented procedure. (L2-39. A13)	

Software Subcontract Management (SSM) Procedures

Documented procedures

The table below lists the recommended documented procedures for the software subcontract management process.

√	Documented Procedures
	The work to be subcontracted is defined and planned according to a documented procedure. (L2-47, A1) This procedure typically specifies that: ❑ The software products and activities to be subcontracted are selected based on a balanced assessment of both technical and nontechnical characteristics of the project. ❑ The functions or subsystems to be subcontracted are selected to match the skills and capabilities of potential **subcontractors**. ❑ The specification of the software products and activities to be subcontracted is determined based on a systematic analysis and appropriate partitioning of the system and software requirements. ❑ The specification of the work to be subcontracted and the standards and procedures to be followed are derived from the project's: ❑ statement of work, ❑ system requirements allocated to software, ❑ software requirements, ❑ software development plan, and ❑ software standards and procedures. ❑ A subcontract statement of work is: ❑ prepared, ❑ reviewed, ❑ agreed to, ❑ revised when necessary, and ❑ managed and controlled. ❑ A plan for selecting a **subcontractor** is prepared concurrent with the subcontract statement of work and is reviewed, as appropriate.

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Documented procedures, continued

The table below lists the recommended documented procedures for the software subcontract management process, continued from the previous page.

√	Documented Procedures
	The **software subcontractor** is selected based on an evaluation of the **subcontract bidders'** ability to perform the work, according to a documented procedure. (L2-49, A2) This procedure covers the evaluation of: ❑ Proposals submitted for the planned subcontract. ❑ Prior performance records on similar work, if available. ❑ The geographic locations of the **subcontract bidders'** organizations relative to the **prime contractor**. ❑ Software engineering and software management capabilities. ❑ Staff available to perform the work. ❑ Prior experience in similar applications, including software expertise on the **subcontractor's software management team**. ❑ Available resources.
	Changes to the software subcontractor's statement of work, subcontract terms and conditions, and other commitments are resolved according to a documented procedure. (L2-51, A6) This procedure typically specifies that: ❑ All **affected groups** of both the **prime contractor** and the **subcontractor** are involved.

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Documented procedures, continued

The table below lists the recommended documented procedures for the software subcontract management process, continued from the previous page.

√	Documented Procedures
	Formal reviews to address the **subcontractor's** software engineering accomplishments and results are conducted at selected milestones according to a documented procedure. (L2-53, A9) This procedure typically specifies that: ❑ Reviews are preplanned and documented in the statement of work. ❑ Reviews address the subcontractor's commitments for, plans for, and status of the software activities. ❑ Significant issues, action items, and decisions are identified and documented. ❑ Software risks are addressed. ❑ The subcontractor's software development plan is refined, as appropriate.

	The **prime contractor's software quality assurance group** monitors the subcontractor's software quality assurance activities according to a documented procedure. (L2-53, A10)
	This procedure typically specifies that:
	❑ The subcontractor's plans, resources, procedures, and standards for software quality assurance are periodically reviewed to ensure they are adequate to monitor the subcontractor's performance.
	❑ Regular reviews of the **subcontractor** are conducted to ensure the approved procedures and standards are being followed.
	  ❑ The **prime contractor's software quality assurance group** spot checks the subcontractor's software engineering activities and products.
	  ❑ The **prime contractor's software quality assurance group** audits the subcontractor's software quality assurance records, as appropriate.
	❑ The subcontractor's records of its software quality assurance activities are periodically audited to assess how well the software quality assurance plans, standards, and procedures are being followed.

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Software Subcontract Management (SSM) Procedures, Continued

Documented procedures, continued

The table below lists the recommended documented procedures for the software subcontract management process, continued from the previous page.

√	Documented Procedures
	The **prime contractor's software configuration management group** monitors the **subcontractor's** activities for software configuration management according to a documented procedure. (L2-54, A11) This procedure typically specifies that: ❑ The subcontractor's plans, resources, procedures, and standards for software configuration management are reviewed to ensure they are adequate. ❑ The **prime contractor** and the **subcontractor** coordinate their activities on matters relating to software configuration management to ensure that the subcontractor's products can be readily integrated or incorporated into the project environment of the **prime contractor**. ❑ The subcontractor's software baseline library is periodically audited to assess how well the standards and procedures for software configuration management are being followed and how effective they are in managing the software baseline.
	The **prime contractor** conducts acceptance testing as part of the delivery of the subcontractor's software products according to a documented procedure. (L2-55, A12) This procedure typically specifies that: ❑ The acceptance procedures and acceptance criteria for each product are defined, reviewed, and approved by both the **prime contractor** and the **subcontractor** prior to the test. ❑ The results of the acceptance tests are documented. ❑ An action plan is established for any software product that does not pass its acceptance test.

Software Quality Assurance (SQA) Procedures

Documented procedures

The table below lists the recommended documented procedures for the software quality assurance process.

√	Documented Procedures	References
	A SQA plan is prepared for the software project according to a documented procedure. (L2-63, A1) This procedure typically specifies that: ❑ The SQA plan is developed in the early stages of, and in parallel with, the overall project planning. ❑ The SQA plan is reviewed by the **affected groups** and **individuals**. ❑ The SQA plan is managed and controlled.	
	Deviations identified in the software activities and software work products are documented and handled according to a documented procedure. (L2-67, A7) This procedure typically specifies that: ❑ Deviations from the software development plan and the designated project standards and procedures are documented and resolved with the appropriate **software task leaders**, **software managers**, or **project manager**, where possible. ❑ Deviations from the software development plan and the designated project standards and procedures not resolvable with the **software task leaders**, **software managers**, or **project manager** are documented and presented to the **senior manager** designated to receive noncompliance items. ❑ Noncompliance items presented to the **senior manager** are periodically reviewed until they are resolved. ❑ The documentation of noncompliance items is managed and controlled.	

Software Configuration Management (SCM) Procedures

Documented procedures

The table below lists the recommended documented procedures for the software configuration management process.

√	Documented Procedures	References
	A SCM plan is prepared for each software project according to a documented procedure. (L2-76, A1) This procedure typically specifies that: ❑ The SCM plan is developed in the early stages of, and in parallel with, the overall project planning. ❑ The SCM plan is reviewed by the **affected groups**. ❑ The SCM plan is managed and controlled.	
	Change requests and problem reports for all configuration items/units are initiated, recorded, reviewed, approved, and tracked according to a documented procedure. (L2-79, A5)	
	Changes to baselines are controlled according to a documented procedure. (L2-80, A6) This procedure typically specifies that: ❑ Reviews and/or regression tests are performed to ensure that changes have not caused unintended effects on the baseline. ❑ Only configuration items/units that are approved by the **SCCB** are entered into the software baseline library. ❑ Configuration items/units are checked in and out in a manner that maintains the correctness and integrity of the software baseline library.	
	Products from the software baseline library are created and their release is controlled according to a documented procedure. (L2-80, A7) This procedure typically specifies that: ❑ The **SCCB** authorizes the creation of products from the software baseline library. ❑ Products from the software baseline library, for both internal and external use, are built only from configuration items/units in the software baseline library.	

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Documented procedures, continued

The table below lists the recommended documented procedures for the software configuration management process, continued from the previous page.

√	Documented Procedures	References
	The status of configuration items/units is recorded according to a documented procedure. (L2-80, A8) This procedure typically specifies that: ❑ The configuration management actions are recorded in sufficient detail so that the content and status of each configuration item/unit are known and previous versions can be recovered. ❑ The current status and history (i.e., changes and other actions) of each configuration item/unit are maintained.	
	Software baseline audits are conducted according to a documented procedure. (L2-81, A10). This procedure typically specifies that: ❑ There is adequate preparation for the audit. ❑ The integrity of software baselines is assessed. ❑ The structure and facilities of the configuration management library system are reviewed. ❑ The completeness and correctness of the software baseline library contents are verified. ❑ Compliance with applicable SCM standards and procedures is verified. ❑ The results of the audit are reported to the **project software manager**. ❑ Action items from the audit are tracked to closure.	

Level 2 Summary

Overview

Section purpose

The purpose of this section is to provide checklists that provide a summary of the repeatable level (level 2). This section contains three perspectives of a CMM level.

- *Key process area (KPA) specific information*:
  KPA purpose
  KPA goals

- *Operational framework information (from a maturity level viewpoint)*:
  Policies
  Standards
  Process descriptions
  Procedures
  Training
  Tools

- *Other key process information (from a maturity level viewpoint)*:
  Reviews and audits
  Work products managed and controlled
  Measurements

Section overview

This section contains the following topics.

Topic	Page
Level 2 - KPA Purposes	L2-Summary-2
Level 2 - KPA Goals	L2-Summary-3
Level 2 - Policies	L2-Summary-5
Level 2 - Standards	L2-Summary-6
Level 2 - Process Descriptions	L2-Summary-7
Level 2 - Procedures	L2-Summary-10
Level 2 - Training	L2-Summary-13
Level 2 - Tools	L2-Summary-14
Level 2 - Reviews and Audits	L2-Summary-15
Level 2 - Work Products Managed and Controlled	L2-Summary-20
Level 2 - Measurements	L2-Summary-21

Level 2 - KPA Purposes

Level 2 KPA purposes

The following table describes the purpose of each key process area in the CMM at level 2.

√	KPA	Purpose of KPAs at Level 2
	RM	The purpose of Requirements Management is to establish a common understanding between the customer and the software project of the customer's requirements that will be addressed by the software project. (L2-1)
	SPP	The purpose of Software Project Planning is to establish reasonable plans for performing the software engineering and for managing the software project. (L2-11)
	SPTO	The purpose of Software Project Tracking and Oversight is to provide adequate visibility into actual progress so that management can take effective actions when the software project's performance deviates significantly from the software plans. (L2-29)
	SSM	The purpose of Software Subcontract Management is to select qualified software subcontractors and manage them effectively. (L2-43)
	SQA	The purpose of Software Quality Assurance is to provide management with appropriate visibility into the process being used by the software project and of the products being built. (L2-59)
	SCM	The purpose of Software Configuration Management is to establish and maintain the integrity of the products of the software project throughout the project's software life cycle. (L2-71)

Level 2 - KPA Goals

Level 2 KPA goals

The following table lists the goals that are described in the CMM for each key process area at level 2.

√	KPA	CMM Goals at Level 2	References
	RM	System requirements allocated to software are controlled to establish a baseline for software engineering and management use. (L2-2, G1)	
	RM	Software plans, products, and activities are kept consistent with the system requirements allocated to software. (L2-2, G2)	
	SPP	Software estimates are documented for use in planning and tracking the software project. (L2-12, G1)	
	SPP	Software project activities and commitments are planned and documented. (L2-12, G2)	
	SPP	**Affected groups** and **individuals** agree to their commitments related to the software project. (L2-12, G3)	
	SPTO	Actual results and performances are tracked against the software plans. (L2-30, G1)	
	SPTO	Corrective actions are taken and managed to closure when actual results and performance deviate significantly from the software plans. (L2-30, G2)	
	SPTO	Changes to software commitments are agreed to by the **affected groups** and **individuals**. (L2-30, G3)	
	SSM	The **prime contractor** selects qualified software subcontractors. (L2-44, G1)	
	SSM	The **prime contractor** and the **software subcontractor** agree to their commitments to each other. (L2-44, G2)	
	SSM	The **prime contractor** and the **software subcontractor** maintain ongoing communications. (L2-44, G3)	
	SSM	The **prime contractor** tracks the software subcontractor's actual results and performance against its commitments. (L2-44, G4)	

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Level 2 - KPA Goals, Continued

Level 2 KPA goals, continued

The following table lists the goals that are described in the CMM for each key process area at level 2, continued from the previous page.

√	KPA	CMM Goals at Level 2	References
	SQA	Software quality assurance activities are planned. (L2-60, G1)	
	SQA	Adherence of software products and activities to applicable standards, procedures, and requirements is verified objectively. (L2-60, G2)	
	SQA	**Affected groups** and **individuals** are informed of software quality assurance activities and results. (L2-60, G3)	
	SQA	Noncompliance issues that cannot be resolved within the software project are addressed by **senior management**. (L2-60, G4)	
	SCM	Software configuration management activities are planned. (L2-72, G1)	
	SCM	Selected software work products are identified, controlled, and available. (L2-72, G2)	
	SCM	Changes to identified software work products are controlled. (L2-72, G3)	
	SCM	**Affected groups** and **individuals** are informed of the status and content of software baselines. (L2-72, G4)	

Level 2 - Policies

Level 2 policies The following table lists the recommended policies in the CMM at level 2.

√	KPA	Description	References
	RM	Written organizational policy for managing the system requirements allocated to software. (L2-2, C1)	
	SPP	Written organizational policy for planing a software project. (L2-12, C2)	
	SPTO	Written organizational policy for managing the software project. (L2-30, C2)	
	SSM	Written organizational policy for managing the software subcontract. (L2-44, C1)	
	SQA	Written organizational policy for implementing software quality assurance (SQA). (L2-60, C1)	
	SCM	Written organizational policy for implementing software configuration management (SCM). (L2-72, C1)	

Level 2 - Standards

Level 2 standards

The CMM recommends the contents of the following work products at level 2:

√	KPA	Standards at Level 2	References
	RM	Allocated requirements. (L2-4, Ab2, 1-3)	
	SPP	Statement of work. (L2-14, Ab1, 1)	
	SPP	Software development plan. (L2-19, A7, 1-10)	
	SSM	Contractual agreement. (L2-50, A3, 1-8)	
	SQA	Software quality assurance plan. (L2-64, A2, 1-10)	
	SCM	Software configuration management plan. (L2-77, A2, 1-2)	

Reference

Refer to the Level 2 Standards Checklists for additional information regarding the content of each standard.

Level 2 - Process Descriptions

RM process description

Requirements Management involves establishing and maintaining an agreement with the customer on the requirements for the software project. This agreement is referred to as the "system requirements allocated to the software." The "customer" may be interpreted as the system engineering group, the marketing group, another internal organization, or an external customer. The agreement covers both the technical and nontechnical (e.g., delivery dates) requirements. The agreement forms the basis for estimating, planning, performing, and tracking the software project's activities throughout the software life cycle.

The allocation of the system requirements to software, hardware, and other system components (e.g., humans) may be performed by a group external to the software engineering group (e.g., the system engineering group), and the software engineering group may have no direct control of this allocation. Within the constraints of the project, the software engineering group takes appropriate steps to ensure that the system requirements allocated to software, which they are responsible for addressing, are documented and controlled.

To achieve this control, the software engineering group reviews the initial and revised system requirements allocated to software to resolve issues before they are incorporated into the software project. Whenever the system requirements allocated to software are changed, the affected software plans, work products, and activities are adjusted to remain consistent with the updated requirements. (L2-1)

SPP process description

Software Project Planning involves developing estimates for the work to be performed, establishing the necessary commitments, and defining the plan to perform the work.

The software planning begins with a statement of the work to be performed and other constraints and goals that define and bound the software project (those established by the practices of the Requirements Management key process area). The software planning process includes steps to estimate the size of the software work products and the resources needed, produce a schedule, identify and assess software risks, and negotiate commitments. Iterating through these steps may be necessary to establish the plan for the software project (i.e., the software development plan).

This plan provides the basis for performing and managing the software project's activities and addresses the commitments to the software project's customer according to the resources, constraints, and capabilities of the software project. (L2-11)

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SPTO process description

Software Project Tracking and Oversight involves tracking and reviewing the software accomplishments and results against documented estimates, commitments, and plans, and adjusting these plans based on the actual accomplishments and results.

A documented plan for the software project (i.e., the software development plan, as described in the Software Project Planning key process area) is used as the basis for tracking the software activities, communicating status, and revising plans. Software activities are monitored by the management. Progress is primarily determined by comparing the actual software size, effort, cost, and schedule to the plan when selected software work products are completed and at selected milestones. When it is determined that the software project's plans are not being met, corrective actions are taken. These actions may include revising the software development plan to reflect the actual accomplishments and replanning the remaining work or taking actions to improve the performance. (L2-29)

SSM process description

Software Subcontract Management involves selecting a software subcontractor, establishing commitments with the subcontractor, and tracking and reviewing the subcontractor's performance and results. These practices cover the management of a software (only) subcontract, as well as the management of the software component of a subcontract that includes software, hardware, and possibly other system components.

The subcontractor is selected based on its ability to perform the work. Many factors contribute to the decision to subcontract a portion of the prime contractor's work. Subcontractors may be selected based on strategic business alliances, as well as technical considerations. The practices of this key process area address the traditional acquisition process associated with subcontracting a defined portion of the work to another organization.

When subcontracting, a documented agreement covering the technical and nontechnical (e.g., delivery dates) requirements is established and is used as the basis for managing the subcontract. The work to be done by the subcontractor and the plans for the work are documented. The standards that are to be followed by the subcontractor are compatible with the prime contractor's standards.

The software planning, tracking, and oversight activities for the subcontracted work are performed by the subcontractor. The prime contractor ensures that these planning, tracking, and oversight activities are performed appropriately and that the software products delivered by the subcontractor satisfy their acceptance criteria. The prime contractor works with the subcontractor to manage their product and process interfaces. (L2-43)

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SQA process description

Software Quality Assurance involves reviewing and auditing the software products and activities to verify that they comply with the applicable procedures and standards and providing the software project and other appropriate managers with the results of these reviews and audits.

The software quality assurance group works with the software project during its early stages to establish plans, standards, and procedures that will add value to the software project and satisfy the constraints of the project and the organization's policies. By participating in establishing the plans, standards, and procedures, the software quality assurance group helps ensure they fit the project's needs and verifies that they will be usable for performing reviews and audits throughout the software life cycle. The software quality assurance group reviews project activities and audits software work products throughout the life cycle and provides management with visibility as to whether the software project is adhering to its established plans, standards, and procedures.

Compliance issues are first addressed within the software project and resolved there if possible. For issues not resolvable within the software project, the software quality assurance group escalates the issue to an appropriate level of management for resolution.

This key process area covers the practices for the group performing the software quality assurance function. The practices identifying the specific activities and work products that the software quality assurance group reviews and/or audits are generally contained in the Verifying Implementation common feature of the other key process areas. (L2-59)

SCM process description

Software Configuration Management involves identifying the configuration of the software (i.e., selected software work products and their descriptions) at given points in time, systematically controlling changes to the configuration, and maintaining the integrity and traceability of the configuration throughout the software life cycle. The work products placed under software configuration management include the software products that are delivered to the customer (e.g., the software requirements document and the code) and the items that are identified with or required to create these software products (e.g., the compiler).

A software baseline library is established containing the software baselines as they are developed. Changes to baselines and the release of software products built from the software baseline library are systematically controlled via the change control and configuration auditing functions of software configuration management.

This key process area covers the practices for performing the software configuration management function. The practices identifying specific configuration items/units are contained in the key process areas that describe the development and maintenance of each configuration item/unit. (L2-71)

Level 2 - Procedures

Level 2 procedures

The table below lists the activities that are recommended to be performed according to a documented procedure in the CMM at level 2. Refer to the Level 2 Procedure Checklists for additional information regarding the content of each documented procedure.

√	KPA	Documented Procedures	References
	RM	There are no required procedures for the RM process.	
	SPP	Software project commitments made to individuals and groups external to the organization are reviewed with **senior management** according to a documented procedure. (L2-17, A4)	
	SPP	The project's software development plan is developed according to a documented procedure. (L2-18, A6)	
	SPP	Estimates for the size of the software work products (or changes to the size of software work products) are derived according to a documented procedure. (L2-21, A9)	
	SPP	Estimates for the software project's effort and costs are derived according to a documented procedure. (L2-22, A10)	
	SPP	Estimates for the project's critical computer resources are derived according to a documented procedure. (L2-23, A11)	
	SPP	The project's software schedule is derived according to a documented procedure. (L2-23, A12)	
	SPTO	The project's software development plan is revised according to a documented procedure. (L2-33, A2)	
	SPTO	Software project commitments and changes to commitments made to individuals and groups external to the organization are reviewed with **senior management** according to a documented procedure. (L2-35, A3)	
	SPTO	Formal reviews to address the accomplishments and results of the software project are conducted at selected project milestones according to a documented procedure. (L2-39, A13)	

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Level 2 - Procedures, Continued

Level 2 procedures, continued

The table below lists the activities that are recommended to be performed according to a documented procedure in the CMM at level 2, continued from the previous page.

√	KPA	Documented Procedures	References
	SSM	The work to be subcontracted is defined and planned according to a documented procedure. (L2-47, A1)	
	SSM	The software subcontractor is selected based on an evaluation of the subcontract bidders' ability to perform the work, according to a documented procedure. (L2-49, A2)	
	SSM	Changes to the software subcontractor's statement of work, subcontract terms and conditions, and other commitments are resolved according to a documented procedure. (L2-51, A6)	
	SSM	Formal reviews to address the subcontractor's software engineering accomplishments and results are conducted at selected milestones according to a documented procedure. (L2-53, A9)	
	SSM	The **prime contractor's software quality assurance group** monitors the subcontractor's software quality assurance activities according to a documented procedure. (L2-53, A10)	
	SSM	The **prime contractor's software configuration management group** monitors the subcontractor's activities for software configuration management according to a documented procedure. (L2-54, A11)	
	SSM	The **prime contractor** conducts acceptance testing as part of the delivery of the subcontractor's software products according to a documented procedure. (L2-55, A12)	
	SQA	A SQA plan is prepared for the software project according to a documented procedure. (L2-63, A1)	

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Level 2 - Procedures, Continued

Level 2 procedures, continued

The table below lists the activities that are recommended to be performed according to a documented procedure in the CMM at level 2, continued from the previous page.

√	KPA	Documented Procedures	References
	SQA	Deviations identified in the software activities and software work products are documented and handled according to a documented procedure. (L2-67, A7)	
	SCM	A SCM plan is prepared for each software project according to a documented procedure. (L2-76, A1)	
	SCM	Change requests and problem reports for all configuration items/units are initiated, recorded, reviewed, approved, and tracked according to a documented procedure. (L2-79, A5)	
	SCM	Changes to baselines are controlled according to a documented procedure. (L2-80, A6)	
	SCM	Products from the software baseline library are created and their release is controlled according to a documented procedure. (L2-80, A7)	
	SCM	The status of configuration items/units is recorded according to a documented procedure (L2-80, A8)	
	SCM	Software baseline audits are conducted according to a documented procedure. (L2-81, A10).	

Level 2 - Training

Level 2 training The table below lists the training recommended in the CMM at level 2.

√	KPA	Training	References
	RM	Members of the **software engineering group** and other **software-related groups** are trained to perform their requirements management activities. (L2-5, Ab4)	
	SPP	The **software managers, software engineers**, and other **individuals** involved in the software project planning are trained in the software estimating and planning procedures applicable to their areas of responsibility. (L2-16, Ab4)	
	SPTO	The **software managers** are trained in managing the technical and personnel aspects of the software project. (L2-32, Ab4)	
	SPTO	**First-line software managers** receive orientation in the technical aspects of the software project. (L2-32, Ab5)	
	SSM	**Software managers** and other **individuals** who are involved in establishing and managing the software subcontract are trained to perform these activities. (L2-46, Ab2)	
	SSM	**Software managers** and other **individuals** who are involved in managing the software subcontract receive orientation in the technical aspects of the subcontract. (L2-46, Ab3)	
	SQA	Members of the **SQA group** are trained to perform their SQA activities. (L2-62, Ab3)	
	SQA	The members of the software project receive orientation on the role, responsibilities, authority, and value of the SQA group. (L2-63, Ab4)	
	SCM	Members of the **SCM group** are trained in the objectives, procedures, and methods for performing their SCM activities. (L2-76, Ab4)	
	SCM	Members of the **software engineering group** and other **software-related groups** are trained to perform their SCM activities. (L2-76, Ab5)	

Level 2 - Tools

Level 2 tools The table below lists the tools recommended in the CMM for level 2.

√	KPA	Tools	References
	RM	Tools to support the activities for managing requirements. (L2-5, Ab3, 2)	
	SPP	Tools to support software project planning activities. (L2-16, Ab3, 2)	
	SPTO	Tools to support software tracking. (L2-32, Ab3, 2)	
	SSM	Tools to support managing the subcontract. (L2-46, Ab1, 2)	
	SQA	Tools to support the SQA activities. (L2-62, Ab2, 3)	
	SCM	Tools to support the SCM activities. (L2-75, Ab3, 2)	
	SCM	A configuration management library system is established as a repository for the software baselines. (L2-77, A3) This library system: ❑ Supports multiple control levels of SCM. ❑ Provides for the storage and retrieval of configuration items/units. ❑ Provides for the sharing and transfer of configuration items/units between the **affected groups** and between control levels within the library. ❑ Helps in the use of product standards for configuration items/units. ❑ Provides for the storage and recovery of archive versions of configuration items/units. ❑ Helps to ensure correct creation of products from the software baseline library. ❑ Provides for the storage, update, and retrieval of SCM records. ❑ Supports production of SCM reports. ❑ Provides for the maintenance of the library structure and contents.	

Level 2 - Reviews and Audits

Level 2 reviews and audits

The table below lists the recommended reviews and audits in the CMM at level 2.

√	KPA	Review or Audit	Review Participants	References
	RM	The **software engineering group** reviews allocated requirements before they are incorporated into the software project. (L2-5, A1)	**Software engineering group**	
	RM	Changes to the allocated requirements are reviewed and incorporated into the software project. (L2-7, A3)	**Not specified in CMM**	
	RM	The activities for managing the allocated requirements are reviewed with **senior management** on a periodic basis. (L2-9, V1)	**Senior management**	
	RM	The activities for managing the allocated requirements are reviewed with the **project manager** on both a periodic and event-driven basis. (L2-9, V2)	**Project manager**	
	RM	The **software quality assurance group** reviews and/or audits the activities and work products for managing the allocated requirements and reports the results. (L2-9, V3)	**SQA group**	
	SPP	Software project commitments made to individuals and groups external to the organization are reviewed with **senior management**. (L2-17, A4)	**Senior management**	
	SPP	The activities for software project planning are reviewed with **senior management** on a periodic basis. (L2-26, V1)	**Senior management**	
	SPP	The activities for software project planning are reviewed with the **project manager** on both a periodic and event-driven basis. (L2-26, V2)	**Project manager**	

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Level 2 - Reviews and Audits, Continued

Level 2 reviews and audits, continued

The table below lists the recommended reviews and audits in the CMM at level 2, continued from the previous page.

√	KPA	Review or Audit	Review Participants	References
	SPP	The **software quality assurance group** reviews and/or audits the activities and work products for software project planning and reports the results (L2-27, V3)	**SQA group**	
	SPTO	Software project commitments and changes to commitments made to **individuals and groups external to the organization** are reviewed with **senior management** according to a documented procedure. (L2-35, A3)	**Senior management**	
	SPTO	The **software engineering group** conducts periodic internal reviews to track technical progress, plans, performance, and issues against the software development plan. (L2-38, A12) These reviews are conducted between: ❑ The **first-line software managers** and their **software task leaders**. ❑ The **project software manager**, **first-line software managers**, and other **software managers**, as appropriate.	**Software engineering group** **First-line software managers** **Project software manager** **Software managers** **Software task leaders**	
	SPTO	Formal reviews to address the accomplishments and results of the software project are conducted at selected project milestones according to a documented procedure. (L2-39, A13) ❑ These reviews are conducted with the **customer**, **end user**, and **affected groups** within the organization, as appropriate. (L2-39, A13, 2)	**Affected groups** **Customer** **End user** **Software managers**	
	SPTO	The activities for software project tracking and oversight are reviewed with **senior management** on a periodic basis. (L2-40, V1)	**Senior management**	

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Level 2 - Reviews and Audits, Continued

Level 2 reviews and audits, continued

The table below lists the recommended reviews and audits in the CMM at level 2, continued from the previous page.

√	KPA	Review or Audit	Review Participants	References
	SPTO	The activities for software project tracking and oversight are reviewed with the **project manager** on both a periodic and event-driven basis. (L2-41, V2)	**Project manager**	
	SPTO	The **software quality assurance group** reviews and/or audits the activities and work products for software project tracking and oversight and reports the results. (L2-41, V3)	**SQA group**	
	SSM	A documented subcontractor's software development plan is reviewed and approved by the **prime contractor**. (L2-51, A4)	**Prime contractor**	
	SSM	The **prime contractor's management** conducts periodic status/coordination reviews with the software **subcontractor's management**. (L2-51, A7)	**Prime contractor's management** **Sub-contractor's management**	
	SSM	Periodic technical reviews and interchanges are held with the **software subcontractor**. (L2-52, A8)	**Software subcontrac-tor**	
	SSM	Formal reviews to address the subcontractor's software engineering accomplishments and results are conducted at selected milestones according to a documented procedure. (L2-53, A9)	**Not specified in the CMM**	
	SSM	The software subcontractor's performance is evaluated on a periodic basis, and the evaluation is reviewed with the **subcontractor**. (L2-55, A13)	**Subcontrac-tor**	

Continued on next page

Level 2 - Reviews and Audits, Continued

Level 2 reviews and audits, continued

The table below lists the recommended reviews and audits in the CMM at level 2, continued from the previous page.

√	KPA	Review or Audit	Review Participants	References
	SSM	The activities for managing the software subcontract are reviewed with **senior management** on a periodic basis. (L2-56, V1)	**Senior management**	
	SSM	The activities for managing the software subcontract are reviewed with the **project manager** on both a periodic and event-driven basis. (L2-56, V2)	**Project manager**	
	SSM	The **software quality assurance group** reviews and/or audits the activities and work products for managing the software subcontract and reports the results. (L2-57, V3)	**SQA group**	
	SQA	The **SQA group** participates in the preparation and review of the project's software development plan, standards, and procedures. (L2-65, A3)	**SQA group**	
	SQA	The **SQA group** reviews the software engineering activities to verify compliance. (L2-66, A4)	**SQA group**	
	SQA	The **SQA group** audits designated software work products to verify compliance. (L2-66, A5)	**SQA group**	
	SQA	The **SQA group** conducts periodic reviews of its activities and findings with the **customer's SQA personnel**, as appropriate. (L2-67, A8)	**SQA group** **Customer's SQA personnel**	
	SQA	The SQA activities are reviewed with **senior management** on a periodic basis. (L2-68, V1)	**Senior management**	

Continued on next page

Level 2 - Reviews and Audits, Continued

Level 2 reviews and audits, continued

The table below lists the recommended reviews and audits in the CMM at level 2, continued from the previous page.

√	KPA	Review or Audit	Review Participants	References
	SQA	The SQA activities are reviewed with the **project manager** on both a periodic and event-driven basis. (L2-69, V2)	**Project manager**	
	SQA	**Experts independent of the SQA group** periodically review the activities and software work products of the project's **SQA group**. (L2-69, V3)	**Experts independent of the SQA group**	
	SCM	Change requests and problem reports for all configuration items/units are initiated, recorded, reviewed, approved, and tracked according to a documented procedure. (L2-79, A5)	**Not specified in CMM**	
	SCM	Software baseline audits are conducted according to a documented procedure. (L2-81, A10)	**Not specified in CMM**	
	SCM	The SCM activities are reviewed with **senior management** on a periodic basis. (L2-82, V1)	**Senior management**	
	SCM	The SCM activities are reviewed with the **project manager** on both a periodic and event-driven basis. (L2-83, V2)	**Project manager**	
	SCM	The **SCM group** periodically audits software baselines to verify that they conform to the documentation that defines them. (L2-83, V3)	**SCM group**	
	SCM	The **software quality assurance group** reviews and/or audits the activities and work products for SCM and reports the results. (L2-83, V4)	**SQA group**	

Level 2 - Work Products Managed and Controlled

Level 2 work products managed and controlled

The table below lists the work products that are recommended to be managed and controlled in the CMM at level 2.

√	KPA	Work Products Managed and Controlled	References
	RM	Allocated requirements. (L2-7, A2, 1)	
	SPP	Project's software development plan. (L2-13, C2, 6)	
	SPP	Statement of work. (L2-15, Ab1, 3)	
	SPP	Software planning data. (L2-25, A15, 2)	
	SPTO	Software development plan (SDP). (L2-34, A2, 4) (Same as project's SDP above in SPP)	
	SPTO	Software replanning data. (L2-38, A11, 2)	
	SSM	Subcontract statement of work. (L2-48, A1, 3.5)	
	SQA	SQA plan. (L2-64, A1, 3)	
	SQA	Documentation of noncompliance items. (L2-67, A7, 4)	
	SCM	SCM plan. (L2-77, A1, 3)	

Level 2 - Measurements

Level 2 measurements

The table below describes the recommended measurements in the CMM at level 2.

√	KPA	Description	References
	RM	Measurements to determine the status of the activities for managing the allocated requirements. (L2-8, M1)	
	SPP	Software planning data. (L2-25, A15) ❑ Information recorded includes the estimates and the associated information needed to reconstruct the estimates and assess their reasonableness. (L2-25, A15, 1)	
	SPP	Measurements to determine the status of the software planning activities. (L2-25, M1)	
	SPTO	Actual measurement data and replanning data for the software project. (L2-38, A11)	
	SPTO	Measurements to determine the status of the software tracking and oversight activities. (L2-39, M1)	
	SSM	Measurements to determine the status of the activities for managing the software subcontract. (L2-55, M1)	
	SQA	Measurements to determine the cost and schedule status of the SQA activities. (L2-68, M1)	
	SCM	Measurements to determine the status of the SCM activities. (L2-82, M1)	

Chapter 5. Defined Level (Level 3)

Overview

Introduction This chapter contains the checklists for level 3 of the CMM.

In this chapter This chapter contains the following sections:

Section Title	Page
Level 3 Policy Checklists	L3-Policy-1
Level 3 Standards Checklists	L3-Standards-1
Level 3 Process Checklists	L3-Process-1
Level 3 Procedure Checklists	L3-Procedures-1
Level 3 Summary	L3-Summary-1

Level 3 Policy Checklists

Overview

Introduction

This section describes the explicit policies found in the Capability Maturity Model at maturity level 3.

Purpose

The purpose of the policy checklists is to provide:

- Guidance in identifying which policies are recommended by the CMM at level 3.
- Criteria that an organization can use to evaluate its software policies to determine if they are consistent with the CMM at level 3.
- Information that can be used to develop software policies so that they are consistent with the CMM at level 3.

Checklist description

Each checklist contains two subsections: the KPA policies and the KPA goals. The table below describes these two subsections of a policy checklist.

Subsection	Description
Policy checklist	This subsection contains criteria that the organizational policy can be evaluated against. These criteria must be addressed by organizational policy to be consistent with the CMM.
Policy goals	This subsection is a reminder to policy designers and evaluators to keep in mind the KPA goals when developing the policies for each KPA. The goals can be thought of as the results of implementing an effective policy.

In this section

This section covers the following policies:

Policies	See Page
Organization process focus policy	L3-Policy-2
Organization process definition policy	L3-Policy-3
Training program policy	L3-Policy-4
Integrated software management policy	L3-Policy-5
Software product engineering policy	L3-Policy-6
Intergroup coordination policy	L3-Policy-7
Peer reviews policy	L3-Policy-8

Organization Process Focus (OPF) Policy

OPF policy checklist

The organization follows a written organizational policy for coordinating software process development and improvement activities across the organization (L3-2, C1). This policy typically specifies that:

√	Description	References
	A group is established that is responsible for the organization-level software process activities and coordinating these activities with the projects. (L3-2, C1, 1)	
	The software processes used by the projects are assessed periodically to determine their strengths and weaknesses. (L3-2, C1, 2)	
	The software processes used by the projects are appropriately tailored from the organization's standard software process. (L3-2, C1, 3)	
	Improvements to, and other useful information on, each project's software process, tools, and methods are available to other projects. (L3-2, C1, 4)	

OPF policy goals

Implementation of an effective organizational process focus policy has the following results:

√	Results of Effectively Implementing OPF Policy	References
	Software process development and improvement activities are coordinated across the organization. (L3-1, G1)	
	The strengths and weaknesses of the software processes used are identified relative to the process standard. (L3-2, G2)	
	Organization-level process development and improvement activities are planned. (L3-2, G3)	

Organization Process Definition (OPD) Policy

OPD policy checklist

The organization follows a written policy for developing and maintaining a standard software process and related process assets (L3-12, C1). This policy typically specifies that:

√	Description	References
	A standard software process is defined for the organization. (L3-12, C1, 1)	
	A project's defined software process is a tailored version of the organization's standard software process. (L3-13, C1, 2)	
	The organization's software process assets are maintained. (L3-13, C1, 3)	
	Information collected from the projects is organized and used to improve the organization's standard software process. (L3-13, C1, 4)	

OPD policy goals

Implementation of an effective organizational process definition policy has the following results:

√	Results of Effectively Implementing OPD Policy	References
	A standard software process for the organization is developed and maintained. (L3-12, G1)	
	Information related to the use of the organization's standard software process by the software projects is collected, reviewed, and made available. (L3-12, G2)	

Training Program (TP) Policy

TP policy checklist

The organization follows a written policy for meeting its training needs (L3-26, C1). This policy typically specifies that:

√	Description	References
	The needed skills and knowledge for each software management and technical role are identified. (L3-26, C1, 1)	
	Training vehicles for imparting skills and knowledge are identified and approved. (L3-26, C1, 2)	
	Training is provided to build the skill base of the organization, to fill the specific needs of the projects, and to develop the skills of individuals. (L3-26, C1, 3)	
	Training is developed within the organization or obtained from outside the organization when appropriate. (L3-26, C1, 4)	

TP policy goals

Implementation of an effective training program policy has the following results:

√	Results of Effectively Implementing TP Policy	References
	Training activities are planned. (L3-25, G1)	
	Training for developing the skills and knowledge needed to perform software management and technical roles is provided. (L3-25, G2)	
	Individuals in the **software engineering group** and **software-related groups** receive the training necessary to perform their roles. (L3-26, G3)	

Integrated Software Management (ISM) Policy

ISM policy checklist

The project follows a written organizational policy requiring that the software project be planned and managed using the organization's standard software process and related process assets (L3-38, C1). This policy typically specifies that:

√	Description	References
	Each project documents the project's defined software process by tailoring the organization's standard software process. (L3-39, C1, 1)	
	The project's deviations from the organization's standard software process are documented and approved. (L3-39, C1, 2)	
	Each project performs its software activities in accordance with the project's defined software process. (L3-39, C1, 3)	
	Each project collects and stores appropriate project measurement data in the organization's software process database. (L3-39, C1, 4)	

ISM policy goals

Implementation of an effective integrated software management policy has the following results:

√	Results of Effectively Implementing ISM Policy	References
	The project's defined software process is a tailored version of the organization's standard software process. (L3-38, G1)	
	The project is planned and managed according to the project's defined software process. (L3-38, G2)	

Software Product Engineering (SPE) Policy

SPE policy checklist

The project follows a written organizational policy for performing the software engineering activities (L3-60, C1). This policy typically specifies that:

√	Description	References
	The software engineering tasks are performed in accordance with the project's defined software process. (L3-60, C1, 1)	
	Appropriate methods and tools are used to build and maintain the software products. (L3-60, C1, 2)	
	The software plans, tasks, and products are traceable to the system requirements allocated to software. (L3-60, C1, 3)	

SPE policy goals

Implementation of an effective software product engineering policy has the following results:

√	Results of Effectively Implementing SPE Policy	References
	The software engineering tasks are defined, integrated, and consistently performed to produce the software. (L3-60, G1)	
	Software work products are kept consistent with each other. (L3-60, G2)	

Intergroup Coordination (IC) Policy

IC policy checklist

The project follows a written organizational policy for establishing interdisciplinary engineering teams (L3-84, C1). This policy typically specifies that:

√	Description	References
	The system requirements and project-level objectives for the project are defined and reviewed by all **affected groups**. (L3-84, C1, 1)	
	The **engineering groups** coordinate their plans and objectives. (L3-84, C1, 2)	
	Managers are responsible for establishing and maintaining an environment to facilitate interaction, coordination, support, and teamwork between the project's engineering groups, between the project and the customer or end users, as appropriate, and throughout the organization. (L3-85, C1, 3)	

IC policy goals

Implementation of an effective intergroup coordination policy has the following results:

√	Results of Effectively Implementing IGC Policy	References
	The customer's requirements are agreed to by all **affected groups**. (L3-84, G1)	
	The commitments between the **engineering groups** are agreed to by the **affected groups**. (L3-84, G2)	
	The **engineering groups** identify, track, and resolve intergroup issues. (L3-84, G3)	

Peer Reviews (PR) Policy

PR policy checklist

The project follows a written organizational policy for performing peer reviews (L3-94, C1). This policy typically specifies that:

√	Description	References
	The organization identifies a standard set of software work products that will undergo peer review. (L3-94, C1, 1)	
	Each project identifies the software work products that will undergo peer review. (L3-94, C1, 2)	
	Peer reviews are led by trained **peer review leaders**. (L3-94, C1, 3)	
	Peer reviews focus on the software work product being reviewed and not on the producer. (L3-94, C1, 4)	
	Results of the peer reviews are not used by **management** to evaluate the performance of individuals. (L3-94, C1, 5)	

PR policy goals

Implementation of an effective Peer Reviews policy has the following results:

√	Results of Effectively Implementing PR Policy	References
	Peer reviews are planned. (L3-93, G1)	
	Defects in the software work products are identified and removed. (L3-93, G2)	

Level 3 Standards Checklists

Overview

Introduction

This section describes the recommended content of selected work products in the CMM at maturity level 3.

Definition

A *standard checklist* describes the content of a work product as recommended by the CMM.

Purpose

The purpose of the standards checklists is to provide:

- Guidance in identifying the contents of standard work products that are recommended by the CMM at level 3.
- Criteria that an organization can use to evaluate its software standards to determine if they are consistent with the CMM at level 3.
- Information that can be used to develop software standards that are consistent with the CMM at level 3.

What the standards checklists are not

The standards checklists contain only what is recommended by the CMM, and *are not complete standards in themselves.* For example, the standard for the software development plan (SDP) contains only content recommended by the CMM. Other sources for the content of a SDP should also be considered, such as ANSI/IEEE Std 1058.1-1987, DOD-STD-2167, DI-MCCR-80030, etc.

Continued on next page

In this section This section covers the following standards:

Standard	KPA	See Page
Action plan	OPF	L3-Standards-3
Software development and improvement plan	OPF	L3-Standards-4
Organization's standard software process	OPD	L3-Standards-5
Software process element	OPD	L3-Standards-6
Tailoring guidelines and criteria	OPD	L3-Standards-7
Software project's training plan	TP	L3-Standards-8
Organization's training plan	TP	L3-Standards-9
Organizational standards for training courses	TP	L3-Standards-10
Project's defined software process	ISM	L3-Standards-11
Software design documentation	SPE	L3-Standards-12
Test plan	SPE	L3-Standards-13
Plan for intergroup commitments	IC	L3-Standards-14
Plans for peer reviews	PR	L3-Standards-15

Action Plan

Standard checklist

The following table contains what the CMM describes as the recommended content of an action plan:

√	Recommended Content
	Which assessment findings will be addressed. (L3-6, A1)
	Guidelines for implementing the changes to address findings. (L3-6, A1)
	The groups or individuals responsible for implementing the changes. (L3-6, A1)

Software Process Development and Improvement Plan

Standard checklist

The following table contains what the CMM describes as the recommended content of the plan for software process development and improvement. This plan:

√	Recommended Content
	Uses the action plans from the software process assessments and other organization improvement initiatives as primary inputs. (L3-7, A2, 1)
	Defines the activities to be performed and the schedule for these activities. (L3-7, A2, 2)
	Specifies the groups and individuals responsible for the (software process development and improvement) activities. (L3-7, A2, 3)
	Identifies the resources required, including staff and tools. (L3-7, A2, 4)

Organization's Standard Software Process

Standard checklist

The following table contains what the CMM describes as the recommended content of an organization's standard software process:

√	Recommended Content
	The process is decomposed into constituent process elements to the granularity needed to understand and describe the process. (L3-17, A2, 1)
	Each process element is described. (L3-17, A2, 2) [Refer to Level 3 Standards for additional information regarding software process elements.]
	The relationships of the process elements are described and address (L3-18, A2, 3): ❑ the ordering, ❑ the interfaces, and ❑ the interdependencies.

Software Process Element

Standard checklist

The following table contains what the CMM describes as the recommended content of a software process element:

√	Recommended Content
	The required procedures, practices, methods, and technologies. (L3-17, A2, 2.1)
	The applicable process and product standards. (L3-17, A2, 2.2)
	The responsibilities for implementing the process. (L3-18, A2, 2.3)
	The required tools and resources. (L3-18, A2, 2.4)
	Inputs. (L3-18, A2, 2.5)
	The software work products produced. (L3-18, A2, 2.6)
	The software work products that should undergo peer review. (L3-18, A2, 2.7)
	The readiness and completion criteria. (L3-18, A2, 2.8)
	The product and process data to be collected. (L3-18, A2, 2.9)

Tailoring Guidelines and Criteria

Standard checklist

The following table contains what the CMM describes as the recommended content of tailoring guidelines and criteria (for tailoring the organization's standard software process). These guidelines and criteria cover:

√	Recommended Content
	Selecting and tailoring the software life cycle for the project. (L3-19, A4, 1.1)
	Tailoring the organization's standard software process to accommodate the software life cycle and the project's characteristics. (L3-19, A4, 1.2)
	Standards for documenting the project's defined software process. (L3-20, A4, 1.3)

Software Project's Training Plan

Standard checklist

The following table contains what the CMM describes as the recommended content of a software project's training plan:

√	Recommended Content
	The set of skills needed and when those skills are needed. (L3-29, A1, 1)
	The skills for which training is required and the skills that will be obtained via other vehicles. (L3-29, A1, 2)
	The training that is required, for whom it is required, and when it is required. (L3-29, A1, 3)
	How training will be provided. (L3-30, A1, 4)

Organization's Training Plan

Standard checklist

The following table contains what the CMM describes as the recommended content of the organization's training plan:

√	Recommended Content
	The specific training needed within the organization and when it is needed. (L3-32, A3, 1)
	The training that will be obtained from external sources and training that will be provided by the training group. (L3-32, A3, 2)
	The funding and resources (including staff, tools, and facilities) needed to prepare and conduct or procure the training. (L3-32, A3, 3)
	Standards for instructional materials used in training courses developed by the training group. (L3-32, A3, 4)
	The schedule for developing and revising the training courses that will be developed by the training group. (L3-32, A3, 5)
	The schedule for conducting the training, based on the projected need dates and the projected number of students. (L3-32, A3, 6)
	The procedures for: (L3-33, A3, 7) ❑ selecting the individuals who will receive the training, ❑ registering and participating in the training, ❑ maintaining records of the training provided, and ❑ collecting, reviewing, and using training evaluations and other training feedback.

Organizational Standards for Training Courses

Standard checklist

The following table contains what the CMM describes as the recommended content of organizational standards for training courses. These standards requires that:

√	Recommended Content
	A description of each training course is developed. (L3-33, A4, 1)
	The materials for the training course are reviewed. (L3-33, A4, 2)
	The materials for the training courses are managed and controlled. (L3-33, A4, 3)

Project's Defined Software Process

Standard checklist

The following table contains what the CMM describes as the recommended content of the project's defined software process:

√	Recommended Content
	Provisions are made for gathering, analyzing, and reporting measurement data needed to manage the software project. (L3-44, A4, 1)
	The activities for software estimating, planning, and tracking are tied to the key tasks and work products of the project's defined software process. (L3-44, A4, 2)
	Readiness and completion criteria are established, documented, and used to authorize initiation and determine completion of key tasks. (L3-44, A4, 3)
	Documented criteria are defined to indicate when to replan the software project. (L3-45, A4, 4)
	Technical and management lessons learned are documented and stored in the organization's library of software process-related documentation. (L3-45, A4, 5)
	Technical and management lessons learned from monitoring the activities of other projects in the organization are systematically reviewed and used to estimate, plan, track, and replan the software project. (L3-45, A4, 6)
	The staffing plan addresses the software project's needs for individuals with special skills and application domain knowledge. (L3-45, A4, 7)
	Training needs are identified and documented to fit the specific needs of the software project. (L3-45, A4, 8)
	The software plans and processes followed in interacting with other groups are adjusted to account for disparities with these groups and for other potential problems. (L3-45, A4, 9)

Software Design Documentation

Standard checklist

The following table contains what the CMM describes as the recommended content of software design documentation:

√	Recommended Content
	The software components. (L3-71, A3, 8.1)
	The internal interfaces between software components. (L3-71, A3, 8.1)
	The software interfaces to other software systems, to hardware, and to other system components (e.g., humans). (L3-71, A3, 8.1)

Test Plan

Standard checklist

The following table contains what the CMM describes as the recommended content of the test plan (for system and acceptance testing):

√	Recommended Content
	The overall testing and verification approach. (L3-75, A7, 2.1)
	Responsibilities of the developing organization, subcontractors, customer, and end users, as appropriate. (L3-76, A7, 2.2)
	Test facility, test equipment, and test support requirements. (L3-76, A7, 2.3)
	Acceptance criteria. (L3-76, A7, 2.4)

Plan for Intergroup Commitments

Standard checklist

The following table contains what the CMM describes as the recommended content of a plan for intergroup commitments. This plan is:

√	Recommended Content
	The baseline for: (L3-88, A3, 1) ❑ the project schedule, ❑ the contractual and technical aspects of the project, and ❑ the assignment of responsibilities to the engineering groups.
	Updated to incorporate all intergroup commitments and changes to these commitments. (L3-88, A3, 4)
	Updated as the work progresses to reflect progress and plan changes at the project level, particularly when major project milestones are completed and when plans change significantly. (L3-88, A3, 5)

Plans for Peer Reviews

Standard checklist

The following table contains what the CMM describes as the recommended content of plans for peer reviews. These plans:

√	Recommended Content
	Identify the software work products that will undergo peer review. (L3-97, A1, 1) ❑ The software work products selected include the set identified in the organization's standard software process. (L3-97, A1, 1.1)
	Specify the schedule of peer reviews. (L3-97, A1, 2)

Level 3 Process Checklists

Overview

Section purpose

The purpose of the process checklists is to provide:

- Guidance in identifying which processes are required by the CMM at level 3.
- Criteria that an organization can use to evaluate its software processes to determine if they are consistent with the CMM at level 3.
- Information that can be used to develop software processes that are consistent with the CMM at level 3.

In this section

This section contains checklists for the following key process areas:

Key Process Area	See Page
Organization Process Focus	L3-Process-3
Organization Process Definition	L3-Process-25
Training Program	L3-Process-49
Integrated Software Management	L3-Process-67
Software Product Engineering	L3-Process-103
Intergroup Coordination	L3-Process-149
Peer Reviews	L3-Process-179

Organization Process Focus (OPF) Process

OPF Process - Overview

OPF process purpose

The purpose of Organization Process Focus is to establish the organizational responsibility for software process activities that improve the organization's overall software process capability. (L3-1)

OPF process description

Organization Process Focus involves developing and maintaining an understanding of the organization's and projects' software processes and coordinating the activities to assess, develop, maintain, and improve these processes.

The organization provides the long-term commitments and resources to coordinate the development and maintenance of the software processes across current and future software projects via a group such as a software engineering process group. This group is responsible for the organization's software process activities. It is specifically responsible for the development and maintenance of the organization's standard software process and related process assets (as described in the Organization Process Definition key process area), and it coordinates the process activities with the software projects. (L3-1)

Continued on next page

Section overview

The table below contains a description and the location of each checklist for this key process area.

Checklist	Description	Page
Roles	List of roles participating in process activities.	L3-Process-5
Entry Criteria	Description of when the process can start.	L3-Process-9
Inputs	Description of the work products used by the process.	L3-Process-10
Activities	Description of the activities of the process.	L3-Process-11
Outputs	Description of the work products produced by the process.	L3-Process-13
Exit Criteria	Description of when the process is complete.	L3-Process-15
Reviews and Audits	List of reviews and audits.	L3-Process-19
Work Products Managed and Controlled	List of work products to be managed and controlled.	L3-Process-20
Measurements	Description of process measurements.	L3-Process-21
Documented Procedures	List of the activities to be completed according to a documented procedure.	L3-Process-22
Training	List of training.	L3-Process-23
Tools	List of tools.	L3-Process-24

OPF Process - Roles

Roles

The table below lists the roles and the activities in which they participate in the organization process focus process.

√	Role	Activities Participated in...	Reference
	Affected groups	A summary report from each (senior management review of the activities for software process development and improvement) is prepared and distributed to the **affected groups** and individuals. (L3-10, V1, 4)	
	Group responsible for the organization's software process activities	❑ Where possible, (the **group responsible for the organization's software process activities**) is staffed by a core of software technical professionals who are assigned full time to the group, possibly supported by others, on a part-time basis. (L3-4, Ab1, 1) ❑ The **(group responsible for the organization's software process activities)** is staffed to represent the software engineering discipline and software-related disciplines. (L3-4, Ab1, 2) ❑ Members of the **group responsible for the organization's software process activities** receive required training to perform these activities. (L3-5, Ab3) ❑ Where appropriate, training (for the organization's and projects' software processes) may be prepared and conducted by the **group responsible for the organization's software process activities (e.g., software engineering process group)** or by the training group. (L3-8, A6, 2)	
	Groups involved in implementing the software processes	The **groups involved in implementing the software processes** are informed of the organization's and projects' activities for software process development and improvement. (L3-9, A7)	

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OPF Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the organization process focus process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Individuals	❑ Experienced **individuals** who have expertise in specialized areas are committed to support (the group responsible for the organization's software process activities). (L3-5, Ab2, 1) ❑ A summary report from each (senior management) review (of the activities for software process development and improvement) is prepared and distributed to the affected groups and **individuals**. (L3-10, V1, 4)	
	Managers	❑ Senior management coordinates software process requirements and issues with higher level staff and **managers**. (L3-3, C3, 3.1) ❑ Senior management coordinates with the organization's **managers** to secure the managers' and staff's support and participation. (L3-3, C3, 3.2)	
	Senior management	❑ **Senior management** sponsors the organization's activities for software process development and improvement. (L3-2, C2) **Senior management**: ❑ Demonstrates to the organization's staff and managers its commitment to these software process activities. ❑ Establishes long-term plans and commitments for funding, staffing, and other resources. ❑ Establishes strategies for managing and implementing the activities for process development and improvement.	
	Role continues on the next page		

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OPF Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the organization process focus process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Senior management, continued	❑ **Senior management** oversees the organization's activities for software process development and improvement. (L3-3, C3) **Senior management**: ❑ Ensures that the organization's standard software process supports its business goals and strategies. ❑ Advises on setting priorities for software process development and improvement. ❑ Participates in establishing plans for software process development and improvement. ❑ Coordinates software process requirements and issues with higher level staff and managers. ❑ Coordinates with the organization's managers to secure the managers' and staff's support and participation. ❑ The activities for software process development and improvement are reviewed with **senior management** on a periodic basis. (L3-10, V1)	
	Senior managers	(The organizational plan for software process development and improvement activities) is reviewed and agreed to by the organization's software managers and **senior managers**. (L3-7, A2, 6)	
	Software engineering group	Members of the **software engineering group** and other software-related groups receive orientation on the organization's software process activities and their roles in those activities. (L3-6, Ab4)	

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OPF Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the organization process focus process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Software managers	(The organizational plan for software process development and improvement activities) is reviewed and agreed to by the organization's **software managers** and senior managers. (L3-7, A2, 6)	
	Software-related groups	Members of the software engineering group and other **software-related groups** receive orientation on the organization's software process activities and their roles in those activities. (L3-6, Ab4)	
	Staff	Senior management coordinates software process requirements and issues with higher level **staff** and managers. (L3-3, C3, 3.1)	
	Training group	Where appropriate, training for the organization's and projects' software processes may be prepared and conducted by the group responsible for the organization's software process activities (e.g., software engineering process group) or by the **training group**. (L3-8, A6, 2)	

OPF Process - Entry Criteria

Input-based entry criteria

There are no input-based entry criteria for the organization process focus process.

General entry criteria

The CMM recommends that the conditions described in the table below be satisfied before entering the organization process focus process.

√	Condition	References
	The organization follows a written organizational policy for coordinating software process development and improvement activities across the organization. (L3-2, C1) [Refer to Level 3 Policies for additional information regarding OPF policy.]	
	Senior management sponsors the organization's activities for software process development and improvement. (L3-2, C2)	
	Senior management oversees the organization's activities for software process development and improvement. (L3-3, C3)	
	A **group that is responsible for the organization's software process activities** exists. (L3-3, Ab1)	
	Where possible, the **group responsible for the organization's software process activities** is staffed by a core of software technical professionals who are assigned full time to the group, possibly supported by others, on a part-time basis. (L3-4, Ab1, 1)	
	The **group responsible for the organization's software process activities** is staffed to represent the software engineering discipline and software-related disciplines. (L3-4, Ab1, 2)	
	Adequate resources and funding are provided for the organization's software process activities. (L3-4, Ab2)	
	Experienced **individuals** who have expertise in specialized areas are committed to support the **group responsible for the organization's software process activities**. (L3-5, Ab2, 1)	
	Tools to support the organization's software process activities are made available. (L3-5, Ab2, 2)	
	Members of the **group responsible for the organization's software process activities** receive required training to perform these activities. (L3-5, Ab3)	

	Members of the **software engineering group** and other **software-related groups** receive orientation on the organization's software process activities and their roles in those activities. (L3-6, Ab4)	

OPF Process - Inputs

Inputs

The table below lists the inputs to the organization process focus process.

√	Input	Org. Input	References
	Action plans from the software process assessments. (L3-7, A2, 1)		
	Business goals and strategies. (L3-3, C3, 1)		
	Improvements to, and other useful information on, each project's software process, tools, and methods. (L3-2, C1, 4)		
	New processes, methods, and tools in limited use in the organization. (L3-8, A5)		
	Organization improvement initiatives. (L3-7, A2, 1)		
	Organization's software process database. (L3-8, A4)		
	Organization's standard software process. (L3-2, C1, 3)		
	Plan for the organization's software process development and improvement activities. (L3-7, A2)		
	Progress and status of the activities to develop and improve the software process. (L3-10, V1, 1)		
	Projects' defined software process. (L3-8, A3, 2)		
	Software process issues. (L3-3, C3, 3.1)		
	Software process requirements. (L3-3, C3, 3.1)		
	Software process. (L3-6, A1)		
	Software processes used by the project. (L3-2, C1, 2)		

OPF Process - Activities

Activities

The table below lists the recommended activities for the organization process focus process.

√	Activities	References
	The software process is assessed periodically, and action plans are developed to address the assessment findings. (L3-6, A1)	
	The organization develops and maintains a plan for its software process development and improvement activities. (L3-7, A2)	
	The organization's and projects' activities for developing and improving their software processes are coordinated at the organization level. (L3-7, A3) This coordination covers the development and improvement of: ❑ The organization's standard software process. ❑ The projects' defined software processes.	
	The use of the organization's software process database is coordinated at the organizational level. (L3-8, A4)	
	New processes, methods, and tools in limited use in the organization are monitored, evaluated, and, where appropriate, transferred to other parts of the organization. (L3-8, A5)	
	Training for the organization's and projects' software processes is coordinated across the organization. (L3-8, A6) ❑ Plans for training on subjects related to the organization's and projects' software processes are prepared. ❑ Where appropriate, training may be prepared and conducted by the **group responsible for the organization's software process activities** (e.g., software engineering process group) or by the **training group**.	
	The **groups involved in implementing the software processes** are informed of the organization's and projects' activities for software process development and improvement. (L3-9, A7)	

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OPF Process - Activities, Continued

Activities, continued

The table below lists the recommended activities for the organization process focus process, continued from the previous page.

√	Activities	References
	Measurements are made and used to determine the status of the organization's process development and improvement activities. (L3-9, M1)	
	The activities for software process development and improvement are reviewed with **senior management** on a periodic basis. (L3-10, V1) ❑ Progress and status of the activities to develop and improve the software process are reviewed against the plan. ❑ Conflicts and issues not resolved at lower levels are addressed. ❑ Action items are assigned, reviewed, and tracked to closure. ❑ A summary report from each review is prepared and distributed to the **affected groups** and **individuals**.	

OPF Process - Outputs

Outputs

The table below lists the outputs produced by the organization process focus process.

√	Output	Org. Outputs	References
	Action items (from senior management reviews of the activities for software process development and improvement). (L3-10, V1, 3)		
	Action plans. (L3-6, A1)		
	Assessment findings. (L3-6, A1)		
	Conflicts and issues not resolved at lower levels. (L3-10, V1, 2)		
	Improvements to, and other useful information on, each project's software process, tools, and methods. (L3-2, C1, 4)		
	Long-term plans and commitments for funding, staffing, and other resources (for the organization's activities for software process development and improvement). (L3-3, C2, 2)		
	Measurements (to determine the status of the organization's process development and improvement activities). (L3-9, M1)		
	Plan for organizational software process development and improvement activities. (L3-7, A2)		
	Plans for software process development and improvement. (L3-3, C3, 3)		
	Plans for training on subjects related to the organization's and projects' software processes. (L3-8, A6, 1)		
	Priorities for software process development and improvement. (L3-3, C3, 2)		
	Progress and status of the activities to develop and improve the software process. (L3-10, V1, 1)		
	Schedule for the software process development and improvement activities. (L3-7, A2, 2)		
	Software process issues. (L3-3, C3, 3.1)		
	Software process requirements. (L3-3, C3, 3.1)		

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OPF Process - Outputs, Continued

Outputs, continued

The table below lists the outputs produced by the organization process focus process, continued from the previous page.

√	Output	Org. Outputs	References
	Strategies for managing and implementing the activities for process development and improvement. (L3-3, C2, 3)		
	Summary report from each (senior management) review of the activities for software process development and improvement. (L3-10, V1, 4)		

OPF Process - Exit Criteria

Output-based exit criteria

The CMM recommends that outputs satisfy the states described in the table below to exit the organization process focus process.

√	Output	State	References
	Action items (from **senior management** reviews of the activities for software process development and improvement)	❑ are assigned. (L3-10, V1, 3) ❑ are reviewed. (L3-10, V1, 3) ❑ are tracked to closure. (L3-10, V1, 3)	
	Action plans	are developed to address software process assessment findings. (L3-6, A1)	
	Conflicts and issues not resolved at lower levels	are addressed (during **senior management** reviews of the activities for software process development and improvement). (L3-10, V1, 2)	
	Improvements to, and other useful information on, each project's software process, tools, and methods	are available to other projects. (L3-2, C1, 4)	
	Long-term plans and commitments for funding, staffing, and other resources (for the organization's activities for software process development and improvement)	are established by **senior management**. (L3-3, C2, 2)	
	Measurements (to determine the status of the organization's process development and improvement activities)	❑ are made. (L3-9, M1) ❑ are used. (L3-9, M1)	

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OPF Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the organization process focus process, continued from the previous page.

√	Output	State	References
	Plan for organizational software process development and improvement activities	❑ is developed by the organization. (L3-7, A2) ❑ is maintained by the organization. (L3-7, A2) ❑ undergoes peer review when initially released and whenever major revisions are made. (L3-7, A2, 5) ❑ is reviewed and agreed to by the organization's **software managers** and **senior managers**. (L3-7, A2, 6)	
	Plans for software process development and improvement	are established with the participation of **senior management**. (L3-3, C3, 3)	
	Plans for training on subjects related to the organization's and projects' software processes	are prepared. (L3-8, A6, 1)	
	Priorities for software process development and improvement	are set with the advice of **senior management**. (L3-3, C3, 2)	
	Progress and status of the activities to develop and improve the software process	are reviewed against the plan. (L3-10, V1, 1)	
	Schedule for the software process development and improvement activities	is defined in the plan (for organizational software process development and improvement activities). (L3-7, A2, 2)	
	Software process issues	are coordinated by **senior management** with higher level **staff** and **managers**. (L3-3, C3, 3.1)	
	Software process requirements	are coordinated by **senior management** with higher level **staff** and **managers**. (L3-3, C3, 3.1)	

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OPF Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the organization process focus process, continued from the previous page.

√	Output	State	References
	Strategies for managing and implementing the activities for process development and improvement	are established by **senior management**. (L3-3, C2, 3)	
	Summary report from each (senior management) review of the activities for software process development and improvement	❑ is prepared. (L3-10, V1, 4) ❑ is distributed to the **affected groups** and **individuals**. (L3-10, V1, 4)	

General exit criteria

The CMM recommends that the conditions described in the table below be satisfied to exit the organization process focus process.

√	Condition	References
	The software processes used by the projects are assessed periodically to determine their strengths and weaknesses. (L3-2, C1, 2)	
	The software processes used by the projects are appropriately tailored from the organization's standard software process. (L3-2, C1, 3)	
	The organization's standard software process supports its business goals and strategies. (L3-3, C3, 1)	
	The software process is assessed periodically, and action plans are developed to address the assessment findings. (L3-6, A1)	
	The organization's and projects' activities for developing and improving their software processes are coordinated at the organization level. (L3-7, A3) This coordination covers the development and improvement of: ❑ The organization's standard software process. ❑ The projects' defined software processes.	
	The use of the organization's software process database is coordinated at the organizational level. (L3-8, A4)	

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OPF Process - Exit Criteria, Continued

General exit criteria, continued

The CMM recommends that the conditions described in the table below be satisfied to exit the organization process focus process, continued from the previous page.

√	Condition	References
	New processes, methods, and tools in limited use in the organization are monitored, evaluated, and, where appropriate, transferred to other parts of the organization. (L3-8, A5)	
	Training for the organization's and projects' software processes is coordinated across the organization. (L3-8, A6)	
	The **groups involved in implementing the software processes** are informed of the organization's and projects' activities for software process development and improvement. (L3-9, A7)	
	The activities for software process development and improvement are reviewed with **senior management** on a periodic basis. (L3-10, V1)	

OPF Process - Reviews and Audits

Reviews and audits

The table below lists the recommended reviews and audits for the organization process focus process.

√	Review or Audit	Review Participants	References
	The plan for organizational software process development and improvement activities undergoes peer review when initially released and whenever major revisions are made. (L3-7, A2, 5)	**Not specified in the CMM**	
	The plan for organizational software process development and improvement activities is reviewed and agreed to by the organization's **software managers** and **senior managers**. (L3-7, A2, 6)	**Software managers** **Senior managers**	
	The activities for software process development and improvement are reviewed with **senior management** on a periodic basis. (L3-10, V1)	**Senior management**	
	Progress and status of the activities to develop and improve the software process are reviewed against the plan. (L3-10, V1, 1)	**Not specified in the CMM**	

OPF Process - Work Products Managed and Controlled

Work products managed and controlled	There are no work products that are recommended to be managed and controlled during the organization process focus process.

OPF Process - Measurements

Measurements

The table below lists the recommended measurements for the organization process focus process.

√	Measurements	References
	Measurements to determine the status of the organization's process development and improvement activities. (L3-9, M1) Examples of measurements include: ❑ Work completed, effort expended, and funds expended in the organization's activities for process assessment, development, and improvement compared to the plans for these activities. ❑ Results of each software process assessment, compared to the results and recommendations of previous assessments.	

OPF Process - Documented Procedures

Documented procedures	There are no activities that are recommended to be performed according to a documented procedure in the organization process focus process.

OPF Process - Training

Training

The table below lists the training recommended for the organization process focus process.

√	Training	References
	Members of the **group responsible for the organization's software process activities** receive required training to perform these activities. (L3-5, Ab3)	
	Members of the **software engineering group** and other **software-related groups** receive orientation on the organization's software process activities and their roles in those activities. (L3-6, Ab4)	
	Training for the organization's and projects' software processes. (L3-8, A6) ❑ Where appropriate, training may be prepared and conducted by the **group responsible for the organization's software process activities (e.g., software engineering process group)** or by the **training group**. (L3-8, A6, 2)	

OPF Process - Tools

Tools

The table below lists the tools recommended for the organization process focus process.

√	Tools	References
	Tools to support the organization's software process activities. (L3-5, Ab2, 2) Examples of support tools include: ❑ statistical analysis tools, ❑ desktop publishing tools, ❑ database management systems, and ❑ process modeling tools.	

Organization Process Definition (OPD) Process

OPD Process - Overview

OPD process purpose

The purpose of Organization Process Definition is to develop and maintain a usable set of software process assets that improve process performance across the projects and provide a basis for cumulative, long-term benefits to the organization. (L3-11)

OPD process description

Organization Process Definition involves developing and maintaining the organization's standard software process, along with related process assets, such as descriptions of software life cycles, process tailoring guidelines and criteria, the organization's software process database, and a library of software process-related documentation.

These assets may be collected in many ways, depending on the organization's implementation of Organization Process Definition. For example, the descriptions of the software life cycles may be an integral part of the organization's standard software process or parts of the library of software process-related documentation may be stored in the organization's software process database.

The organization's software process assets are available for use in developing, implementing, and maintaining the projects' defined software processes. (The practices related to the development and maintenance of the project's defined software process are described in the Integrated Software Management key process area.) (L3-11)

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Section overview

The table below contains a description and the location of each checklist for this key process area.

Checklist	Description	Page
Roles	List of roles participating in process activities.	L3-Process-27
Entry Criteria	Description of when the process can start.	L3-Process-29
Inputs	Description of the work products used by the process.	L3-Process-30
Activities	Description of the activities of the process.	L3-Process-31
Outputs	Description of the work products produced by the process.	L3-Process-33
Exit Criteria	Description of when the process is complete.	L3-Process-35
Reviews and Audits	List of reviews and audits.	L3-Process-41
Work Products Managed and Controlled	List of work products to be managed and controlled.	L3-Process-43
Measurements	Description of process measurements.	L3-Process-44
Documented Procedures	List of the activities to be completed according to a documented procedure.	L3-Process-45
Training	List of training.	L3-Process-46
Tools	List of tools.	L3-Process-47

OPD Process - Roles

Roles

The table below lists the roles and the activities in which they participate in the organization process definition process.

√	Role	Activities Participated in...	Reference
	Group responsible for the organization's software process activities (e.g., software engineering process group)	❑ The development and maintenance of the organization's standard software process and related process assets is performed or coordinated by the **group responsible for the organization's software process activities (e.g., software engineering process group)**. (L3-14, Ab1, 1) ❑ Changes proposed for the organization's standard software process are documented, reviewed, and approved by the **group responsible for the organization's software process activities (e.g., software engineering process group)** before they are incorporated. (L3-16, A1, 6) ❑ Changes proposed for the descriptions of software life cycles are documented, reviewed, and approved by the **group responsible for the organization's software process activities (e.g., software engineering process group)** before they are incorporated. (L3-18, A3, 2) ❑ Changes proposed for the tailoring guidelines and criteria (for the projects' tailoring of the organization's standard software process) are documented, reviewed, and approved by the **group responsible for the organization's software process activities (e.g., software engineering process group)** before they are incorporated. (L3-20, A4, 2)	

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OPD Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the organization process definition process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Individuals who develop and maintain the organization's standard software process and related process assets	The **individuals who develop and maintain the organization's standard software process and related process assets** receive required training to perform these activities. (L3-14, Ab2)	
	Software quality assurance group	The **software quality assurance group** reviews and/or audits the organization's activities and work products for developing and maintaining the organization's standard software process and related process assets and reports the results. (L3-23, V1)	

OPD Process - Entry Criteria

Input-based entry criteria

The CMM recommends that inputs satisfy the states described in the table below before entering the organization process definition process.

√	Input	State	References
	Descriptions of software life cycles	❑ are approved for use by the projects. (L3-18, A3) ❑ are documented. (L3-18, A3)	
	Organizational standards (for documenting the organization's standard software process)	are established. (L3-17, A2)	

General entry criteria

The CMM recommends that the conditions described in the table below be satisfied before entering the organization process definition process.

√	Condition	References
	The organization follows a written policy for developing and maintaining a standard software process and related process assets. (L3-12, C1) [Refer to Level 3 Policies for additional information regarding OPD policy.]	
	Adequate resources and funding are provided for developing and maintaining the organization's standard software process and related process assets. (L3-14, Ab1)	
	The development and maintenance of the organization's standard software process and related process assets is performed or coordinated by the **group responsible for the organization's software process activities (e.g., software engineering process group)**. (L3-14, Ab1, 1)	
	Tools to support process development and maintenance are made available. (L3-14, Ab1, 2)	
	The **individuals who develop and maintain the organization's standard software process and related process assets** receive required training to perform these activities. (L3-14, Ab2)	

OPD Process - Inputs

Inputs

The table below lists the recommended inputs to the organization process definition process.

√	Input	Org. Input	References
	Candidate documentation items. (L3-21, A6, 1)		
	Changes proposed for the descriptions of software life cycles. (L3-18, A3, 2)		
	Changes proposed for the organization's standard software process. (L3-16, A1, 6)		
	Changes proposed for the tailoring guidelines and criteria. (L3-20, A4, 2)		
	Data entered into the (software process) database. (L3-21, A5, 2)		
	Data on the software work products (resulting from the software processes). (L3-20, A5, 1)		
	Data on the software processes. (L3-20, A5, 1)		
	Descriptions of software life cycles. (L3-18, A3)		
	Guidelines and criteria for the projects' tailoring of the organization's standard software process. (L3-19, A4)		
	Information collected from the projects (to improve the organization's standard software process). (L3-13, C1, 4)		
	Library of software process-related documentation. (L3-21, A6)		
	Organization's software process assets or related process assets. (L3-12, C1)		
	Organization's standard software process. (L3-12, C1)		
	Organization standards. (L3-17, A2)		
	Software policies. (L3-15, A1, 1)		
	Software process standards. (L3-15, A1, 1)		
	Software product standards. (L3-15, A1, 1)		
	State-of-the-practice software engineering methods. (L3-15, A1, 3)		
	State-of-the-practice software engineering tools. (L3-15, A1, 3)		

OPD Process - Activities

Activities

The table below lists the recommended activities for the organization process definition process.

√	Activities	References
	The organization's standard software process is developed and maintained according to a documented procedure. (L3-15, A1) [Refer to Level 3 Procedure Checklists for additional information.]	
	The organization's standard software process is documented according to established organization standards. (L3-17, A2) [Refer to Level 3 Standards for additional information regarding the organization's standard software process.]	
	Descriptions of software life cycles that are approved for use by the projects are documented and maintained. (L3-18, A3) ❑ Changes proposed for the descriptions of software life cycles are documented, reviewed, and approved by the **group responsible for the organization's software process activities (e.g., software engineering process group)** before they are incorporated. (L3-18, A3, 2) ❑ The descriptions of the software life cycles undergo peer review when initially documented and whenever significant changes or additions are made. (L3-19, A3, 3) ❑ The descriptions of the software life cycles are managed and controlled. (L3-19, A3, 4)	
	Guidelines and criteria for the projects' tailoring of the organization's standard software process are developed and maintained. (L3-19, A4) ❑ The tailoring guidelines and criteria are managed and controlled. (L3-20, A4, 3) [Refer to Level 3 Standards for additional information regarding tailoring guidelines and criteria.]	

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OPD Process - Activities, Continued

Activities, continued

The table below lists the recommended activities for the organization process definition process, continued from the previous page.

√	Activities	References
	The organization's software process database is established and maintained. (L3-20, A5) ❑ The database is established to collect and make available data on the software processes and resulting software work products. ❑ The data entered into the database are reviewed to ensure the integrity of the database contents. ❑ The database is managed and controlled. ❑ User access to the database contents is controlled to ensure completeness, integrity, and accuracy of the data.	
	A library of software process-related documentation is established and maintained. (L3-21, A6) ❑ Candidate documentation items are reviewed and appropriate items that may be useful in the future are included in the library. ❑ The documentation items are catalogued for easy access. ❑ Revisions made to documentation items currently in the library are reviewed, and the library contents are updated as appropriate. ❑ The library contents are made available for use by the software projects and other **software-related groups**. ❑ The use of each documentation item is reviewed periodically, and the results are used to maintain the library contents. ❑ The library contents are managed and controlled.	
	Measurements are made and used to determine the status of the organization's process definition activities. (L3-22, M1)	
	The **software quality assurance group** reviews and/or audits the organization's activities and work products for developing and maintaining the organization's standard software process and related process assets and reports the results. (L3-23, V1)	

OPD Process - Outputs

Outputs

The table below lists the recommended outputs produced by the organization process definition process.

√	Output	Org. Output	References
	Candidate documentation items (for the library of software process-related documentation). (L3-21, A6, 1)		
	Data on the software work products (resulting from the software processes). (L3-20, A5, 1)		
	Data on the software processes. (L3-20, A5, 1)		
	Descriptions of software life cycles *or* software life cycles. (L3-18, A3)		
	External process interfaces between the software process and the processes of other affected groups. (L3-16, A1, 5)		
	Guidelines and criteria for the projects' tailoring of the organization's standard software process. (L3-19, A4)		
	Internal process interfaces between the software disciplines. (L3-15, A1, 4)		
	Library of software process-related documentation *or* library contents. (L3-21, A6)		
	Measurements (to determine the status of the organization's process definition activities). (L3-22, M1)		
	Organization's software process assets *or* related process assets. (L3-12, C1)		
	Organization's standard software process. (L3-12, C1)		
	Plans for introducing changes to the software process of ongoing projects. (L3-16, A1, 7)		
	Process element relationships. (L3-18, A2, 3)		
	Process element. (L3-17, A2, 1)		
	Results of periodic reviews of the use of software-process related documentation items. (L3-22, A6, 5)		

	Results of **SQA group** reviews and/or audits. (L3-23, V1)		

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OPD Process - Outputs, Continued

Outputs, continued

The table below lists the recommended outputs produced by the organization process definition process, continued from the previous page.

√	Output	Org. Output	References
	Revisions made to documentation items currently in the (software process-related documentation) library. (L3-22, A6, 3)		
	Software process-related documentation *or* documentation items. (L3-21, A6)		

OPD Process - Exit Criteria

Output-based exit criteria

The CMM recommends that outputs satisfy the states described in the table below to exit the organization process definition process.

√	Output	State	References
	Candidate (software process-related) documentation items	❑ are reviewed. (L3-21, A6, 1) ❑ are included in the library (of software process-related documentation), if they may be useful in the future. (L3-21, A6, 1)	
	Data on the software work products (resulting from the software processes)	❑ are collected into the organization's software process database. (L3-20, A5) ❑ are made available from the organization's software process database. (L3-20, A5) ❑ completeness of is ensured by controlling access to the software process database. (L3-21, A5, 4) ❑ integrity of is ensured by controlling access to the software process database. (L3-21, A5, 4) ❑ accuracy of is ensured by controlling access to the software process database. (L3-21, A5, 4)	

	Data on the software processes	❑ are collected into the organization's software process database. (L3-20, A5) ❑ are made available from the organization's software process database. (L3-20, A5) ❑ completeness of is ensured by controlling access to the software process database. (L3-21, A5, 4) ❑ integrity of is ensured by controlling access to the software process database. (L3-21, A5, 4) ❑ accuracy of is ensured by controlling access to the software process database. (L3-21, A5, 4)	

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OPD Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the organization process definition process, continued from the previous page.

√	Output	State	References
	Descriptions of software life cycles	❑ are documented. (L3-18, A3) ❑ are maintained. (L3-18, A3) ❑ are compatible with the organization's standard software process. (L3-18, A3, 1) ❑ undergo peer review when initially documented and whenever significant changes or additions are made. (L3-19, A3, 3) ❑ are managed and controlled. (L3-19, A3, 4)	
	External process interfaces between the software process and the processes of other **affected groups**	are described. (L3-16, A1, 5)	
	Guidelines and criteria for the projects' tailoring of the organization's standard software process	❑ are developed. (L3-19, A4) ❑ are maintained. (L3-19, A4) ❑ are managed and controlled. (L3-20, A4, 3)	
	Internal process interfaces between the software disciplines	are described. (L3-15, A1, 4)	
	Library of software process-related documentation *or* library contents	❑ is established. (L3-21, A6) ❑ is maintained. (L3-21, A6) ❑ is updated as appropriate. (L3-22, A6, 3) ❑ is made available for use by the software projects and other software-related groups. (L3-22, A6, 4) ❑ is managed and controlled. (L3-22, A6, 6)	

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OPD Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the organization process definition process, continued from the previous page.

√	Output	State	References
	Measurements (to determine the status of the organization's process definition activities)	❑ are made. (L3-22, M1) ❑ are used. (L3-22, M1)	
	Organization's software process assets *or* related process assets	❑ are maintained. (L3-13, C1, 3) ❑ are controlled. (L3-23, V1, 2) ❑ are used appropriately. (L3-23, V1, 2)	

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OPD Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the organization process definition process, continued from the previous page.

√	Output	State	References
	Organization's standard software process	❑ is defined for the organization. (L3-12, C1, 1) ❑ is developed according to a documented procedure. (L3-15, A1) ❑ is maintained according to a documented procedure. (L3-15, A1) ❑ satisfies the software policies, process standards, and product standards imposed on the organization, as appropriate. (L3-15, A1, 1) ❑ satisfies the software process and product standards that are commonly imposed on the organization's projects by their customers, as appropriate. (L3-15, A1, 2) ❑ incorporates state-of-the-practice software engineering tools and methods, as appropriate. (L3-15, A1, 3) ❑ description undergoes peer review when initially developed and whenever significant changes or additions are made. (L3-16, A1, 8) ❑ is placed under configuration management. (L3-17, A1, 9) ❑ is documented according to established organization standards. (L3-17, A2) ❑ is decomposed into constituent process elements to the granularity needed to understand and describe the process. (L3-17, A2, 1)	
Exit criteria continued on next page			

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OPD Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the organization process definition process, continued from the previous page.

√	Output	State	References
	Organization's standard software process, continued	❑ is controlled. (L3-23, V1, 2) ❑ is used appropriately. (L3-23, V1, 2)	
	Plans for introducing changes to the software process of ongoing projects	are defined as appropriate. (L3-16, A1, 7)	
	Process element relationships	❑ are described. (L3-18, A2, 3) ❑ address: (L3-18, A2, 3) ❑ the ordering, ❑ the interfaces, and ❑ the interdependencies.	
	Process element	is described. (L3-17, A2, 2)	
	Results of periodic reviews of the use of documentation items	are used to maintain the library (of software process-related documentation) contents. (L3-22, A6, 5)	
	Results of **SQA group** reviews and/or audits	are reported. (L3-23, V1)	
	Revisions made to documentation items currently in the library	are reviewed. (L3-22, A6, 3)	
	Software process-related documentation or documentation items	❑ are catalogued for easy access. (L3-22, A6, 2) ❑ are reviewed periodically. (L3-22, A6, 5)	

OPD Process - Exit Criteria, Continued

General exit criteria

The CMM recommends that the conditions described in the table below be satisfied to exit the organization process definition process.

√	Condition	References
	A project's defined software process is a tailored version of the organization's standard software process. (L3-13, C1, 2)	
	Information collected from the projects is organized and used to improve the organization's standard software process. (L3-13, C1, 4)	
	Changes proposed for the descriptions of software life cycles are documented, reviewed, and approved by the **group responsible for the organization's software process activities (e.g., software engineering process group)** before they are incorporated. (L3-18, A3, 2)	
	Changes proposed for the tailoring guidelines and criteria are documented, reviewed, and approved by the **group responsible for the organization's software process activities (e.g., software engineering process group)** before they are incorporated. (L3-20, A4, 2)	
	The organization's software process database is established and maintained. (L3-20, A5) ❑ The database is established to collect and make available data on the software processes and resulting software work products. ❑ The data entered into the database are reviewed to ensure the integrity of the database contents. ❑ The database is managed and controlled. ❑ User access to the database contents is controlled to ensure completeness, integrity, and accuracy of the data.	
	The **software quality assurance group** reviews and/or audits the organization's activities and work products for developing and maintaining the organization's standard software process and related process assets and reports the results. (L3-23, V1)	
	The appropriate standards are followed in developing, documenting, and maintaining the organization's standard software process and related process assets. (L3-23, V1, 1)	

OPD Process - Reviews and Audits

Reviews and audits

The table below lists the recommended reviews and audits for the organization process definition process.

√	Review or Audit	Review Participants	References
	Changes proposed for the organization's standard software process are documented, reviewed, and approved by the **group responsible for the organization's software process activities (e.g., software engineering process group)** before they are incorporated. (L3-16, A1, 6)	**Group responsible for the organization's software process activities (e.g., software engineering process group)**	
	The description of the organization's standard software process undergoes peer review when initially developed and whenever significant changes or additions are made. (L3-16, A1, 8)	**Not specified in the CMM**	
	Changes proposed for the descriptions of software life cycles are documented, reviewed, and approved by the **group responsible for the organization's software process activities (e.g., software engineering process group)** before they are incorporated. (L3-18, A3, 2)	**Group responsible for the organization's software process activities (e.g., software engineering process group)**	
	The descriptions of the software life cycles undergo peer review when initially documented and whenever significant changes or additions are made. (L3-19, A3, 3)	**Not specified in the CMM**	

	Changes proposed for the tailoring guidelines and criteria are documented, reviewed, and approved by the **group responsible for the organization's software process activities (e.g., software engineering process group)** before they are incorporated. (L3-20, A4, 2)	**Group responsible for the organization's software process activities (e.g., software engineering process group)**	

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Reviews and audits, continued

The table below lists the recommended reviews and audits for the organization process definition process, continued from the previous page.

√	Review or Audit	Review Participants	References
	The data entered into the (organization's software process) database is reviewed to ensure the integrity of the database contents. (L3-21, A5, 2)	**Not specified in the CMM**	
	Candidate (software process-related) documentation items are reviewed and appropriate items that may be useful in the future are included in the library (of software-process related documentation). (L3-21, A6, 1)	**Not specified in the CMM**	
	Revisions made to (software process-related) documentation items currently in the library are reviewed, and the library contents are updated as appropriate. (L3-22, A6, 3)	**Not specified in the CMM**	
	The use of each (software process-related) documentation item is reviewed periodically, and the results are used to maintain the library contents. (L3-22, A6, 5)	**Not specified in the CMM**	
	The **software quality assurance group** reviews and/or audits the organization's activities and work products for developing and maintaining the organization's standard software process and related process assets and reports the results. (L3-23, V1) At a minimum, these reviews and/or audits verify that: ❑ The appropriate standards are followed in developing, documenting, and maintaining the organization's standard software process and related process assets. ❑ The organization's standard software process and related process assets are controlled and used appropriately.	**Software quality assurance group**	

OPD Process - Work Products Managed and Controlled

Work products managed and controlled

The table below lists the work products that are recommended to be managed and controlled during the organization process definition process.

√	Work Products Managed and Controlled	References
	Description of the organization's standard software process.* (L3-17, A1, 9)	
	Descriptions of the software life cycles. (L3-19, A3, 4)	
	Tailoring guidelines and criteria. (L3-20, A4, 3)	
	Organization's software process database. (L3-21, A5, 3)	
	Library of software process-related documentation. (L3-22, A6, 6)	

*Indicates that the CMM recommends that this item must be placed under configuration management

OPD Process - Measurements

Measurements

The table below lists the recommended measurements for the organization process definition process.

√	Measurements	References
	Data on the software work products (resulting from the software process). (L3-20, A5, 1)	
	Data on the software processes. (L3-20, A5, 1)	
	Measurements to determine the status of the organization's process definition activities. (L3-22, M1) Examples of measurements include: ❑ Status of the schedule milestones for process development and maintenance. ❑ Costs for the process definition activities.	

OPD Process - Documented Procedures

Documented procedures

The table below lists the activities for the organization process definition process recommended to be performed according to a documented procedure.

√	Documented Procedure(s)	References
	The organization's standard software process is developed and maintained according to a documented procedure. (L3-15, A1)	

OPD Process - Training

Training

The table below lists the training recommended for the organization process definition process.

√	Training	References
	The **individuals who develop and maintain the organization's standard software process and related process assets** receive required training to perform these activities. (L3-14, Ab2)	

OPD Process - Tools

Tools

The table below lists the tools recommended for the organization process definition process.

√	Tools	References
	Tools to support process development and maintenance. (L3-14, Ab1, 2) Examples of support tools include: ❑ desktop publishing tools, ❑ database management systems, and ❑ process modeling tools.	
	State-of-the-practice software engineering tools. (L3-15, A1, 3)	
	Organization's software process database. (L3-20, A5)	

Training Program (TP) Process

TP Process - Overview

TP process purpose

The purpose of the Training Program key process area is to develop the skills and knowledge of individuals so they can perform their roles effectively and efficiently. (L3-25)

TP process description

Training Program involves first identifying the training needed by the organization, projects, and individuals, then developing or procuring training to address the identified needs.

Each software project evaluates its current and future skill needs and determines how these skills will be obtained. Some skills are effectively and efficiently imparted through informal vehicles (e.g., on-the-job training and informal mentoring), whereas other skills need more formal training vehicles (e.g., classroom training and guided self-study) to be effectively and efficiently imparted. The appropriate vehicles are selected and used.

This key process area covers the practices for the group performing the training function. The practices identifying the specific training topics (i.e., knowledge or skill needed) are contained in the Ability to Perform common feature of the individual key process areas. (L3-25)

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TP Process - Overview, Continued

Section overview

The table below contains a description and the location of each checklist for this key process area.

Checklist	Description	Page
Roles	List of roles participating in process activities.	L3-Process-51
Entry Criteria	Description of when the process can start.	L3-Process-52
Inputs	Description of the work products used by the process.	L3-Process-53
Activities	Description of the activities of the process.	L3-Process-54
Outputs	Description of the work products produced by the process.	L3-Process-55
Exit Criteria	Description of when the process is complete.	L3-Process-56
Reviews and Audits	List of reviews and audits.	L3-Process-60
Work Products Managed and Controlled	List of work products to be managed and controlled.	L3-Process-61
Measurements	Description of process measurements.	L3-Process-62
Documented Procedures	List of the activities to be completed according to a documented procedure.	L3-Process-63
Training	List of training.	L3-Process-64
Tools	List of tools.	L3-Process-65

TP Process - Roles

Roles

The table below lists the roles and the activities in which they participate in the training program process.

√	Role	Activities Participated in...	Reference
	Affected groups	The organization's training plan is readily available to the **affected groups** and individuals. (L3-31, A2, 6)	
	Affected individuals	❑ The organization's training plan is reviewed by the **affected individuals** when it is initially released and whenever major revisions are made. (L3-31, A2, 4) ❑ The organization's training plan is readily available to the **affected** groups and **individuals**. (L3-31, A2, 6)	
	Manager	A **manager** is designated to be responsible for implementing the organization's training program. (L3-28, Ab2, 1)	
	Senior management	The training program activities are reviewed with **senior management** on a periodic basis. (L3-35, V1)	
	Software manager	**Software managers** receive orientation on the training program. (L3-29, Ab4)	
	Training group	Members of the **training group** have the necessary skills and knowledge to perform their training activities. (L3-28, Ab3)	

TP Process - Entry Criteria

Input-based entry criteria

There are no input-based entry criteria in the training program process.

General entry criteria

The CMM recommends that the conditions described in the table below be satisfied before entering the training program process.

√	Condition	References
	The organization follows a written policy for meeting its training needs. (L3-26, C1) [Refer to Level 3 Policies for additional information regarding TP policy.]	
	A **group responsible for fulfilling the training needs of the organization** exists. (L3-27, Ab1)	
	Adequate resources and funding are provided for implementing the training program. (L3-27, Ab2)	
	A **manager** is designated to be responsible for implementing the organization's training program. (L3-28, Ab2, 1)	
	Tools to support the training program activities are made available. (L3-28, Ab2, 2)	
	Appropriate facilities are made available to conduct training. (L3-28, Ab2, 3)	
	Members of the **training group** have the necessary skills and knowledge to perform their training activities. (L3-28, Ab3)	
	Software managers receive orientation on the training program. (L3-29, Ab4)	

TP Process - Inputs

Inputs

The table below lists the recommended inputs to the training program process.

√	Input	Org. Input	References
	Changes to the organization's training plan. (L3-31, A2, 3)		
	Organization's training plan. (L3-30, A2) [Refer to Level 3 Standards for additional information regarding the organization's training plan.]		
	Organizational standards for training courses. (L3-33, A4) [Refer to Level 3 Standards for additional information regarding organizational standards for training.]		
	Procedures for collecting, reviewing, and using training evaluations and other training feedback. (L3-33, A3, 7.4)		
	Procedures for maintaining records of the training provided. (L3-33, A3, 7.3)		
	Procedures for registering and participating in the training. (L3-33, A3, 7.2)		
	Procedures for selecting the individuals who will receive the training. (L3-33, A3, 7.1)		
	Skills needed by the organization and when those skills are needed. (L3-30, A2, 2)		
	Software projects' training needs. (L3-29, A1)		
	Standards for instructional materials used in training courses. (L3-32, A3, 4)		
	Training courses prepared at the organizational level. (L3-33, A4)		
	Training evaluations. (L3-33, A3, 7.4)		
	Training plan (for each software project). (L3-29, A1)		
	Waiver procedure for required training. (L3-34, A5)		

TP Process - Activities

Activities The table below lists the recommended activities for the training program process.

√	Activities	References
	Each software project develops and maintains a training plan that specifies its training needs. (L3-29, A1)	
	The organization's training plan is developed and revised according to a documented procedure. (L3-30, A2) [Refer to Level 3 Procedures for additional information.]	
	The training for the organization is performed in accordance with the organization's training plan. (L3-32, A3)	
	Training courses prepared at the organization level are developed and maintained according to organization standards. (L3-33, A4)	
	A waiver procedure for required training is established and used to determine whether individuals already possess the knowledge and skills required to perform in their designated roles. (L3-34, A5)	
	Records of training are maintained. (L3-34, A6) ❑ Records are kept of all students who successfully complete each training course or other approved training activity. ❑ Records are kept of all students who successfully complete their designated required training. ❑ Records of successfully completed training are made available for consideration in assignments of the staff and managers.	
	Measurements are made and used to determine the status of the training program activities. (L3-34, M1)	
	Measurements are made and used to determine the quality of the training program. (L3-35, M2)	
	The training program activities are reviewed with **senior management** on a periodic basis. (L3-35, V1)	
	The training program is independently evaluated on a periodic basis for consistency with, and relevance to, the organization's needs. (L3-36, V2)	
	The training program activities and work products are reviewed and/or audited and the results are reported. (L3-36, V3) [Refer to TP Process Reviews and Audits for additional information]	

TP Process - Outputs

Outputs

The table below lists the recommended outputs produced by the training program process.

√	Output	Org. Outputs	References
	Description of each training course. (L3-33, A4, 1)		
	Materials for the training course. (L3-33, A4, 2)		
	Measurements. (L3-34, M1)		
	Needed skills and knowledge for each software management role. (L3-26, C1, 1)		
	Needed skills and knowledge for each technical role. (L3-26, C1, 1)		
	Organization's training plan. (L3-30, A2)		
	Records of all students who successfully complete each training course or other approved training activity. (L3-34, A6, 1)		
	Records of all students who successfully complete their designated required training. (L3-34, A6, 2)		
	Records of successfully completed training. (L3-34, A6, 3)		
	Records of training or training records. (L3-34, A6)		
	Results of reviews and/or audits of the training program activities and work products. (L3-36, V3)		
	Specific training to be provided. (L3-30, A2, 2)		
	Training courses prepared at the organization level. (L3-33, A4)		
	Training plan (for each software project). (L3-29, A1)		
	Training program work products. (L3-36, V3)		
	Training vehicles for imparting skills and knowledge. (L3-26, C1, 2)		
	Waiver procedure for required training. (L3-34, A5)		

TP Process - Exit Criteria

Output-based exit criteria

The CMM recommends that outputs satisfy the states described in the table below to exit the training program process.

√	Output	State	References
	Description of each training course	is developed. (L3-33, A4, 1)	
	Materials for the training course	❑ are reviewed. (L3-33, A4, 2) ❑ are managed and controlled. (L3-34, A4, 3)	
	Measurements	❑ are made to determine the status of the training program activities. (L3-34, M1) ❑ are used to determine the status of the training program activities. (L3-34, M1) ❑ are made to determine the quality of the training program. (L3-35, M2) ❑ are used to determine the quality of the training program. (L3-35, M2)	
	Needed skills and knowledge for each software management role	are identified. (L3-26, C1, 1)	
	Needed skills and knowledge for each technical role	are identified. (L3-26, C1, 1)	

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Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the training program process, continued from the previous page.

√	Output	State	References
	Organization's training plan	❑ is developed according to a documented procedure. (L3-30, A2) ❑ is revised according to a documented procedure. (L3-30, A2) ❑ uses the software projects' training needs identified in their training plans. (L3-30, A2, 1) ❑ is revised, as appropriate, to incorporate changes. (L3-31, A2, 3) ❑ is reviewed by the **affected individuals** when it is initially released and whenever major revisions are made. (L3-31, A2, 4) ❑ is managed and controlled. (L3-31, A2, 5) ❑ is readily available to the **affected groups** and **individuals**. (L3-31, A2, 6)	
	Records of all students who successfully complete each training course or other approved training activity	are kept. (L3-34, A6, 1)	
	Records of all students who successfully complete their designated required training	are kept. (L3-34, A6, 2)	
	Records of successfully completed training	are made available for consideration in assignments of the staff and managers. (L3-34, A6, 3)	
	Records of training or training records	are properly maintained. (L3-36, V3, 3)	

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Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the training program process, continued from the previous page.

√	Output	State	References
	Results of reviews and/or audits of the training program activities and work products	are reported. (L3-36, V3)	
	Specific training to be provided	is identified based on the skills needed by the organization and when those skills are needed. (L3-30, A2, 2)	
	Training courses prepared at the organization level	❑ are developed according to organization standards. (L3-33, A4) ❑ are maintained according to organization standards. (L3-33, A4)	
	Training plan (for each software project)	❑ is developed. (L3-29, A1) ❑ is maintained. (L3-29, A1) ❑ specifies the software project's training needs. (L3-29, A1)	
	Training program work products	❑ are reviewed. (L3-36, V3) ❑ are audited. (L3-36, V3)	
	Training vehicles for imparting skills and knowledge	❑ are identified. (L3-26, C1, 2) ❑ are approved. (L3-26, C1, 2)	
	Waiver procedure for required training	❑ is established. (L3-34, A5) ❑ is used to determine whether individuals already possess the knowledge and skills required to perform in their designated roles. (L3-34, A5)	

TP Process - Exit Criteria, Continued

General exit criteria

The CMM recommends that the conditions described in the table below be satisfied to exit the training program process.

√	Condition	References
	The training for the organization is performed in accordance with the organization's training plan. (L3-32, A3)	
	The training program activities are reviewed with **senior management** on a periodic basis. (L3-35, V1)	
	The training program is independently evaluated on a periodic basis for consistency with, and relevance to, the organization's needs. (L3-36, V2)	
	The training program activities and work products are reviewed and/or audited and the results are reported. (L3-36, V3)	

TP Process - Reviews and Audits

Reviews and audits

The table below lists the recommended reviews and audits for the training program process.

√	Review or Audit	Review Participants	References
	The organization's training plan is reviewed by the **affected individuals** when it is initially released and whenever major revisions are made. (L3-31, A2, 4)	**Affected individuals**	
	The materials for the training course are reviewed. (L3-33, A4, 2)	**Not specified in the CMM**	
	The training program activities are reviewed with **senior management** on a periodic basis. (L3-35, V1)	**Senior management**	
	The training program is independently evaluated on a periodic basis for consistency with, and relevance to, the organization's needs. (L3-36, V2)	**Not specified in the CMM**	
	The training program activities and work products are reviewed and/or audited and the results are reported. (L3-36, V3) At a minimum, the reviews and/or audits verify that: ❑ The process for developing and revising the organization's training plan is followed. ❑ The process for developing and revising a training course is followed. ❑ Training records are properly maintained. ❑ Individuals designated as requiring specific training complete that training. ❑ The organization's training plan is followed.	**Not specified in the CMM**	

TP Process - Work Products Managed and Controlled

Work products managed and controlled

The table below lists the work products that are recommended to be managed and controlled during the training program process.

√	Work Products Managed and Controlled	References
	The organization's training plan. (L3-31, A2, 5)	
	The materials for the training courses. (L3-34, A4, 3)	

TP Process - Measurements

Measurements The table below lists the measurements recommended for the training program process.

√	Measurements	References
	Measurements to determine the status of the training program activities. (L3-34, M1) Examples of measurements include: ❑ Actual attendance at each training course compared to the projected attendance. ❑ Progress in providing training courses compared to the organization's and projects' training plans. ❑ Number of training waivers approved over time.	
	Measurements to determine the quality of the training program. (L3-35, M2) Examples of measurements include: ❑ Results of post-training tests. ❑ Reviews of the courses from the students. ❑ Feedback from the software managers.	

TP Process - Documented Procedures

Documented procedures

The table below lists the activities for the training program process recommended to be performed according to a documented procedure.

√	Documented Procedure(s)	References
	The organization's training plan is developed and revised according to a documented procedure. (L3-30, A2) [Refer to Level 3 Procedure Checklists for additional information.]	

TP Process - Training

Training

The table below lists the training recommended for the training program process.

√	Training	References
	Software managers receive orientation on the training program. (L3-29, Ab4)	

TP Process - Tools

Tools

The table below lists the tools recommended for the training program process.

√	Tools	References
	Tools to support the training program activities. (L3-28, Ab2, 2) Examples of support tools include: ❑ workstations, ❑ instructional design tools, ❑ database programs, and ❑ packages for developing presentation materials.	

Integrated Software Management (ISM) Process

ISM Process - Overview

ISM process purpose

The purpose of Integrated Software Management is to integrate the software engineering and management activities into a coherent, defined software process that is tailored from the organization's standard software process and related process assets, which are described in Organization Process Definition. (L3-37)

ISM process description

Integrated Software Management involves developing the project's defined software process and managing the software project using this defined software process. The project's defined software process is tailored from the organization's standard software process to address the specific characteristics of the project.

The software development plan is based on the project's defined software process and describes how the activities of the project's defined software process will be implemented and managed. The management of the software project's size, effort, cost, schedule, staffing, and other resources is tied to the tasks of the project's defined software process.

Since the projects' defined software processes are all tailored from the organization's standard software process, the software projects can share process data and lessons learned.

The basic practices for estimating, planning, and tracking a software project are described in the Software Project Planning and Software Project Tracking and Oversight key process areas. They focus on recognizing problems when they occur and adjusting the plans and/or performance to address the problems. The practices of this key process area build on, and are in addition to, the practices of those two key process areas. The emphasis of Integrated Software Management shifts to anticipating problems and acting to prevent or minimize the effects of these problems. (L3-37)

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Section overview

The table below contains a description and the location of each checklist for this key process area.

Checklist	Description	Page
Roles	List of roles participating in process activities.	L3-Process-69
Entry Criteria	Description of when the process can start.	L3-Process-72
Inputs	Description of the work products used by the process.	L3-Process-73
Activities	Description of the activities of the process.	L3-Process-75
Outputs	Description of the work products produced by the process.	L3-Process-78
Exit Criteria	Description of when the process is complete.	L3-Process-83
Reviews and Audits	List of reviews and audits.	L3-Process-95
Work Products Managed and Controlled	List of work products to be managed and controlled.	L3-Process-98
Measurements	Description of process measurements.	L3-Process-99
Documented Procedures	List of the activities to be completed according to a documented procedure.	L3-Process-100
Training	List of training.	L3-Process-101
Tools	List of tools.	L3-Process-102

ISM Process - Roles

Roles

The table below lists the roles and the activities in which they participate in the integrated software management process.

√	Role	Activities Participated in...	Reference
	Affected groups	The software engineering group and other **affected groups** and individuals are included in the communications on the software risks, the software risk management plans, and the results of risk mitigation. (L3-55, A10, 7)	
	Affected individuals	The software engineering group and other **affected** groups and **individuals** are included in the communications on the software risks, the software risk management plans, and the results of risk mitigation. (L3-55, A10, 7)	
	Customer	Waivers for deviations from contractual software process requirements are documented and are reviewed and approved by senior management and the software project's **customer**, as appropriate. (L3-42, A1, 4)	
	Group responsible for coordinating the organization's software process activities (e.g., software engineering process group)	Tailoring of the organization's standard software process for the project is reviewed by the **group responsible for coordinating the organization's software process activities (e.g., software engineering process group)** and approved by senior management. (L3-42, A1, 3)	
	Group that is independent of the software engineering group	A **group that is independent of the software engineering group** reviews the procedures for estimating the size of the software work products, and provides guidance in using historical data from the organization's software process database to establish credible estimates. (L3-47, A6, 1)	

	Individuals who prepare the size estimates	The **individuals who prepare the size estimates** ensure that the procedures and data used in the estimates are appropriate. (L3-48, A6, 1.1)	

Continued on next page

ISM Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the integrated software management process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Individuals responsible for developing the project's defined software process	The **individuals responsible for developing the project's defined software process** receive required training in how to tailor the organization's standard software process and use the related process assets. (L3-39, Ab2)	
	Project manager	The activities for managing the software project are reviewed with the **project manager** on both a periodic and event-driven basis. (L3-57, V2)	
	Senior management	❑ Tailoring of the organization's standard software process for the project is reviewed by the group responsible for coordinating the organization's software process activities (e.g., software engineering process group) and approved by **senior management.** (L3-42, A1, 3) ❑ Waivers for deviations from the organization's standard software process are documented and are reviewed and approved by **senior management**. (L3-42, A1, 3.1) ❑ Waivers for deviations from contractual software process requirements are documented and are reviewed and approved by **senior management** and the software project's customer, as appropriate. (L3-42, A1, 4) ❑ The activities for managing the software project are reviewed with **senior management** on a periodic basis. (L3-56, V1)	
	Software engineering group	The **software engineering group** and other affected groups and individuals are included in the communications on the software risks, the software risk management plans, and the results of risk mitigation. (L3-55, A10, 7)	

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ISM Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the integrated software management process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Software manager	The **software managers** receive required training in managing the technical, administrative, and personnel aspects of the software project based on the project's defined software process. (L3-40, Ab3)	
	Software quality assurance (SQA) group	The **software quality assurance group** reviews and/or audits the activities and work products for managing the software project and reports the results. (L3-57, V3)	
	Team of peers and experts	When the validity of a size estimate is questioned, a **team of peers and experts** reviews the estimate. (L3-48, A6, 1.2)	

ISM Process - Entry Criteria

Input-based entry criteria

The CMM recommends that inputs satisfy the states described in the table below before entering the integrated software management process.

√	Input	State	References
	Available capacity for the critical computer resources	provides for a specified reserve capacity when the initial estimates are made. (L3-51, A8, 4)	
	Software effort, cost, and staffing profile models	❑ if used, are adapted to the project. (L3-49, A7, 1) ❑ use available historical data where appropriate. (L3-49, A7, 1)	
	Software schedule	identifies specific tasks and milestones whose completion can be objectively determined (i.e., a binary or yes/no determination). (L3-51, A9, 1.1)	

General entry criteria

The CMM recommends that the conditions described in the table below be satisfied before entering the integrated software management process.

√	Condition	References
	The project follows a written organizational policy requiring that the software project be planned and managed using the organization's standard software process and related process assets. (L3-38, C1)	
	Adequate resources and funding are provided for managing the software project using the project's defined software process. (L3-39, Ab1)	
	The **individuals responsible for developing the project's defined software process** receive required training in how to tailor the organization's standard software process and use the related process assets. (L3-39, Ab2)	
	The **software managers** receive required training in managing the technical, administrative, and personnel aspects of the software project based on the project's defined software process. (L3-40, Ab3)	

ISM Process - Inputs

Inputs

The table below lists the recommended inputs to the integrated software management process.

√	Input	Org. Input	References
	Actual data on project productivity and other new software costs. (L3-50, A7, 4.2)		
	Available capacity for the critical computer resources. (L3-51, A8, 4)		
	Available computer resources. (L3-50, A8, 3)		
	Available historical data. (L3-49, A7, 1)		
	Changes proposed by the software project (to the project's defined software process). (L3-43, A2, 1.2)		
	Critical dependencies of the project's software schedule. (L3-51, A9)		
	Critical paths of the project's software schedule. (L3-51, A9)		
	Data for similar software projects. (L3-46, A5, 1)		
	Historical data from the organization's software process database. (L3-47, A6, 1)		
	Historical experience, simulations, prototyping, or analysis. (L3-50, A8, 1)		
	Lessons learned (management) from monitoring the activities of other projects in the organization. (L3-45, A4, 6)		
	Lessons learned (technical) from monitoring the activities of other projects in the organization. (L3-45, A4, 6)		
	Lessons learned from monitoring the software activities of the organization's projects. (L3-43, A2, 1.1)		
	Organization's library of software process-related documentation. (L3-45, A4, 5)		
	Organization's software process database. (L3-39, C1, 4)		
	Organization's standard software process. (L3-38, C1)		

Continued on next page

ISM Process - Inputs, Continued

Inputs, continued

The table below lists the recommended inputs to the integrated software management process, continued from the previous page.

√	Input	Org. Input	References
	Organization's standards. (L3-41, A1, 1.3)		
	Organization's tailoring guidelines and criteria (for the organization's standard software process). (L3-41, A1, 1.2)		
	Planned computer resources. (L3-50, A8, 2)		
	Process and work product measurement data. (L3-43, A2, 1.3)		
	Project's contractual and operational constraints. (L3-41, A1, 1.1)		
	Project's critical computer resource requirements. (L3-50, A8, 2)		
	Project's critical computer resources. (L3-50, A8)		
	Project's defined software process. (L3-39, C1, 3)		
	Project's software development plan. (L3-44, A3)		
	Project's software risks. (L3-52, A10)		
	Related process assets. (L3-38, C1)		
	Risk priorities. (L3-55, A10, 6.1)		
	Software design. (L3-50, A8, 2)		
	Software effort, cost, and staffing profile models. (L3-49, A7, 1)		
	Software requirements. (L3-50, A8, 2)		
	Software risk management plan. (L3-53, A10, 1)		
	Software schedule. (L3-51, A9, 1.1)		
	Specific needs of the software project. (L3-45, A4, 8)		
	System requirements allocated to software. (L3-50, A8, 2)		

ISM Process - Activities

Activities

The table below lists the required activities for the integrated software management process.

√	Activities	References
	The project's defined software process is developed by tailoring the organization's standard software process according to a documented procedure. (L3-41, A1) [Refer to Level 3 Procedure Checklists for additional information.]	
	Each project's defined software process is revised according to a documented procedure. (L3-43, A2) [Refer to Level 3 Procedure Checklists for additional information.]	
	The project's software development plan, which describes the use of the project's defined software process, is developed and revised according to a documented procedure. (L3-44, A3)	
	The software project is managed in accordance with the project's defined software process. (L3-44, A4) [Refer to Level 3 Standards for additional information regarding the project's defined software process.]	
	The organization's software process database is used for software planning and estimating. (L3-46, A5) ❑ The database is used as a source of data to estimate, plan, track, and replan a software project; data for similar software projects are used when possible. ❑ Parameter values used to derive estimates for software size, effort, cost, schedule, and use of critical computer resources are compared to those of other software projects to assess their validity. ❑ Similarities and differences to the other projects in terms of application domain and design approach are assessed and recorded. ❑ Rationales for similarities and differences between the parameter values are recorded. ❑ The reasoning used to judge the credibility of the project's estimates is recorded. ❑ The software project provides appropriate software planning data, replanning data, and actual measured data for storage in the organization's software process database.	

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ISM Process - Activities, Continued

Activities, continued

The table below lists the recommended activities for the integrated software management process, continued from the previous page.

√	Activities	References
	The size of the software work products (or size of changes to the software work products) is managed according to a documented procedure. (L3-47, A6) [Refer to Level 3 Procedure Checklists for additional information.]	
	The project's software effort and costs are managed according to a documented procedure. (L3-48, A7) [Refer to Level 3 Procedure Checklists for additional information.]	
	The project's critical computer resources are managed according to a documented procedure. (L3-50, A8) [Refer to Level 3 Procedure Checklists for additional information.]	
	The critical dependencies and critical paths of the project's software schedule are managed according to a documented procedure. (L3-51, A9) [Refer to Level 3 Procedure Checklists for additional information.]	
	The project's software risks are identified, assessed, documented, and managed according to a documented procedure. (L3-52, A10) [Refer to Level 3 Procedure Checklists for additional information.]	
	Reviews of the software project are periodically performed to determine the actions needed to bring the software project's performance and results in line with the current and projected needs of the business, customer, and end users, as appropriate. (L3-55, A11)	
	Measurements are made and used to determine the effectiveness of the integrated software management activities. (L3-56, M1)	
	The activities for managing the software project are reviewed with **senior management** on a periodic basis. (L3-56, V1)	

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ISM Process - Activities, Continued

Activities, continued

The table below lists the recommended activities for the integrated software management process, continued from the previous page.

√	Activities	References
	The activities for managing the software project are reviewed with the **project manager** on both a periodic and event-driven basis. (L3-57, V2)	
	The **software quality assurance group** reviews and/or audits the activities and work products for managing the software project and reports the results. (L3-57, V3) [Refer to ISM Process Reviews and Audits for additional information.]	

ISM Process - Outputs

Outputs

The table below lists the outputs produced by the integrated software management process.

√	Output	Org. Outputs	References
	Actions needed to bring the software project's performance and results in line with the current and projected needs of the business, customer, and end users. (L3-55, A11)		
	Actual expenditures over time and against work completed. (L3-49, A7, 4)		
	Actual measured data (from the software project). (L3-47, A5, 3)		
	Alternatives for each software risk. (L3-54, A10, 3)		
	Changes to the project's defined software process derived from changes proposed by the software project. (L3-43, A2, 1.2)		
	Changes to the project's defined software process derived from lessons learned from monitoring the software activities of the organization's projects. (L3-43, A2, 1.1)		
	Changes to the project's defined software process derived from process and work product measurement data. (L3-43, A2, 1.3)		
	Changes to the project's defined software process. (L3-43, A2, 2)		
	Commitments. (L3-51, A9, 1)		
	Completion criteria (for key tasks). (L3-44, A4, 3)		
	Contingency factor applied to the size estimate (of the software work product) for each software element identified as a software risk. (L3-48, A6, 2)		
	Costs. (L3-51, A9, 1)		
	Criteria for selecting among the alternatives for each software risk. (L3-54, A10, 3)		
	Critical dependencies (of the project’s software schedule). (L3-51, A9, 2)		

	Description of the project's defined software process. (L3-41, A1, 2)		

Continued on next page

ISM Process - Outputs, Continued

Outputs, continued

The table below lists the outputs produced by the integrated software management process, continued from the previous page.

√	Output	Org. Outputs	References
	Documented criteria to indicate when to replan the software project. (L3-45, A4, 4)		
	Effort and cost threshold for each individually managed software task or stage. (L3-50, A7, 5)		
	Effort to modify and incorporate reusable components. (L3-48, A6, 3.2)		
	Estimates for the project's critical computer resources. (L3-50, A8, 1)		
	Factors which could significantly affect the size of the software work products. (L3-48, A6, 4)		
	Information obtained from monitoring the (software) risks. (L3-55, A10, 6.2)		
	Initial release of the software risk management plan. (L3-54, A10, 4)		
	Lessons learned (management). (L3-45, A4, 5)		
	Lessons learned (technical). (L3-45, A4, 5)		
	Lessons learned from monitoring the software activities of the organization’s projects. (L3-43, A2, 1.1)		
	Major revisions to the software risk management plan. (L3-54, A10, 4)		
	Measurement data needed to manage the software project. (L3-44, A4, 1)		
	Measurements (to determine the effectiveness of the integrated software management activities). (L3-56, M1)		
	Milestones. (L3-51, A9, 1)		
	Organization's software process database. (L3-46, A5)		
	Overall software effort and cost. (L3-49, A7, 3)		

	Parameter values of the models used in estimating software effort and costs. (L3-50, A7, 4.1)		

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ISM Process - Outputs, Continued

Outputs, continued

The table below lists the outputs produced by the integrated software management process, continued from the previous page.

√	Output	Org. Outputs	References
	Parameter values used to derive estimates for software size, effort, cost, schedule, and use of critical computer resources. (L3-46, A5, 2)		
	Productivity and cost data. (L3-49, A7, 2)		
	Project measurement data. (L3-39, C1, 4)		
	Project's defined software process. (L3-39, C1, 1)		
	Project's deviations from the organization's standard software process. (L3-39, C1, 2)		
	Project's software costs. (L3-48, A7)		
	Project's software development plan. (L3-44, A3)		
	Project's software effort. (L3-48, A7)		
	Project's software risks. (L3-52, A10)		
	Rationale for the contingency (for each software element identified as a software risk). (L3-48, A6, 2.1)		
	Rationales for similarities and differences between the parameter values (used to derive estimates for software size, effort, cost, schedule, and use of critical computer resources). (L3-46, A5, 2.2)		
	Readiness criteria (for key tasks). (L3-44, A4, 3)		
	Reasoning used to judge the credibility of the estimates for the project's critical computer resources. (L3-50, A8, 1.3)		
	Reasoning used to judge the credibility of the project's estimates (for software size, effort, cost, schedule, and use of critical computer resources). (L3-47, A5, 2.3)		
	Replanning data (from the software project). (L3-47, A5, 3)		
	Results of **software quality assurance** reviews and/or audits of software project activities and work products. (L3-57, V3)		

	Reuse measurements. (L3-48, A6, 3.1)		

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ISM Process - Outputs, Continued

Outputs, continued

The table below lists the outputs produced by the integrated software management process, continued from the previous page.

√	Output	Org. Outputs	References
	Risks associated with reducing or eliminating the contingency (for each software element identified as a software risk). (L3-48, A6, 2.2)		
	Schedule critical paths. (L3-52, A9, 3)		
	Similarities and differences between the project and the sources for historical data in terms of application domain and design approach. (L3-50, A8, 1.2)		
	Similarities and differences to the other projects in terms of application domain and design approach. (L3-46, A5, 2.1)		
	Size estimates. (L3-48, A6, 1.1)		
	Size of changes to the software work products. (L3-47, A6)		
	Size of the software work products. (L3-47, A6)		
	Size threshold for each managed software element. (L3-48, A6, 5)		
	Software effort and cost status. (L3-49, A7, 4)		
	Software life cycle. (L3-41, A1, 1)		
	Software planning data (from the software project). (L3-47, A5, 3)		
	Software plans followed in interacting with other groups. (L3-45, A4, 9)		
	Software risk management plan. (L3-53, A10, 1)		
	Software schedule. (L3-51, A9, 1.1)		
	Sources and rationale for estimates (for the project's critical computer resources). (L3-50, A8, 1.1)		
	Staffing plan. (L3-45, A4, 7)		
	Staffing. (L3-51, A9, 1)		
	Threshold criteria for each critical path. (L3-52, A9, 5)		

	Threshold for each critical computer resource. (L3-51, A8, 5)		

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ISM Process - Outputs, Continued

Outputs, continued

The table below lists the outputs produced by the integrated software management process, continued from the previous page.

√	Output	Org. Outputs	References
	Training needs. (L3-45, A4, 8)		
	Waivers for deviations from contractual software process requirements. (L3-42, A1, 4)		
	Waivers for deviations from the organization's standard software process. (L3-42, A1, 3.1)		
	Work products of the project's defined software process. (L3-44, A4, 2)		

ISM Process - Exit Criteria

Output-based exit criteria

The CMM recommends that outputs satisfy the states described in the table below to exit the integrated software management process.

√	Output	State	References
	Actions needed to bring the software project's performance and results in line with the current and projected needs of the business, customer, and end users	are determined by periodic reviews of the software project. (L3-55, A11)	
	Actual measured data (from the software project)	are provided for storage in the organization's software process database (L3-47, A5, 3)	
	Alternatives for each software risk	are defined. (L3-54, A10, 3)	
	Changes to the project's defined software process	❑ are reviewed. (L3-43, A2, 2) ❑ are approved before they are incorporated. (L3-43, A2, 2)	
	Changes to the project's defined software process derived from changes proposed by the software project	❑ are documented. (L3-43, A2, 1.2) ❑ are systematically reviewed. (L3-43, A2, 1.2)	
	Changes to the project's defined software process derived from lessons learned from monitoring the software activities of the organization's projects	❑ are documented. (L3-43, A2, 1.1) ❑ are systematically reviewed. (L3-43, A2, 1.1)	
	Changes to the project's defined software process derived from process and work product measurement data	❑ are documented. (L3-43, A2, 1.3) ❑ are systematically reviewed. (L3-43, A2, 1.3)	
	Commitments	are allocated in the schedule consistent with the project's defined software process. (L3-51, A9, 1)	

Continued on next page

ISM Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the integrated software management process, continued from the previous page.

√	Output	State	References
	Completion criteria	❑ are established. (L3-44, A4, 3) ❑ are documented. (L3-44, A4, 3) ❑ are used to determine completion of key tasks. (L3-44, A4, 3)	
	Contingency factor applied to the size estimate	is applied to the size estimate for each software element identified as a software risk. (L3-48, A6, 2)	
	Costs	are allocated in the schedule consistent with the project's defined software process. (L3-51, A9, 1)	
	Criteria for selecting among the alternatives for each software risk	are defined. (L3-54, A10, 3)	
	Critical dependencies (of the project's software schedule)	❑ are managed according to a documented procedure. (L3-51, A9) ❑ are allocated in the schedule consistent with the project's defined software process. (L3-51, A9, 1) ❑ are defined. (L3-51, A9, 2) ❑ are negotiated. (L3-51, A9, 2) ❑ are reflected in the software schedule. (L3-51, A9, 2)	
	Description of the project's defined software process	❑ is documented. (L3-41, A1, 2) ❑ is managed and controlled. (L3-42, A1, 5)	
	Documented criteria to indicate when to replan the software project	are defined. (L3-45, A4, 4)	

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ISM Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the integrated software management process, continued from the previous page.

√	Output	State	References
	Effort and cost threshold for each individually managed software task or stage	❑ is established. (L3-50, A7, 5) ❑ requires action when projected to be exceeded. (L3-50, A7, 5)	
	Effort to modify and incorporate reusable components	is factored into the size estimates. (L3-48, A6, 3.2)	
	Estimates for the project's critical computer resources	are derived based on historical experience, simulations, prototyping, or analysis, as appropriate. (L3-50, A8, 1)	
	Factors which could significantly affect the size of the software work products	❑ are identified. (L3-48, A6, 4) ❑ are monitored closely. (L3-48, A6, 4)	
	Information obtained from monitoring the (software) risks	is used to refine the risk assessments and software risk management plans. (L3-55, A10, 6.2)	
	Initial release of the software risk management plan	undergoes peer review. (L3-54, A10, 4)	
	Lessons learned (management)	❑ are documented. (L3-45, A4, 5) ❑ are stored in the organization's library of software process-related documentation. (L3-45, A4, 5)	
	Lessons learned (technical)	❑ are documented. (L3-45, A4, 5) ❑ are stored in the organization's library of software process-related documentation. (L3-45, A4, 5)	
	Major revisions to the software risk management plan	undergo peer review. (L3-54, A10, 4)	

	Measurement data needed to manage the software project	❑ are gathered. (L3-44, A4, 1) ❑ are analyzed. (L3-44, A4, 1) ❑ are reported. (L3-44, A4, 1)	

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ISM Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the integrated software management process, continued from the previous page.

√	Output	State	References
	Measurements (to determine the effectiveness of the integrated software management activities)	❑ are made. (L3-56, M1) ❑ are used. (L3-56, M1)	
	Milestones	are allocated in the schedule consistent with the project's defined software process. (L3-51, A9, 1)	
	Organization's software process database	❑ is used for software planning. (L3-46, A5) ❑ is used for software estimating. (L3-46, A5)	
	Overall software effort and cost	is allocated to individually managed tasks or stages as needed to manage the effort and cost effectively. (L3-49, A7, 3)	
	Parameter values of the models used in estimating software effort and costs	are updated whenever major changes are made to the software requirements. (L3-50, A7, 4.1)	
	Parameter values used to derive estimates for software size, effort, cost, schedule, and use of critical computer resources	are compared to those of other software projects to assess their validity. (L3-46, A5, 2)	
	Productivity and cost data	are adjusted to incorporate project variables. (L3-49, A7, 2)	
	Project measurement data	❑ are collected by each project. (L3-39, C1, 4) ❑ are stored by each project in the organization's software process database. (L3-39, C1, 4)	

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ISM Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the integrated software management process, continued from the previous page.

√	Output	State	References
	Project's defined software process	❑ is documented by each project by tailoring the organization's standard software process. (L3-39, C1, 1) ❑ is developed by tailoring the organization's standard software process according to a documented procedure. (L3-41, A1) ❑ is revised according to a documented procedure. (L3-43, A2)	
	Project's deviations from the organization's standard software process	❑ are documented. (L3-39, C1, 2) ❑ are approved. (L3-39, C1, 2)	
	Project's software costs	are managed according to a documented procedure. (L3-48, A7)	
	Project's software development plan	❑ is developed according to a documented procedure. (L3-44, A3) ❑ is revised according to a documented procedure. (L3-44, A3)	
	Project's software effort	is managed according to a documented procedure. (L3-48, A7)	

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Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the integrated software management process, continued from the previous page.

√	Output	State	References
	Project's software risks or software risks	❑ are identified according to a documented procedure. (L3-52, A10) ❑ are assessed according to a documented procedure. (L3-52, A10) ❑ are documented according to a documented procedure. (L3-52, A10) ❑ are managed according to a documented procedure. (L3-52, A10) ❑ are tracked. (L3-55, A10, 6) ❑ are reassessed at selected project milestones, at designated risk checkpoints, and during the planning of significant changes that affect the software project. (L3-55, A10, 6) ❑ are replanned at selected project milestones, at designated risk checkpoints, and during the planning of significant changes that affect the software project. (L3-55, A10, 6)	
	Rationale for the contingency (for each software element identified as a software risk)	is documented. (L3-48, A6, 2.1)	
	Rationales for similarities and differences between the parameter values (used to derive estimates for software size, effort, cost, schedule, and use of critical computer resources)	are recorded. (L3-46, A5, 2.2)	

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ISM Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the integrated software management process, continued from the previous page.

√	Output	State	References
	Readiness criteria	❑ are established. (L3-44, A4, 3) ❑ are documented. (L3-44, A4, 3) ❑ are used to authorize initiation of key tasks. (L3-44, A4, 3)	
	Reasoning used to judge the credibility of the estimates for the project's critical computer resources	is recorded. (L3-50, A8, 1.3)	
	Reasoning used to judge the credibility of the project's estimates (for software size, effort, cost, schedule, and use of critical computer resources)	is recorded. (L3-47, A5, 2.3)	
	Replanning data (from the software project)	are provided for storage in the organization's software process database. (L3-47, A5, 3)	
	Reuse measurements	account for the reuse of requirements, design, code, test plan, and test procedures, etc. (L3-48, A6, 3.1)	
	Risks associated with reducing or eliminating the contingency (for each software element identified as a software risk)	❑ are assessed. (L3-48, A6, 2.2) ❑ are documented. (L3-48, A6, 2.2)	
	Schedule critical paths	❑ are defined. (L3-52, A9, 3) ❑ are reflected in the software schedule. (L3-52, A9, 3)	

Continued on next page

ISM Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the integrated software management process, continued from the previous page.

√	Output	State	References
	Similarities and differences between the project and the sources for historical data in terms of application domain and design approach	❑ are assessed. (L3-50, A8, 1.2) ❑ are recorded. (L3-50, A8, 1.2)	
	Similarities and differences to the other projects in terms of application domain and design approach	❑ are assessed. (L3-46, A5, 2.1) ❑ are recorded. (L3-46, A5, 2.1)	
	Size estimates	are prepared using appropriate procedures and data. (L3-48, A6, 1.1)	
	Size of changes to the software work products	is managed according to a documented procedure. (L3-47, A6)	
	Size of the software work products	is managed according to a documented procedure. (L3-47, A6)	
	Size threshold for each managed software element	❑ is established. (L3-48, A6, 5) ❑ requires action when projected to be exceeded. (L3-48, A6, 5)	
	Software life cycle	❑ is selected from among those approved by the organization, to satisfy the project's contractual and operational constraints. (L3-41, A1, 1.1) ❑ is modified, if necessary, in ways permitted by the organization's tailoring guidelines and criteria. (L3-41, A1, 1.2) ❑ is documented according to the organization's standards. (L3-41, A1, 1.3)	

	Software planning data (from the software project)	are provided for storage in the organization's software process database. (L3-47, A5, 3)	

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ISM Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the integrated software management process, continued from the previous page.

√	Output	State	References
	Software plans followed in interacting with other groups	are adjusted to account for disparities with these groups and for other potential problems. (L3-45, A4, 9)	
	Software risk management plan	❑ is documented. (L3-53, A10, 1) ❑ is used to identify and manage the software risks. (L3-53, A10, 1) ❑ is managed and controlled. (L3-54, A10, 5) ❑ is reviewed at reassessment checkpoints (i.e., at selected project milestones, at designated risk checkpoints, and during the planning of significant changes that affect the software project). (L3-55, A10, 6.1) ❑ is revised at reassessment checkpoints (i.e., at selected project milestones, at designated risk checkpoints, and during the planning of significant changes that affect the software project). (L3-55, A10, 6.1)	
	Software schedule	identifies specific tasks and milestones whose completion can be objectively determined (i.e., a binary or yes/no determination). (L3-51, A9, 1.1)	
	Sources and rationale for estimates (for the project's critical computer resources)	are documented. (L3-50, A8, 1.1)	
	Staffing	is allocated in the schedule consistent with the project's defined software process. (L3-51, A9, 1)	

	Staffing plan	addresses the software project's needs for individuals with special skills and application domain knowledge. (L3-45, A4, 7)	

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ISM Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the integrated software management process, continued from the previous page.

√	Output	State	References
	Threshold criteria for each critical path	❑ are documented. (L3-52, A9, 5) ❑ are established. (L3-52, A9, 5) ❑ require action when projected to be exceeded. (L3-52, A9, 5)	
	Threshold for each critical computer resource	❑ is established. (L3-51, A8, 5) ❑ requires action when projected to be exceeded. (L3-51, A8, 5)	
	Training needs	❑ are identified. (L3-45, A4, 8) ❑ are documented to fit the specific needs of the software project. (L3-45, A4, 8)	
	Waivers for deviations from contractual software process requirements	❑ are documented. (L3-42, A1, 4) ❑ are reviewed by **senior management** and the software project's **customer**, as appropriate. (L3-42, A1, 4) ❑ are approved by **senior management** and the software project's **customer**, as appropriate. (L3-42, A1, 4)	
	Waivers for deviations from the organization's standard software process	❑ are documented. (L3-42, A1, 3.1) ❑ are reviewed by **senior management**. (L3-42, A1, 3.1) ❑ are approved by **senior management**. (L3-42, A1, 3.1)	
	Work products of the project's defined software process	are tied to the software estimating, planning, and tracking activities. (L3-44, A4, 2)	

General Exit Criteria

The CMM recommends that the conditions described in the table below be satisfied to exit the integrated software management process.

√	Condition	References

	Each project performs its software activities in accordance with the project's defined software process. (L3-39, C1, 3)	

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ISM Process - Exit Criteria, Continued

General exit criteria, continued

The table below describes the conditions that must be satisfied in order to exit the integrated software management process, continued from the previous page.

√	Condition	References
	The project's defined software process is developed by tailoring the organization's standard software process according to a documented procedure. (L3-41, A1)	
	Tailoring of the organization's standard software process for the project is reviewed by the **group responsible for coordinating the organization's software process activities (e.g., software engineering process group)** and approved by **senior management**. (L3-42, A1, 3)	
	The software project is managed in accordance with the project's defined software process. (L3-44, A4)	
	Technical and management lessons learned from monitoring the activities of other projects in the organization are systematically reviewed and used to estimate, plan, track, and replan the software project. (L3-45, A4, 6)	
	The organization's software process database is used as a source of data to estimate, plan, track, and replan a software project; data for similar software projects are used when possible. (L3-46, A5, 1)	
	When the software effort and cost status is reviewed and the estimates are revised, actual expenditures over time and against work completed are compared to the software development plan and used to refine the effort and cost estimates for remaining work. (L3-49, A7, 4)	
	Actual data on project productivity and other new software costs are used where appropriate. (L3-50, A7, 4.2)	
	The project's critical computer resources are managed according to a documented procedure. (L3-50, A8)	
	The planned computer resources, the system requirements allocated to software, the software requirements, and/or the software design are adjusted to achieve the project's critical computer resource requirements. (L3-50, A8, 2)	
	The available computer resources are allocated to the software components. (L3-50, A8, 3)	
	The critical dependencies and critical paths of the project's software schedule are managed according to a documented procedure. (L3-51, A9)	
	The software project's critical dependencies and schedule critical paths are tracked on a regular basis. (L3-52, A9, 4)	

	Contingency planning is based on the project's defined software process and is performed throughout the project's software life cycle. (L3-54, A10, 2)	

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ISM Process - Exit Criteria, Continued

General exit criteria, continued

The table below describes the conditions that must be satisfied in order to exit the integrated software management process, continued from the previous page.

√	Condition	References
	The **software engineering group** and other **affected groups** and **individuals** are included in the communications on the software risks, the software risk management plans, and the results of risk mitigation. (L3-55, A10, 7)	
	Reviews of the software project are periodically performed to determine the actions needed to bring the software project's performance and results in line with the current and projected needs of the business, customer, and end users, as appropriate. (L3-55, A11)	
	The activities for managing the software project are reviewed with **senior management** on a periodic basis. (L3-56, V1)	
	The activities for managing the software project are reviewed with the **project manager** on both a periodic and event-driven basis. (L3-57, V2)	
	The **software quality assurance group** reviews and/or audits the activities and work products for managing the software project and reports the results. (L3-57, V3)	

ISM Process - Reviews and Audits

Reviews and audits

The table below lists the recommended reviews and audits for the integrated software management process.

√	Review or Audit	Review Participants	References
	Tailoring of the organization's standard software process for the project is reviewed by the **group responsible for coordinating the organization's software process activities (e.g., software engineering process group)** and approved by **senior management**. (L3-42, A1, 3)	**Group responsible for coordinating the organization's software process activities** **Senior management**	
	Waivers for deviations from the organization's standard software process are documented and are reviewed and approved by **senior management**. (L3-42, A1, 3.1)	**Senior management**	
	Waivers for deviations from contractual software process requirements are documented and are reviewed and approved by **senior management** and the software project's **customer**, as appropriate. (L3-42, A1, 4)	**Senior management** **Customer**	
	Changes derived from the following are documented and systematically reviewed: (L3-43, A2, 1) ❑ Lessons learned from monitoring the software activities of the organization's projects. ❑ Changes proposed by the software project. ❑ Process and work product measurement data.	**Not specified in the CMM**	
	Changes to the project's defined software process are reviewed and approved before they are incorporated. (L3-43, A2, 2)	**Not specified in the CMM**	

	Technical and management lessons learned from monitoring the activities of other projects in the organization are systematically reviewed and used to estimate, plan, track, and replan the software project. (L3-45, A4, 6)	**Not specified in the CMM**	

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Reviews and audits, continued

The table below lists the recommended reviews and audits for the integrated software management process, continued from the previous page.

√	Review or Audit	Review Participants	References
	A **group that is independent of the software engineering group** reviews the procedures for estimating the size of the software work products, and provides guidance in using historical data from the organization's software process database to establish credible estimates. (L3-47, A6, 1)	**Group that is independent of the software engineering group**	
	When the validity of a size estimate is questioned, a **team of peers and experts** reviews the estimate. (L3-48, A6, 1.2)	**Team of peers and experts**	
	When the software effort and cost status is reviewed and the estimates are revised, actual expenditures over time and against work completed are compared to the software development plan and used to refine the effort and cost estimates for remaining work. (L3-49, A7, 4)	**Not specified in the CMM**	
	The initial release and major revisions to the software risk management plan undergo peer review. (L3-54, A10, 4)	**Not specified in the CMM**	
	Risk priorities and software risk management plans are reviewed and revised at these reassessment points (i.e., at selected project milestones, at designated risk checkpoints, and during the planning of significant changes that affect the software project). (L3-55, A10, 6.1)	**Not specified in the CMM**	
	Reviews of the software project are periodically performed to determine the actions needed to bring the software project's performance and results in line with the current and projected needs of the business, customer, and end users, as appropriate. (L3-55, A11)	**Not specified in the CMM**	
	The activities for managing the software project are reviewed with **senior management** on a periodic basis. (L3-56, V1)	**Senior management**	

	The activities for managing the software project are reviewed with the **project manager** on both a periodic and event-driven basis. (L3-57, V2)	**Project manager**	

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ISM Process - Reviews and Audits, Continued

Reviews and audits, continued

The table below lists the recommended reviews and audits for the integrated software management process, continued from the previous page.

√	Review or Audit	Review Participants	References
	The **software quality assurance group** reviews and/or audits the activities and work products for managing the software project and reports the results. (L3-57, V3) At a minimum, the reviews and/or audits verify: ❑ The process for developing and revising the project's defined software process. ❑ The process for preparing the project's software development plan and software risk management plan. ❑ The processes for managing the project in accordance with the project's defined software process. ❑ The processes for collecting and providing appropriate data to the organization's software process database. ❑ The process for using the organization's software process database to support the software project's planning, estimating, and tracking activities.	**SQA group**	

ISM Process - Work Products Managed and Controlled

Work products managed and controlled

The table below lists the work products that are recommended to be managed and controlled during the integrated software management process.

√	Work Products Managed and Controlled	References
	Description of the project's defined software process. (L3-42, A1, 5)	
	Software risk management plan. (L3-54, A10, 5)	

ISM Process - Measurements

Measurements

The table below lists the recommended measurements for the integrated software management process.

√	Measurements	References
	Project measurement data. (L3-39, C1, 4)	
	Process and work product measurement data. (L3-43, A2, 1.3)	
	Measurement data needed to manage the software project. (L3-44, A4, 1)	
	Software planning data, replanning data, and actual measured data. (L3-47, A5, 3)	
	Reuse measurements (reuse of requirements, design, code, test plan, and test procedures, etc.). (L3-48, A6, 3.1)	
	Measurements to determine the effectiveness of the integrated software management activities. (L3-56, M1) Examples of measurements include: ❑ Effort expended over time to manage the software project, compared to the plan. ❑ Frequency, causes, and magnitude of replanning effort. ❑ For each identified software risk, the realized adverse impact compared to the estimated loss. ❑ The number and magnitude of unanticipated major adverse impacts to the software project, tracked over time.	

ISM Process - Documented Procedures

Documented procedures

The table below lists the activities for the integrated software management process recommended to be performed according to a documented procedure.

√	Documented Procedure(s)	References
	The project's defined software process is developed by tailoring the organization's standard software process according to a documented procedure. (L3-41, A1) [Refer to Level 3 Procedure Checklists for additional information.]	
	Each project's defined software process is revised according to a documented procedure. (L3-43, A2) [Refer to Level 3 Procedure Checklists for additional information.]	
	The project's software development plan, which describes the use of the project's defined software process, is developed and revised according to a documented procedure. (L3-44, A3)	
	The size of the software work products (or size of changes to the software work products) is managed according to a documented procedure. (L3-47, A6) [Refer to Level 3 Procedure Checklists for additional information.]	
	The project's software effort and costs are managed according to a documented procedure. (L3-48, A7) [Refer to Level 3 Procedure Checklists for additional information.]	
	The project's critical computer resources are managed according to a documented procedure. (L3-50, A8) [Refer to Level 3 Procedure Checklists for additional information.]	
	The critical dependencies and critical paths of the project's software schedule are managed according to a documented procedure. (L3-51, A9) [Refer to Level 3 Procedure Checklists for additional information.]	
	The project's software risks are identified, assessed, documented, and managed according to a documented procedure. (L3-52, A10) [Refer to Level 3 Procedure Checklists for additional information.]	

ISM Process - Training

Training

The table below lists the training recommended for the integrated software management process.

√	Training	References
	The **individuals** responsible for developing the project's defined software process receive required training in how to tailor the organization's standard software process and use the related process assets. (L3-39, Ab2)	
	The **software managers** receive required training in managing the technical, administrative, and personnel aspects of the software project based on the project's defined software process. (L3-40, Ab3)	

ISM Process - Tools

Tools

The table below lists the tools recommended for the integrated software management process.

√	Tools	References
	Organization's software process database. (L3-39, C1, 4)	

Software Product Engineering (SPE) Process

SPE Process - Overview

SPE process purpose

The purpose of Software Product Engineering is to consistently perform a well-defined engineering process that integrates all the software engineering activities to produce correct, consistent software products effectively and efficiently. (L3-59)

SPE process description

Software Product Engineering involves performing the engineering tasks to build and maintain the software using the project's defined software process (which is described in the Integrated Software Management key process area) and appropriate methods and tools.

The software engineering tasks include analyzing the system requirements allocated to software (these system requirements are described in the Requirements Management key process area), developing the software requirements, developing the software architecture, designing the software, implementing the software in the code, integrating the software components, and testing the software to verify that it satisfies the specified requirements (i.e., the system requirements allocated to software and the software requirements).

Documentation needed to perform the software engineering tasks (e.g., software requirements document, software design document, test plan, and test procedures) is developed and reviewed to ensure that each task addresses the results of predecessor tasks and the results produced are appropriate for the subsequent tasks (including the tasks of operating and maintaining the software). When changes are approved, affected software work products, plans, commitments, processes, and activities are revised to reflect the approved changes. (L3-59)

Continued on next page

Section overview

The table below contains a description and the location of each checklist for this key process area.

Checklist	Description	Page
Roles	List of roles participating in process activities.	L3-Process-105
Entry Criteria	Description of when the process can start.	L3-Process-110
Inputs	Description of the work products used by the process.	L3-Process-112
Activities	Description of the activities of the process.	L3-Process-114
Outputs	Description of the work products produced by the process.	L3-Process-123
Exit Criteria	Description of when the process is complete.	L3-Process-126
Reviews and Audits	List of reviews and audits.	L3-Process-140
Work Products Managed and Controlled	List of work products to be managed and controlled.	L3-Process-144
Measurements	Description of process measurements.	L3-Process-145
Documented Procedures	List of the activities to be completed according to a documented procedure.	L3-Process-146
Training	List of training.	L3-Process-147
Tools	List of tools.	L3-Process-148

SPE Process - Roles

Roles

The table below lists the roles and the activities in which they participate in the software product engineering process.

√	Role	Activities Participated in...	Reference
	Affected groups	Changes (to the software work products, plans, process descriptions, and activities) are negotiated with and communicated to the **affected groups**. (L3-79, A10, 4.4)	
	Customer	❑ The software requirements document is reviewed with the **customer** and end users, as appropriate. (L3-68, A2, 10) ❑ Testing criteria are developed and reviewed with the **customer** and the end users, as appropriate. (L3-72, A5, 1) ❑ System and acceptance testing are documented in a test plan, which is reviewed with, and approved by, the **customer** and end users, as appropriate. (L3-75, A7, 2) ❑ The test cases are documented and are reviewed with, and approved by, the **customer** and end users, as appropriate, before the testing begins. (L3-76, A7, 4) ❑ Preliminary versions of the documentation are developed and made available early in the software life cycle for the **customer**, end users, and software maintainers, as appropriate, to review and provide feedback. (L3-77, A8, 3) ❑ The final documentation is reviewed and approved by the **customer**, end users, and software maintainers, as appropriate. (L3-77, A8, 7)	
	Documentation specialist	**Documentation specialists** actively participate in planning, developing, and maintaining documentation. (L3-77, A8, 2)	

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SPE Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the software product engineering process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	End users	❑ The software requirements document is reviewed with the customer and **end users**, as appropriate. (L3-68, A2, 10) ❑ Testing criteria are developed and reviewed with the customer and the **end users**, as appropriate. (L3-72, A5, 1) ❑ System and acceptance testing are documented in a test plan, which is reviewed with, and approved by, the customer and **end users**, as appropriate. (L3-75, A7, 2) ❑ The test cases are documented and are reviewed with, and approved by, the customer and **end users**, as appropriate, before the testing begins. (L3-76, A7, 4) ❑ Preliminary versions of the documentation are developed and made available early in the software life cycle for the customer, **end users**, and software maintainers, as appropriate, to review and provide feedback. (L3-77, A8, 3) ❑ The final documentation is reviewed and approved by the customer, **end users**, and software maintainers, as appropriate. (L3-77, A8, 7)	
	Group responsible for the system requirements	Problems with the software requirements are identified and reviewed with the **group responsible for the system requirements**; appropriate changes are made to the allocated requirements and to the software requirements. (L3-67, A2, 4.1)	
	Group responsible for system and acceptance testing	The **group responsible for system and acceptance testing** of the software analyzes each software requirement to verify it can be tested. (L3-67, A2, 6)	

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SPE Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the software product engineering process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Individuals	Skilled **individuals** are available to perform the different software engineering tasks, including: (L3-61, Ab1, 1) ❑ software requirements analysis, ❑ software design, ❑ coding, ❑ testing, and ❑ software maintenance.	
	Individuals involved in coding	The **individuals involved in coding** review the software requirements and software design to ensure that issues affecting the coding are identified and resolved. (L3-71, A4, 1)	
	Individuals involved in developing the software requirements	The **individuals involved in developing the software requirements** review the allocated requirements to ensure that issues affecting the software requirements analysis are identified and resolved. (L3-66, A2, 1)	
	Individuals involved in software design	The **individuals involved in the software design** review the software requirements to ensure that issues affecting the software design are identified and resolved. (L3-69, A3, 2)	
	Individuals responsible for system and acceptance testing	The integration test cases and test procedures are reviewed with the **individuals responsible for** the software requirements, software design, and **system and acceptance testing**. (L3-75, A6, 2)	
	Individuals responsible for the software design	The integration test cases and test procedures are reviewed with the **individuals responsible for the** software requirements, **software design**, and system and acceptance testing. (L3-75, A6, 2)	

	Individuals responsible for the software requirements	The integration test cases and test procedures are reviewed with the **individuals responsible for the software requirements**, software design, and system and acceptance testing. (L3-75, A6, 2)	

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SPE Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the software product engineering process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Project manager	❑ The **project manager** and all software managers receive orientation in the technical aspects of the software project. (L3-64, Ab4) ❑ The activities for software product engineering are reviewed with the **project manager** on both a periodic and event-driven basis. (L3-80, V2)	
	Senior management	The activities for software product engineering are reviewed with **senior management** on a periodic basis. (L3-80, V1)	
	Software engineering technical staff	❑ Members of the **software engineering technical staff** receive required training to perform their technical assignments. (L3-63, Ab2) ❑ Members of the **software engineering technical staff** receive orientation in related software engineering disciplines. (L3-64, Ab3)	
	Software maintainer	❑ Preliminary versions of the documentation are developed and made available early in the software life cycle for the customer, end users, and **software maintainers**, as appropriate, to review and provide feedback. (L3-77, A8, 3) ❑ The final documentation is reviewed and approved by the customer, end users, and **software maintainers**, as appropriate. (L3-77, A8, 7)	
	Software manager	The project manager and all **software managers** receive orientation in the technical aspects of the software project. (L3-64, Ab4)	

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SPE Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the software product engineering process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Software quality assurance (SQA) group	The **software quality assurance group** reviews and/or audits the activities and work products for software product engineering and reports the results. (L3-81, V3)	
	Test group	The test cases and test procedures are planned and prepared by a **test group** that is independent of the software developers. (L3-76, A7, 3)	

SPE Process - Entry Criteria

Input-based entry criteria

The CMM recommends that inputs satisfy the states described in the table below before entering the software product engineering process.

√	Input	State	References
	Changes to allocated requirements	❑ are approved. (L3-79, A10, 4.2) ❑ are incorporated before any software work products or activities are changed. (L3-79, A10, 4.2)	
	Changes to software process descriptions	are proposed. (L3-78, A10, 4)	
	Changes to software activities	are proposed. (L3-78, A10, 4)	
	Changes to software plans	are proposed. (L3-78, A10, 4)	
	Changes to software work products	are proposed. (L3-78, A10, 4)	
	Test plan	is documented. (L3-81, V3, 5)	

General entry criteria

The CMM recommends that the conditions described in the table below be satisfied before entering the software product engineering process.

√	Condition	References
	The project follows a written organizational policy for performing the software engineering activities. (L3-60, C1)	
	Adequate resources and funding are provided for performing the software engineering tasks. (L3-61, Ab1)	
	Skilled **individuals** are available to perform the different software engineering tasks, including: (L3-61, Ab1, 1) ❑ software requirements analysis, ❑ software design, ❑ coding, ❑ testing, and ❑ software maintenance.	
	Tools to support the software engineering tasks are made available. (L3-61, Ab1, 2)	

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SPE Process - Entry Criteria, Continued

General entry criteria, continued

The CMM recommends that the conditions described in the table below be satisfied before entering the software product engineering process, continued from the previous page.

√	Condition	References
	Members of the **software engineering technical staff** receive required training to perform their technical assignments. (L3-63, Ab2)	
	Members of the **software engineering technical staff** receive orientation in related software engineering disciplines. (L3-64, Ab3)	
	The **project manager** and all **software managers** receive orientation in the technical aspects of the software project. (L3-64, Ab4)	

SPE Process - Inputs

Inputs

The table below lists the recommended inputs to the software product engineering process.

√	Input	Org. Input	References
	Allocated requirements. (L3-66, A2, 1)		
	Application standards. (L3-70, A3, 3)		
	Baselined documentation of the allocated requirements. (L3-76, A7, 5)		
	Baselined software. (L3-76, A7, 5)		
	Changes to allocated requirements. (L3-69, A2, 12)		
	Changes to code being tested. (L3-74, A5, 8)		
	Changes to process descriptions. (L3-78, A10, 4)		
	Changes to software activities. (L3-78, A10, 4)		
	Changes to software design. (L3-72, A4, 6)		
	Changes to software plans. (L3-78, A10, 4)		
	Changes to software products. (L3-79, A10, 4.3)		
	Changes to software requirements. (L3-71, A3, 11)		
	Changes to software work products. (L3-78, A10, 4)		
	Completion criteria for each software engineering task. (L3-81, V3, 2)		
	Methods for programming. (L3-71, A4, 2)		
	Methods for requirements analysis. (L3-67, A2, 2)		
	Methods for software design. (L3-70, A3, 4)		
	Methods for software engineering. (L3-65, A1)		
	Methods for software test. (L3-72, A5, 2)		
	Needs of the customer. (L3-72, A4, 3)		
	Needs of the end users. (L3-72, A4, 3)		

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SPE Process - Inputs, Continued

Inputs, continued

The table below lists the recommended inputs to the software product engineering process, continued from the previous page.

√	Input	Org. Inputs	References
	Plan (that accounts for factors such as criticality, difficulty, integration and test issues, and needs of the customer and end users, as appropriate). (L3-72, A4, 3)		
	Process descriptions. (L3-78, A10)		
	Project's defined software process. (L3-60, C1)		
	Readiness criteria for each software engineering task. (L3-81, V3, 2)		
	Software baseline. (L3-82, V3, 10)		
	Software baselined for software acceptance testing. (L3-77, A8, 4)		
	Software code. (L3-78, A10)		
	Software design document. (L3-75, A6, 3)		
	Software design. (L3-71, A4)		
	Software development plan. (L3-75, A6, 1)		
	Software engineering tools. (L3-65, A1)		
	Software plans. (L3-78, A10)		
	Software requirements document. (L3-75, A6, 3)		
	Software requirements. (L3-66, A2)		
	Software standards. (L3-81, V3, 3)		
	Software work products. (L3-78, A10)		
	System requirements allocated to software. (L3-60, C1, 3)		
	Test cases. (L3-78, A10, 2)		
	Test plans. (L3-78, A10)		
	Test procedures. (L3-78, A10)		

SPE Process - Activities

Activities

The table below lists the recommended activities for the software product engineering process.

√	Activities	References
	Appropriate software engineering methods and tools are integrated into the project's defined software process. (L3-65, A1) ❑ The software engineering tasks are integrated according to the project's defined software process. ❑ Methods and tools appropriate for use on the software project are selected. ❑ The rationale for selecting a particular tool or method is documented. ❑ Configuration management models appropriate to the software project are selected and used. ❑ The tools used to develop and maintain the software products are placed under configuration management.	

Continued on next page

SPE Process - Activities, Continued

Activities, continued

The table below lists the recommended activities for the software product engineering process, continued from the previous page.

√	Activities	References
	The software requirements are developed, maintained, documented, and verified by systematically analyzing the allocated requirements according to the project's defined software process. (L3-66, A2) ❑ The **individuals involved in developing the software requirements** review the allocated requirements to ensure that issues affecting the software requirements analysis are identified and resolved. ❑ Effective methods for requirements analysis are used to identify and derive the software requirements. ❑ The results of the requirements analysis and the rationale for the selected alternative are documented. ❑ The software requirements are analyzed to ensure they are feasible and appropriate to implement in software, clearly stated, consistent with each other, testable, and complete (when considered as a set). ❑ Problems with the software requirements are identified and reviewed with the **group responsible for the system requirements**; appropriate changes are made to the allocated requirements and to the software requirements. ❑ The software requirements are documented. ❑ The **group responsible for system and acceptance testing** of the software analyzes each software requirement to verify it can be tested. ❑ The methods for verifying and validating that each software requirement is satisfied are identified and documented. ❑ The software requirements document undergoes peer review before it is considered complete. ❑ The software requirements document is reviewed and approved. ❑ The software requirements document is reviewed with the **customer** and **end users**, as appropriate. ❑ The software requirements document is placed under configuration management. ❑ The software requirements are appropriately changed whenever the allocated requirements change.	

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SPE Process - Activities, Continued

Activities, continued

The table below lists the recommended activities for the software product engineering process, continued from the previous page.

√	Activities	References
	The software design is developed, maintained, documented, and verified, according to the project's defined software process, to accommodate the software requirements and to form the framework for coding. (L3-69, A3) ❑ Design criteria are developed and reviewed. ❑ The **individuals involved in the software design** review the software requirements to ensure that issues affecting the software design are identified and resolved. ❑ Application standards are used where appropriate. ❑ Effective methods are used to design the software. ❑ The software architecture is developed early, within the constraints of the software life cycle and technology being used. ❑ The software architecture is reviewed to ensure that architecture issues affecting the software detailed design are identified and resolved. ❑ The software detailed design is developed based on the software architecture. ❑ The software design (i.e., the software architecture and detailed design) is documented. ❑ The documentation of the software design covers the software components; the internal interfaces between software components; and the software interfaces to other software systems, to hardware, and to other system components (e.g., humans). ❑ The software design document undergoes peer review before the design is considered complete. ❑ The software design document is placed under configuration management. ❑ The software design document is appropriately changed whenever the software requirements change.	

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SPE Process - Activities, Continued

Activities, continued

The table below lists the recommended activities for the software product engineering process, continued from the previous page.

√	Activities	References
	The software code is developed, maintained, documented, and verified, according to the project's defined software process, to implement the software requirements and software design. (L3-71, A4) ❑ The **individuals involved in coding** review the software requirements and software design to ensure that issues affecting the coding are identified and resolved. ❑ Effective programming methods are used to code the software. ❑ The sequence in which code units are developed is based on a plan that accounts for factors such as criticality, difficulty, integration and test issues, and needs of the customer and end users, as appropriate. ❑ Each code unit undergoes peer review and is unit tested before the unit is considered complete. ❑ The code is placed under configuration management. ❑ The code is appropriately changed whenever the software requirements or software design changes.	

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SPE Process - Activities, Continued

Activities, continued

The table below lists the recommended activities for the software product engineering process, continued from the previous page.

√	Activities	References

	Software testing is performed according to the project's defined software process. (L3-72, A5)
	❑ Testing criteria are developed and reviewed with the **customer** and the **end users**, as appropriate.
	❑ Effective methods are used to test the software.
	❑ The adequacy of testing is determined based on:
	  ❑ the level of testing performed,
	  ❑ the test strategy selected, and
	  ❑ the test coverage to be achieved.
	❑ For each level of software testing, test readiness criteria are established and used.
	❑ Regression testing is performed, as appropriate, at each test level whenever the software being tested or its environment changes.
	❑ The test plan, test procedures, and test cases undergo peer review before they are considered ready for use.
	❑ The test plans, test procedures, and test cases are managed and controlled.
	❑ Test plans, test procedures, and test cases are appropriately changed whenever the allocated requirements, software requirements, software design, or code being tested changes.	

	Integration testing of the software is planned and performed according to the project's defined software process. (L3-74, A6) ❑ The plans for integration testing are documented and based on the software development plan. ❑ The integration test cases and test procedures are reviewed with the **individuals responsible for the software requirements**, **software design**, and **system and acceptance testing**. ❑ Integration testing of the software is performed against the designated version of the software requirements document and the software design document.	

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SPE Process - Activities, Continued

Activities, continued

The table below lists the recommended activities for the software product engineering process, continued from the previous page.

√	Activities	References
	System and acceptance testing of the software are planned and performed to demonstrate that the software satisfies its requirements. (L3-75, A7) ❑ Resources for testing the software are assigned early enough to provide for adequate test preparation. ❑ System and acceptance testing are documented in a test plan, which is reviewed with, and approved by, the **customer** and **end users**, as appropriate. ❑ The test cases and test procedures are planned and prepared by a **test group** that is independent of the software developers. ❑ The test cases are documented and are reviewed with, and approved by, the **customer** and **end users**, as appropriate, before the testing begins. ❑ Testing of the software is performed against baselined software and the baselined documentation of the allocated requirements and the software requirements. ❑ Problems identified during testing are documented and tracked to closure. ❑ Test results are documented and used as the basis for determining whether the software satisfies its requirements. ❑ The test results are managed and controlled.	

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SPE Process - Activities, Continued

Activities, continued

The table below lists the recommended activities for the software product engineering process, continued from the previous page.

√	Activities	References
	The documentation that will be used to operate and maintain the software is developed and maintained according to the project's defined software process. (L3-76, A8) ❑ Appropriate methods and tools are used to develop the documentation. ❑ **Documentation specialists** actively participate in planning, developing, and maintaining documentation. ❑ Preliminary versions of the documentation are developed and made available early in the software life cycle for the customer, end users, and software maintainers, as appropriate, to review and provide feedback. ❑ Final versions of the documentation are verified against the software baselined for software acceptance testing. ❑ The documentation undergoes peer review. ❑ The documentation is managed and controlled. ❑ The final documentation is reviewed and approved by the **customer**, **end users**, and **software maintainers**, as appropriate.	
	Data on defects identified in peer reviews and testing are collected and analyzed according to the project's defined software process. (L3-78, A9)	

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SPE Process - Activities, Continued

Activities, continued

The table below lists the recommended activities for the software product engineering process, continued from the previous page.

√	Activities	References
	Consistency is maintained across software work products, including the software plans, process descriptions, allocated requirements, software requirements, software design, code, test plans, and test procedures. (L3-78, A10) ❑ Software work products are documented, and the documentation is readily available. ❑ The software requirements, design, code, and test cases are traced to the source from which they were derived and to the products of the subsequent software engineering activities. ❑ The documentation tracing the allocated requirements through the software requirements, design, code, and test cases is managed and controlled. ❑ As understanding of the software improves, changes to the software work products, plans, process descriptions, and activities are proposed, analyzed, and incorporated as appropriate. ❑ The project determines the impact of the change before the change is made. ❑ Where changes to the allocated requirements are needed, they are approved and incorporated before any software work products or activities are changed. ❑ Changes to all software products, plans, process descriptions, and activities are coordinated. ❑ Changes are negotiated with and communicated to the **affected groups**. ❑ Changes are tracked to completion.	
	Measurements are made and used to determine the functionality and quality of the software products. (L3-79, M1)	
	Measurements are made and used to determine the status of the software product engineering activities. (L3-80, M2)	
	The activities for software product engineering are reviewed with **senior management** on a periodic basis. (L3-80, V1)	

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SPE Process - Activities, Continued

Activities, continued

The table below lists the recommended activities for the software product engineering process, continued from the previous page.

√	Activities	References
	The activities for software product engineering are reviewed with the **project manager** on both a periodic and event-driven basis. (L3-80, V2)	
	The **software quality assurance group** reviews and/or audits the activities and work products for software product engineering and reports the results. (L3-81, V3) [Refer to SPE Process Reviews and Audits for additional information.]	

SPE Process - Outputs

Outputs

The table below lists the recommended outputs produced by the software product engineering process.

√	Output	Org. Outputs	References
	Architecture issues (affecting the software detailed design). (L3-70, A3, 6)		
	Changes to allocated requirements. (L3-67, A2, 4.1)		
	Changes to process descriptions. (L3-79, A10, 4.3)		
	Changes to software activities. (L3-79, A10, 4.3)		
	Changes to software plans. (L3-79, A10, 4.3)		
	Changes to the software requirements. (L3-67, A2, 4.1)		
	Changes to software work products. (L3-79, A10, 4.3)		
	Code unit. (L3-72, A4, 3)		
	Configuration management models. (L3-66, A1, 3)		
	Data on defects identified in peer reviews. (L3-78, A9)		
	Data on defects identified in testing. (L3-78, A9)		
	Defects detected in **SQA group** reviews and/or audits. (L3-82, V3, 8)		
	Design criteria. (L3-69, A3, 1)		
	Documentation that will be used to operate and maintain the software. (L3-76, A8)		
	Documentation tracing the allocated requirements through the software requirements, design, code, and test cases. (L3-78, A10, 3)		
	Integration test cases. (L3-75, A6, 2)		
	Integration test procedures. (L3-75, A6, 2)		
	Issues affecting the coding. (L3-71, A4, 1)		
	Issues affecting the software design. (L3-69, A3, 2)		

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SPE Process - Outputs, Continued

Outputs, continued

The table below lists the recommended outputs produced by the software product engineering process, continued from the previous page.

√	Output	Org. Outputs	References
	Issues affecting the software requirements analysis. (L3-66, A2, 1)		
	Measurements (to determine the functionality and quality of the software products). (L3-79, M1)		
	Methods for validating that each software requirement is satisfied. (L3-68, A2, 7)		
	Methods for verifying that each software requirement is satisfied. (L3-68, A2, 7)		
	Plans for integration testing. (L3-75, A6, 1)		
	Problems detected in **SQA group** reviews and/or audits. (L3-82, V3, 8)		
	Problems identified during testing. (L3-76, A7, 6)		
	Problems with the software requirements. (L3-67, A2, 4.1)		
	Rationale for selecting a particular (software engineering) method. (L3-66, A1, 2.1)		
	Rationale for selecting a particular (software engineering) tool. (L3-66, A1, 2.1)		
	Rationale for the selected alternative. (L3-67, A2, 3)		
	Results of **SQA group** reviews and/or audits. (L3-81, V3)		
	Results of the requirements analysis. (L3-67, A2, 3)		
	Software architecture. (L3-70, A3, 5)		
	Software code. (L3-71, A4)		
	Software design document. (L3-71, A3, 8.1)		
	Software design. (L3-69, A3)		
	Software detailed design. (L3-70, A3, 7)		
	Software plans. (L3-60, C1, 3)		

	Software products. (L3-60, C1, 2)		

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SPE Process - Outputs, Continued

Outputs, continued

The table below lists the recommended outputs produced by the software product engineering process, continued from the previous page.

√	Output	Org. Outputs	References
	Software requirements document. (L3-68, A2, 8)		
	Software requirements. (L3-66, A2)		
	Software work products. (L3-78, A10, 1)		
	Test cases. (L3-74, A5, 6)		
	Test plan. (L3-74, A5, 6)		
	Test procedures. (L3-74, A5, 6)		
	Test readiness criteria. (L3-73, A5, 4)		
	Test results. (L3-76, A7, 7)		
	Testing criteria. (L3-72, A5, 1)		

SPE Process - Exit Criteria

Output-based exit criteria

The CMM recommends that outputs satisfy the states described in the table below to exit the software product engineering process.

√	Output	State	References
	Architecture issues (affecting the software detailed design)	❑ are identified. (L3-70, A3, 6) ❑ are resolved. (L3-70, A3, 6)	
	Changes to allocated requirements	are made. (L3-67, A2, 4.1)	
	Changes to process descriptions	❑ are analyzed. (L3-78, A10, 4) ❑ are incorporated as appropriate. (L3-78, A10, 4) ❑ have their impact determined by the project before the changes are made. (L3-79, A10, 4.1) ❑ are coordinated. (L3-79, A10, 4.3) ❑ are negotiated with the **affected groups**. (L3-79, A10, 4.4) ❑ are communicated to the **affected groups**. (L3-79, A10, 4.4) ❑ are tracked to completion. (L3-79, A10, 4.5)	
	Changes to software activities	❑ are analyzed. (L3-78, A10, 4) ❑ are incorporated as appropriate. (L3-78, A10, 4) ❑ have their impact determined by the project before the changes are made. (L3-79, A10, 4.1) ❑ are coordinated. (L3-79, A10, 4.3) ❑ are negotiated with the **affected groups**. (L3-79, A10, 4.4) ❑ are communicated to the **affected groups**. (L3-79, A10, 4.4) ❑ are tracked to completion. (L3-79, A10, 4.5)	

	Changes to software requirements	are made (based on problems identified with the software requirements). (L3-67, A2, 4.1)	

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Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the software product engineering process, continued from the previous page.

√	Output	State	References
	Changes to software plans	❑ are analyzed. (L3-78, A10, 4) ❑ are incorporated as appropriate. (L3-78, A10, 4) ❑ have their impact determined by the project before the changes are made. (L3-79, A10, 4.1) ❑ are coordinated. (L3-79, A10, 4.3) ❑ are negotiated with the **affected groups**. (L3-79, A10, 4.4) ❑ are communicated to the **affected groups**. (L3-79, A10, 4.4) ❑ are tracked to completion. (L3-79, A10, 4.5)	
	Changes to software work products	❑ are analyzed. (L3-78, A10, 4) ❑ are incorporated as appropriate. (L3-78, A10, 4) ❑ have their impact determined by the project before the changes are made. (L3-79, A10, 4.1) ❑ are coordinated. (L3-79, A10, 4.3) ❑ are negotiated with the **affected groups**. (L3-79, A10, 4.4) ❑ are communicated to the **affected groups**. (L3-79, A10, 4.4) ❑ are tracked to completion. (L3-79, A10, 4.5)	

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Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the software product engineering process, continued from the previous page.

√	Output	State	References
	Code unit	❑ development sequence is based on a plan that accounts for factors such as: ❑ criticality, ❑ difficulty, ❑ integration and test issues, and ❑ needs of the **customer** and **end users**, as appropriate. (L3-72, A4, 3) ❑ undergoes peer review. (L3-72, A4, 4) ❑ is unit tested before the unit is considered complete. (L3-72, A4, 4)	
	Configuration management models	❑ are appropriate to the software project. (L3-66, A1, 3) ❑ are selected. (L3-66, A1, 3) ❑ are used. (L3-66, A1, 3)	
	Data on defects identified in peer reviews	❑ are collected according to the project's defined software process. (L3-78, A9) ❑ are analyzed according to the project's defined software process. (L3-78, A9)	
	Data on defects identified in testing	❑ are collected according to the project's defined software process. (L3-78, A9) ❑ are analyzed according to the project's defined software process. (L3-78, A9)	
	Design criteria	❑ are developed. (L3-69, A3, 1) ❑ are reviewed. (L3-69, A3, 1)	

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SPE Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the software product engineering process, continued from the previous page.

√	Output	State	References

	Documentation (that will be used to operate and maintain the software)	❑ is developed according to the project's defined software process. (L3-76, A8) ❑ is maintained according to the project's defined software process. (L3-76, A8) ❑ is developed by using appropriate methods and tools. (L3-76, A8, 1) ❑ (preliminary versions) are developed. (L3-77, A8, 3) ❑ (preliminary versions) are made available early in the software life cycle for the **customer**, **end users**, and **software maintainers**, as appropriate, to review and to provide feedback. (L3-77, A8, 3) ❑ (final versions) are verified against the software baselined for software acceptance testing. (L3-77, A8, 4) ❑ undergoes peer review. (L3-77, A8, 5) ❑ is managed and controlled. (L3-77, A8, 6) ❑ (final version) is reviewed by the **customer**, **end users**, and **software maintainers**, as appropriate. (L3-77, A8, 7) ❑ (final version) is approved by the **customer**, **end users**, and **software maintainers**, as appropriate. (L3-77, A8, 7) ❑ is verified against the software baseline and any applicable allocated requirements before the software product is released to the customer or end users. (L3-82, V3, 10)	

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SPE Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the software product engineering process, continued from the previous page.

√	Output	State	References
	Documentation (tracing the allocated requirements through the software requirements, design, code, and test cases)	is managed and controlled. (L3-78, A10, 3)	
	Integration test cases	are reviewed with the **individuals responsible for the software requirements**, **software design**, and **system and acceptance testing**. (L3-75, A6, 2)	
	Issues affecting the coding	❑ are identified. (L3-71, A4, 1) ❑ are resolved. (L3-71, A4, 1)	
	Issues affecting the software design	❑ are identified. (L3-69, A3, 2) ❑ are resolved. (L3-69, A3, 2)	
	Issues affecting the software requirements analysis	❑ are identified. (L3-66, A2, 1) ❑ are resolved. (L3-66, A2, 1)	
	Measurements (to determine the functionality and quality of the software products)	❑ are made. (L3-79, M1) ❑ are used. (L3-79, M1)	
	Measurements (to determine the status of the software product engineering activities)	❑ are made. (L3-80, M2) ❑ are used. (L3-80, M2)	
	Methods for validating that each software requirement is satisfied	❑ are identified. (L3-68, A2, 7) ❑ are documented. (L3-68, A2, 7)	
	Methods for verifying that each software requirement is satisfied	❑ are identified. (L3-68, A2, 7) ❑ are documented. (L3-68, A2, 7)	

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Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the software product engineering process, continued from the previous page.

√	Output	State	References
	Plans for integration testing	❑ are documented. (L3-75, A6, 1) ❑ are based on the software development plan. (L3-75, A6, 1)	
	Problems identified during testing	❑ are documented. (L3-76, A7, 6) ❑ are tracked to closure. (L3-76, A7, 6)	
	Problems with the software requirements	❑ are identified. (L3-67, A2, 4.1) ❑ are reviewed with the **group responsible for the system requirements**. (L3-67, A2, 4.1)	
	Rationale for selecting a particular method	is documented. (L3-66, A1, 2.1)	
	Rationale for selecting a particular tool	is documented. (L3-66, A1, 2.1)	
	Rationale for the selected alternative	is documented. (L3-67, A2, 3)	
	Results of **SQA group** reviews and/or audits	are reported. (L3-81, V3)	
	Results of the requirements analysis	are documented. (L3-67, A2, 3)	
	Software architecture	❑ is developed early, within the constraints of the software life cycle and technology being used. (L3-70, A3, 5) ❑ is reviewed to ensure that architecture issues affecting the software detailed design are identified and resolved. (L3-70, A3, 6) ❑ is documented. (L3-70, A3, 8)	

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Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the software product engineering process, continued from the previous page.

√	Output	State	References
	Software code	❑ is, (according to the project's defined software process,) (L3-71, A4) ❑ developed, ❑ maintained, ❑ documented, and ❑ verified. ❑ implements the software requirements and software design. (L3-71, A4) ❑ is placed under configuration management. (L3-72, A4, 5) ❑ is appropriately changed whenever the software requirements or software design changes. (L3-72, A4, 6)	
	Software design document	❑ undergoes peer review before the design is considered complete. (L3-71, A3, 9) ❑ is placed under configuration management. (L3-71, A3, 10) ❑ is appropriately changed whenever the software requirements change. (L3-71, A3, 11)	

	Software design	❑ is, according to the project's defined software process, (L3-69, A3) ❑ developed, ❑ maintained, ❑ documented, and ❑ verified. ❑ accommodates the software requirements. (L3-69, A3) ❑ forms the framework for coding. (L3-69, A3) ❑ is documented. (L3-70, A3, 8)	

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SPE Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the software product engineering process, continued from the previous page.

√	Output	State	References
	Software detailed design	❑ is developed based on the software architecture. (L3-70, A3, 7) ❑ is documented. (L3-70, A3, 8)	
	Software plans	are traceable to the system requirements allocated to software. (L3-60, C1, 3)	
	Software products	❑ are built using appropriate methods and tools. (L3-60, C1, 2) ❑ are maintained using appropriate methods and tools. (L3-60, C1, 2) ❑ are traceable to the system requirements allocated to software. (L3-60, C1, 3) ❑ comply with the standards and requirements specified for them. (L3-81, V3, 3)	
	Software requirements document	❑ undergoes peer review before it is considered complete. (L3-68, A2, 8) ❑ is reviewed. (L3-68, A2, 9) ❑ is approved. (L3-68, A2, 9) ❑ is reviewed with the **customer** and **end users**, as appropriate. (L3-68, A2, 10) ❑ is placed under configuration management. (L3-69, A2, 11)	

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SPE Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the software product engineering process, continued from the previous page.

√	Output	State	References
	Software requirements	❑ are: (L3-66, A2) ❑ developed, ❑ maintained, ❑ documented, and ❑ verified by systematically analyzing the allocated requirements according to the project's defined software process. ❑ are identified using effective methods for requirements analysis. (L3-67, A2, 2) ❑ are derived using effective methods for requirements analysis. (L3-67, A2, 2) ❑ are analyzed to ensure they are: (L3-67, A2, 4) ❑ feasible and appropriate to implement in software, ❑ clearly stated, ❑ consistent with each other, ❑ testable, and ❑ complete (when considered as a set). ❑ are documented. (L3-67, A2, 5) ❑ (each) is analyzed by the **group responsible for system and acceptance testing** to verify it can be tested. (L3-67, A2, 6) ❑ are appropriately changed whenever the allocated requirements change. (L3-69, A2, 12)	
	Software work products	are documented, and the documentation is readily available. (L3-78, A10, 1)	

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SPE Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the software product engineering process, continued from the previous page.

√	Output	State	References
	Test cases	❑ undergo peer review before they are considered ready for use. (L3-74, A5, 6) ❑ are managed and controlled. (L3-74, A5, 7) ❑ are appropriately changed whenever the allocated requirements, software requirements, software design, or code being tested changes. (L3-74, A5, 8) ❑ are planned and prepared by a **test group** that is independent of the software developers. (L3-76, A7, 3) ❑ are documented. (L3-76, A7, 4) ❑ are reviewed with the **customer** and **end users**, as appropriate, before the testing begins. (L3-76, A7, 4) ❑ are approved by the **customer** and **end users**, as appropriate, before the testing begins. (L3-76, A7, 4)	

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SPE Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the software product engineering process, continued from the previous page.

√	Output	State	References
	Test plan	❑ undergoes peer review before it is considered ready for use. (L3-74, A5, 6) ❑ is managed and controlled. (L3-74, A5, 7) ❑ is appropriately changed whenever the allocated requirements, software requirements, software design, or code being tested changes. (L3-74, A5, 8) ❑ is reviewed with the **customer** and **end users**, as appropriate. (L3-75, A7, 2) ❑ is approved by the **customer** and **end users**, as appropriate. (L3-75, A7, 2)	
	Test procedures	❑ undergo peer review before they are considered ready for use. (L3-74, A5, 6) ❑ are managed and controlled. (L3-74, A5, 7) ❑ are appropriately changed whenever the allocated requirements, software requirements, software design, or code being tested changes. (L3-74, A5, 8) ❑ are planned and prepared by a test group that is independent of the software developers. (L3-76, A7, 3)	
	Test readiness criteria	❑ are established. (L3-73, A5, 4) ❑ are used. (L3-73, A5, 4)	

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SPE Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the software product engineering process, continued from the previous page.

√	Output	State	References
	Test results	❑ are documented. (L3-76, A7, 7) ❑ are used as the basis for determining whether the software satisfies its requirements. (L3-76, A7, 7) ❑ are managed and controlled. (L3-76, A7, 8)	
	Testing criteria	❑ are developed. (L3-72, A5, 1) ❑ are reviewed with the **customer** and the **end users**, as appropriate. (L3-72, A5, 1)	

General exit criteria

The CMM recommends that the conditions described in the table below be satisfied to exit the software product engineering process.

√	Condition	References
	The software engineering tasks are performed in accordance with the project's defined software process. (L3-60, C1, 1)	
	Appropriate software engineering methods and tools are integrated into the project's defined software process. (L3-65, A1)	
	The software engineering tasks are integrated according to the project's defined software process. (L3-65, A1, 1)	
	Methods and tools appropriate for use on the software project are selected. (L3-65, A1, 2)	
	Effective methods for requirements analysis are used to identify and derive the software requirements. (L3-67, A2, 2)	
	Problems with the software requirements are identified and reviewed with the **group responsible for the system requirements**; appropriate changes are made to the allocated requirements and to the software requirements. (L3-67, A2, 4.1)	
	The **individuals involved in the software design** review the software requirements to ensure that issues affecting the software design are identified and resolved. (L3-69, A3, 2)	

	Application standards are used where appropriate. (L3-70, A3, 3)	

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SPE Process - Exit Criteria, Continued

General exit criteria, continued

The CMM recommends that the conditions described in the table below be satisfied to exit the software product engineering process, continued from the previous page.

√	Condition	References
	Effective methods are used to design the software. (L3-70, A3, 4)	
	The **individuals involved in coding** review the software requirements and software design to ensure that issues affecting the coding are identified and resolved. (L3-71, A4, 1)	
	Effective programming methods are used to code the software. (L3-71, A4, 2)	
	Software testing is performed according to the project's defined software process. (L3-72, A5)	
	Effective methods are used to test the software. (L3-72, A5, 2)	
	The adequacy of testing is determined based on: (L3-72, A5, 3) ❑ the level of testing performed, ❑ the test strategy selected, and ❑ the test coverage to be achieved.	
	Regression testing is performed, as appropriate, at each test level whenever the software being tested or its environment changes. (L3-74, A5, 5)	
	Integration testing of the software is planned and performed according to the project's defined software process. (L3-74, A6)	
	Integration testing of the software is performed against the designated version of the software requirements document and the software design document. (L3-75, A6, 3)	
	System and acceptance testing of the software are planned and performed to demonstrate that the software satisfies its requirements. (L3-75, A7)	
	Resources for testing the software are assigned early enough to provide for adequate test preparation. (L3-75, A7, 1)	
	Testing of the software is performed against baselined software and the baselined documentation of the allocated requirements and the software requirements. (L3-76, A7, 5)	

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SPE Process - Exit Criteria, Continued

General exit criteria, continued

The CMM recommends that the conditions described in the table below be satisfied to exit the software product engineering process, continued from the previous page.

√	Condition	References
	Documentation specialists actively participate in planning, developing, and maintaining documentation. (L3-77, A8, 2)	
	Consistency is maintained across software work products, including the software plans, process descriptions, allocated requirements, software requirements, software design, code, test plans, and test procedures. (L3-78, A10) ❑ The software requirements, design, code, and test cases are traced to the source from which they were derived and to the products of the subsequent software engineering activities. (L3-78, A10, 2)	
	The activities for software product engineering are reviewed with **senior management** on a periodic basis. (L3-80, V1)	
	The activities for software product engineering are reviewed with the **project manager** on both a periodic and event-driven basis. (L3-80, V2)	
	The **software quality assurance group** reviews and/or audits the activities and work products for software product engineering and reports the results. (L3-81, V3)	
	Readiness and completion criteria for each software engineering task are satisfied. (L3-81, V3, 2)	
	Required testing is performed. (L3-81, V3, 4)	
	System and acceptance testing of the software are performed according to documented plans and procedures. (L3-81, V3, 5)	
	Tests satisfy their acceptance criteria, as documented in the software test plan. (L3-81, V3, 6)	
	Tests are satisfactorily completed and recorded. (L3-81, V3, 7)	
	Problems and defects detected are documented, tracked, and addressed. (L3-82, V3, 8)	
	Tracing of the allocated requirements through the software requirements, design, code, and test cases is performed. (L3-82, V3, 9)	
	The documentation used to operate and maintain the software is verified against the software baseline and any applicable allocated requirements before the software product is released to the customer or end users. (L3-82, V3, 10)	

SPE Process - Reviews and Audits

Reviews and audits

The table below lists the recommended reviews and audits for the software product engineering process.

√	Review or Audit	Review Participants	References
	The **individuals involved in developing the software requirements** review the allocated requirements to ensure that issues affecting the software requirements analysis are identified and resolved. (L3-66, A2, 1)	**Individuals involved in developing the software requirements**	
	Problems with the software requirements are identified and reviewed with the **group responsible for the system requirements**; appropriate changes are made to the allocated requirements and to the software requirements. (L3-67, A2, 4.1)	**Group responsible for the system requirements**	
	The software requirements document undergoes peer review before it is considered complete. (L3-68, A2, 8)	**Not specified in the CMM**	
	The software requirements document is reviewed and approved. (L3-68, A2, 9)	**Not specified in the CMM**	
	The software requirements document is reviewed with the **customer** and **end users**, as appropriate. (L3-68, A2, 10)	**Customer** **End Users**	
	Design criteria are developed and reviewed. (L3-69, A3, 1)	**Not specified in the CMM**	
	The **individuals involved in the software design** review the software requirements to ensure that issues affecting the software design are identified and resolved. (L3-69, A3, 2)	**Individuals involved in the software design**	
	The software architecture is reviewed to ensure that architecture issues affecting the software detailed design are identified and resolved. (L3-70, A3, 6)	**Not specified in the CMM**	
	The software design document undergoes peer review before the design is considered complete. (L3-71, A3, 9)	**Not specified in the CMM**	

	The **individuals involved in coding** review the software requirements and software design to ensure that issues affecting the coding are identified and resolved. (L3-71, A4, 1)	**Individuals involved in coding**	

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Reviews and audits, continued

The table below lists the recommended reviews and audits for the software product engineering process, continued from the previous page.

√	Review or Audit	Review Participants	References
	Each code unit undergoes peer review and is unit tested before the unit is considered complete. (L3-72, A4, 4)	**Not specified in the CMM**	
	Testing criteria are developed and reviewed with the **customer** and the **end users**, as appropriate. (L3-72, A5, 1)	**Customer** **End users**	
	The test plan, test procedures, and test cases undergo peer review before they are considered ready for use. (L3-74, A5, 6)	**Not specified in the CMM**	
	The integration test cases and test procedures are reviewed with the **individuals responsible for the software requirements, software design, and system and acceptance testing**. (L3-75, A6, 2)	**Individuals responsible for the software requirements, software design, and system and acceptance testing**	
	System and acceptance testing are documented in a test plan, which is reviewed with, and approved by, the **customer** and **end users**, as appropriate. (L3-75, A7, 2)	**Customer** **End users**	
	The test cases are documented and are reviewed with, and approved by, the **customer** and **end users**, as appropriate, before the testing begins. (L3-76, A7, 4)	**Customer** **End users**	
	Preliminary versions of the documentation (that will be used to operate and maintain the software) are developed and made available early in the software life cycle for the **customer**, **end users**, and **software maintainers**, as appropriate, to review and provide feedback. (L3-77, A8, 3)	**Customer** **End users** **Software maintainers**	
	The documentation (that will be used to operate and maintain the software) undergoes peer review. (L3-77, A8, 5)	**Not specified in the CMM**	

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Reviews and audits, continued

The table below lists the recommended reviews and audits for the software product engineering process, continued from the previous page.

√	Review or Audit	Review Participants	References
	The final documentation (that will be used to operate and maintain the software) is reviewed and approved by the **customer**, **end users**, and **software maintainers**, as appropriate. (L3-77, A8, 7)	**Customer** **End users** **Software maintainers**	
	The activities for software product engineering are reviewed with **senior management** on a periodic basis. (L3-80, V1)	**Senior management**	
	The activities for software product engineering are reviewed with the **project manager** on both a periodic and event-driven basis. (L3-80, V2)	**Project manager**	
	The **software quality assurance group** reviews and/or audits the activities and work products for software product engineering and reports the results. (L3-81, V3) At a minimum, the reviews and/or audits verify that: ❑ The software requirements are reviewed to ensure that they are: ❑ complete, ❑ correct, ❑ consistent, ❑ feasible, and ❑ testable. ❑ Readiness and completion criteria for each software engineering task are satisfied. ❑ Software products comply with the standards and requirements specified for them. ❑ Required testing is performed. ❑ System and acceptance testing of the software are performed according to documented plans and procedures.	**SQA group**	

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SPE Process - Reviews and Audits, Continued

Reviews and audits, continued

The table below lists the required reviews and audits for the software product engineering process, continued from the previous page.

√	Review or Audit	Review Participants	References
	This review continued from previous page		
	❑ Tests satisfy their acceptance criteria, as documented in the software test plan. ❑ Tests are satisfactorily completed and recorded. ❑ Problems and defects detected are documented, tracked, and addressed. ❑ Tracing of the allocated requirements through the software requirements, design, code, and test cases is performed. ❑ The documentation used to operate and maintain the software is verified against the software baseline and any applicable allocated requirements before the software product is released to the customer or end users.	**SQA group**	

SPE Process - Work Products Managed and Controlled

Work products managed and controlled

The table below lists the work products that are recommended to be managed and controlled during the software product engineering process.

√	Work Products Managed and Controlled	References
	Tools used to develop and maintain the software products.* (L3-66, A1, 4)	
	Software requirements document.* (L3-69, A2, 11)	
	Software design document.* (L3-71, A3, 10)	
	Code.* (L3-72, A4, 5)	
	Test plans, test procedures, and test cases. (L3-74, A5, 7)	
	Test results. (L3-76, A7, 8)	
	Documentation (that will be used to operate and maintain the software). (L3-77, A8, 6)	
	Documentation tracing the allocated requirements through the software requirements, design, code, and test cases. (L3-78, A10, 3)	

*Indicates that the CMM recommends that this item be placed under configuration management

SPE Process - Measurements

Measurements

The table below lists the measurements recommended for the software product engineering process.

√	Measurements	References
	Data on defects identified in peer reviews. (L3-78, A9)	
	Data on defects identified in testing. (L3-78, A9)	
	Measurements to determine the functionality and quality of the software products. (L3-79, M1) Examples of measurements include: ❑ Numbers, types, and severity of defects identified in the software products tracked cumulatively and by stage. ❑ Allocated requirements summarized by category (e.g., security, system configuration, performance, and reliability), and traced to the software requirements and system test cases.	
	Measurements to determine the status of the software product engineering activities. (L3-80, M2) Examples of measurements include: ❑ Status of each allocated requirement throughout the life of the project. ❑ Problem reports by severity and length of time they are open. ❑ Change activity for the allocated requirements. ❑ Effort to analyze proposed changes for each proposed change and cumulative totals. ❑ Number of changes incorporated into the software baseline by category (e.g., interface, security, system configuration, performance, and usability). ❑ Size and cost to implement and test incorporated changes, including initial estimate and actual size and cost.	

SPE Process - Documented Procedures

Documented procedures	There are no activities that are recommended to be performed according to a documented procedure in the software product engineering process.

SPE Process - Training

Training

The table below lists the training recommended for the software product engineering process.

√	Training	References
	Members of the **software engineering technical staff** receive required training to perform their technical assignments. (L3-63, Ab2)	
	Members of the **software engineering technical staff** receive orientation in related software engineering disciplines. (L3-64, Ab3)	
	The **project manager** and all **software managers** receive orientation in the technical aspects of the software project. (L3-64, Ab4)	

SPE Process - Tools

Tools

The table below lists the tools recommended for the software product engineering process.

√	Tools	References
	Tools to build and maintain the software products. (L3-60, C1, 2)	
	Tools to support the software engineering tasks. (L3-61, Ab1, 2) Examples of support tools include: ❑ workstations, ❑ database management systems, ❑ on-line help aids, ❑ graphics tools, ❑ interactive documentation tools, and ❑ word processing systems.	
	Software engineering tools. (L3-65, A1)	
	Tools to develop the documentation. (L3-76, A8, 1)	

Intergroup Coordination (IC) Process

IC Process - Overview

IC process purpose

The purpose of Intergroup Coordination is to establish a means for the software engineering group to participate actively with the other engineering groups so the project is better able to satisfy the customer's needs effectively and efficiently. (L3-83)

IC process description

Intergroup Coordination involves the software engineering group's participation with other project engineering groups to address system-level requirements, objectives, and issues. Representatives of the project's engineering groups participate in establishing the system-level requirements, objectives, and plans by working with the customer and end users, as appropriate. These requirements, objectives, and plans become the basis for all engineering activities.

The technical working interfaces and interactions between groups are planned and managed to ensure the quality and integrity of the entire system. Technical reviews and interchanges are regularly conducted with representatives of the project's engineering groups to ensure that all engineering groups are aware of the status and plans of all the groups, and that system and intergroup issues receive appropriate attention.

The software-specific practices related to these engineering tasks are described in the Requirements Management and Software Product Engineering key process areas. (L3-83)

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Section overview

The table below contains a description and the location of each checklist for this key process area.

Checklist	Description	Page
Roles	List of roles participating in process activities.	L3-Process-151
Entry Criteria	Description of when the process can start.	L3-Process-158
Inputs	Description of the work products used by the process.	L3-Process-159
Activities	Description of the activities of the process.	L3-Process-160
Outputs	Description of the work products produced by the process.	L3-Process-162
Exit Criteria	Description of when the process is complete.	L3-Process-164
Reviews and Audits	List of reviews and audits.	L3-Process-172
Work Products Managed and Controlled	List of work products to be managed and controlled.	L3-Process-174
Measurements	Description of process measurements.	L3-Process-175
Documented Procedures	List of the activities to be completed according to a documented procedure.	L3-Process-176
Training	List of training.	L3-Process-177
Tools	List of tools.	L3-Process-178

IC Process - Roles

Roles

The table below lists the roles and the activities in which they participate in the intergroup coordination process.

√	Role	Activities Participated in...	Reference
	Affected groups	The system requirements and project-level objectives for the project are defined and reviewed by all **affected groups**. (L3-84, C1, 1)	
	Customers	The software engineering group and the other engineering groups participate with the **customer** and end users, as appropriate, to establish the system requirements. (L3-86, A1)	
	End users	The software engineering group and the other engineering groups participate with the customer and **end users**, as appropriate, to establish the system requirements. (L3-86, A1)	

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Roles, continued

The table below lists the roles and the activities in which they participate in the intergroup coordination process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Engineering groups	❑ The **engineering groups** coordinate their plans and activities. (L3-84, C1, 2) ❑ The members of the **engineering groups** receive orientation in working as a team. (L3-86, Ab5) ❑ The software engineering group and the other **engineering groups** participate with the customer and end users, as appropriate, to establish the system requirements. (L3-86, A1) Specifically, these groups: ❑ Define the critical characteristics of the customer's and end users' requirements, as appropriate. ❑ Negotiate critical dependencies. ❑ Document the acceptance criteria for each product delivered to the customer or end user, as appropriate. ❑ The plan used to communicate intergroup commitments and track the work performed is reviewed and agreed to by all **engineering groups** and the project manager. (L3-89, A3, 6) ❑ Critical dependencies are negotiated between the software engineering group and other **engineering groups** in the project and organization. (L3-89, A4, 2)	
	Group responsible for providing the critical dependency item	The agreement for each critical dependency is documented, reviewed, and approved by both the receiving group and the **group responsible for providing the critical dependency item**. (L3-89, A4, 4)	

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Roles, continued

The table below lists the roles and the activities in which they participate in the intergroup coordination process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Manager	❑ **Managers** are responsible for establishing and maintaining an environment to facilitate interaction, coordination, support, and teamwork between the project's engineering groups, between the project and the customer or end users, as appropriate, and throughout the organization. (L3-85, C1, 3) ❑ All **managers** in the organization receive required training in teamwork. (L3-85, Ab3) ❑ Actual and potential problems are reported to the appropriate **managers**. (L3-89, A4, 5.3)	
	Project manager	❑ The documented plan that is used to communicate intergroup commitments and to coordinate and track the work performed is reviewed and agreed to by all engineering groups and the **project manager**. (L3-89, A3, 6) ❑ The activities for intergroup coordination are reviewed with the **project manager** on both a periodic and event-driven basis. (L3-92, V2)	
	Receiving group of a critical dependency item	The agreement for each critical dependency is documented, reviewed, and approved by both the **receiving group** and the group responsible for providing the critical dependency item. (L3-89, A4, 4)	

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IC Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the intergroup coordination process, continued from the previous page.

√	Role	Activities Participated in...	Reference

	Representative's of the project's software engineering group	❑ **Representatives of the project's software engineering group** work with representatives of the other engineering groups to monitor and coordinate technical activities and resolve technical issues. (L3-87, A2)
		❑ The **representatives** of these groups monitor and coordinate technical activities by: (L3-87, A2, 1)
		  ❑ coordinating the specification and providing the technical review and approval of the system requirements and system design;
		  ❑ providing the project-level technical review and analysis needed to manage and control changes to the system requirements and project-level objectives throughout the project's life cycle;
		  ❑ tracking and reviewing the design and development activities for hardware, software, and other system components; and
		  ❑ assessing, developing recommendations for, and tracking technical risks that involve more than one engineering group.
		❑ The **representatives** of the groups handle technical issues by: (L3-88, A2, 2)
		  ❑ resolving project-level conflicts and clarifying system requirements and design issues;
		  ❑ developing joint recommendations to resolve problems; and
		  ❑ addressing process issues that span the engineering groups of the project.	

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Roles, continued

The table below lists the roles and the activities in which they participate in the intergroup coordination process, continued from the previous page.

√	Role	Activities Participated in...	Reference

	Representatives of the other engineering groups	❑ Representatives of the project's software engineering group work with **representatives of the other engineering groups** to monitor and coordinate technical activities and resolve technical issues. (L3-87, A2)
		❑ The **representatives** of these groups monitor and coordinate technical activities by: (L3-87, A2, 1)
		  ❑ coordinating the specification and providing the technical review and approval of the system requirements and system design;
		  ❑ providing the project-level technical review and analysis needed to manage and control changes to the system requirements and project-level objectives throughout the project's life cycle;
		  ❑ tracking and reviewing the design and development activities for hardware, software, and other system components; and
		  ❑ assessing, developing recommendations for, and tracking technical risks that involve more than one engineering group.
		❑ The **representatives** of the groups handle technical issues by: (L3-88, A2, 2)
		  ❑ resolving project-level conflicts and clarifying system requirements and design issues;
		  ❑ developing joint recommendations to resolve problems; and
		  ❑ addressing process issues that span the engineering groups of the project.	

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IC Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the intergroup coordination process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Representatives of the project engineering groups	❑ Intergroup issues not resolvable by the individual **representatives of the project engineering groups** are handled according to a documented procedure. (L3-90, A6) ❑ **Representatives of the project engineering groups** conduct periodic technical reviews and interchanges. (L3-90, A7)	
	Representatives of the receiving group of a critical dependency item	Work products produced as input to other engineering groups are reviewed by **representatives of the receiving groups** to ensure that the work products meet their needs. (L3-90, A5)	
	Senior management	The activities for intergroup coordination are reviewed with **senior management** on a periodic basis. (L3-91, V1)	
	Software engineering group	❑ The **software engineering group** and the other engineering groups participate with the customer and end users, as appropriate, to establish the system requirements. (L3-86, A1) Specifically, these groups: ❑ define the critical characteristics of the customer's and end users' requirements, as appropriate; ❑ negotiate critical dependencies; and ❑ document the acceptance criteria for each product delivered to the customer or end user, as appropriate. ❑ Critical dependencies are negotiated between the **software engineering group** and other engineering groups in the project and organization. (L3-89, A4, 2)	

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IC Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the intergroup coordination process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Software quality assurance group	The **software quality assurance group** reviews and/or audits the activities and work products for intergroup coordination and reports the results. (L3-92, V3)	
	Task leaders	All **task leaders** in each engineering group receive orientation in the processes, methods, and standards used by the other engineering groups. (L3-86, Ab4)	

IC Process - Entry Criteria

Input-based entry criteria

The CMM recommends that inputs satisfy the states described in the table below before entering the intergroup coordination process.

√	Input	State	References
	Plan used to communicate intergroup commitments and to coordinate and track the work performed	is documented. (L3-88, A3)	

General entry criteria

The CMM recommends that the conditions described in the table below be satisfied before entering the intergroup coordination process.

√	Condition	References
	The project follows a written organizational policy for establishing interdisciplinary engineering teams. (L3-84, C1)	
	Adequate resources and funding are provided for coordinating the software engineering activities with other engineering groups. (L3-85, Ab1)	
	The support tools used by the different engineering groups are compatible to enable effective communication and coordination. (L3-85, Ab2)	
	All **managers** in the organization receive required training in teamwork. (L3-85, Ab3)	
	All **task leaders** in each engineering group receive orientation in the processes, methods, and standards used by the other engineering groups. (L3-86, Ab4)	
	The members of the **engineering groups** receive orientation in working as a team. (L3-86, Ab5)	

IC Process - Inputs

Inputs

The table below lists the recommended inputs to the intergroup coordination process.

√	Input	Org. Input	References
	Actual completion (of critical dependencies). (L3-89, A4, 5.1)		
	Changes to intergroup commitments. (L3-88, A3, 4)		
	Changes to the plan (used to communicate intergroup commitments and to coordinate and track the work performed). (L3-88, A3, 5)		
	Changes to the project-level objectives. (L3-87, A2, 1.2)		
	Changes to the system requirements. (L3-87, A2, 1.2)		
	Commitments. (L3-90, A7, 4)		
	Customer's requirements. (L3-87, A1, 1)		
	End users' requirements. (L3-87, A1, 1)		
	Intergroup commitments. (L3-88, A3)		
	Plan (used to communicate intergroup commitments and to coordinate and track the work performed). (L3-88, A3)		
	Project schedule. (L3-89, A4, 3)		
	Projected completion (of critical dependencies). (L3-89, A4, 5.1)		
	Software schedule. (L3-89, A4, 3)		
	Status (of critical dependencies). (L3-89, A4, 5.1)		
	System requirements. (L3-90, A7, 3)		
	Technical issues. (L3-90, A7, 5)		
	Technical requirements. (L3-90, A7, 3)		
	Technical risks. (L3-88, A2, 1.4)		

IC Process - Activities

Activities

The table below lists the recommended activities for the intergroup coordination process.

√	Activities	References
	The **software engineering group** and the other **engineering groups** participate with the **customer** and **end users**, as appropriate, to establish the system requirements. (L3-86, A1) Specifically, these **groups**: ❑ Define the critical characteristics of the customer's and end users' requirements, as appropriate. ❑ Negotiate critical dependencies. ❑ Document the acceptance criteria for each product delivered to the customer or end user, as appropriate.	

	Representatives of the project's software engineering group work with **representatives of the other engineering groups** to monitor and coordinate technical activities and resolve technical issues. (L3-87, A2)
	❑ The **representatives of these groups** monitor and coordinate technical activities by:
	  ❑ coordinating the specification and providing the technical review and approval of the system requirements and system design;
	  ❑ providing the project-level technical review and analysis needed to manage and control changes to the system requirements and project-level objectives throughout the project's life cycle;
	  ❑ tracking and reviewing the design and development activities for hardware, software, and other system components; and
	  ❑ assessing, developing recommendations for, and tracking technical risks that involve more than one engineering group.
	❑ The **representatives of the groups** handle technical issues by:
	  ❑ resolving project-level conflicts and clarifying system requirements and design issues;
	  ❑ developing joint recommendations to resolve problems; and
	  ❑ addressing process issues that span the engineering groups of the project.	

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Activities, continued

The table below describes the activities associated with the intergroup coordination process, continued from the previous page.

√	Activities	References
	A documented plan is used to communicate intergroup commitments and to coordinate and track the work performed. (L3-88, A3)	
	Critical dependencies between engineering groups are identified, negotiated, and tracked according to a documented procedure. (L3-89, A4) [Refer to Level 3 Procedure Checklists for additional information.]	
	Work products produced as input to other engineering groups are reviewed by **representatives of the receiving groups** to ensure that the work products meet their needs. (L3-90, A5)	
	Intergroup issues not resolvable by the **individual representatives of the project engineering groups** are handled according to a documented procedure. (L3-90, A6)	
	Representatives of the project engineering groups conduct periodic technical reviews and interchanges. (L3-90, A7) [Refer to IC Process Reviews and Audits for additional information.]	
	Measurements are made and used to determine the status of the intergroup coordination activities. (L3-91, M1)	
	The activities for intergroup coordination are reviewed with **senior management** on a periodic basis. (L3-91, V1)	
	The activities for intergroup coordination are reviewed with the **project manager** on both a periodic and event-driven basis. (L3-92, V2)	
	The **software quality assurance group** reviews and/or audits the activities and work products for intergroup coordination and reports the results. (L3-92, V3) [Refer to IC Process Reviews and Audits for additional information.]	

IC Process - Outputs

Outputs

The table below lists the outputs produced by the intergroup coordination process.

√	Output	Org. Outputs	References
	Acceptance criteria for each product delivered to the customer. (L3-87, A1, 3)		
	Acceptance criteria for each product delivered to the end user. (L3-87, A1, 3)		
	Agreement for each critical dependency. (L3-89, A4, 4)		
	Availability dates of critical dependency items. (L3-89, A4, 3)		
	Commitments. (L3-90, A7, 4)		
	Critical characteristics of the customer's requirements. (L3-87, A1, 1)		
	Critical characteristics of the end users' requirements. (L3-87, A1, 1)		
	Critical dependencies. (L3-87, A1, 2)		
	Intergroup issues not resolvable by the **individual representatives of the project engineering groups**. (L3-90, A6)		
	Intergroup issues. (L3-92, V3, 2)		
	Joint recommendations to resolve problems. (L3-88, A2, 2.2)		
	Measurements to determine the status of the intergroup coordination activities. (L3-91, M1)		
	Need dates of critical dependency items. (L3-89, A4, 3)		
	Plan used to communicate intergroup commitments and to coordinate and track the work performed. (L3-88, A3)		
	Problems (actual and potential). (L3-89, A4, 5.3)		
	Process issues. (L3-88, A2, 2.3)		
	(Project engineering) groups' interpretation and implementation of the technical requirements. (L3-90, A7, 3)		
	Project-level conflicts. (L3-88, A2, 2.1)		
	Project-level objectives. (L3-84, C1, 1)		

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IC Process - Outputs, Continued

Outputs, continued

The table below lists the outputs produced by the intergroup coordination process, continued from the previous page.

√	Output	Org. Outputs	References
	Recommendations for technical risks (that involve more than one engineering group). (L3-88, A2, 1.4)		
	Results of **software quality assurance group** reviews and/or audits. (L3-92, V3)		
	Specification of the system design. (L3-87, A2, 1.1)		
	Specification of the system requirements. (L3-87, A2, 1.1)		
	System design. (L3-87, A2, 1.1)		
	System design issues. (L3-88, A2, 2.1)		
	System requirements issues. (L3-88, A2, 2.1)		
	System requirements. (L3-84, C1, 1)		
	Technical issues. (L3-87, A2)		
	Work products produced as input to other engineering groups. (L3-90, A5)		

IC Process - Exit Criteria

Output-based exit criteria

The CMM recommends that outputs satisfy the states described in the table below to exit the intergroup coordination process.

√	Output	State	References
	Acceptance criteria for each product delivered to the customer	are documented. (L3-87, A1, 3)	
	Acceptance criteria for each product delivered to the end user	are documented. (L3-87, A1, 3)	
	Agreement for each critical dependency	❑ is documented. (L3-89, A4, 4) ❑ is reviewed. (L3-89, A4, 4) ❑ is approved by both the **receiving group** and the **group responsible for providing the critical dependency item**. (L3-89, A4, 4)	
	Availability dates of critical dependency items	❑ are tied to the project schedule. (L3-89, A4, 3) ❑ are tied to the software schedule. (L3-89, A4, 3)	
	Critical characteristics of the customer's requirements	are defined. (L3-87, A1, 1)	
	Critical characteristics of the end users' requirements	are defined. (L3-87, A1, 1)	

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IC Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the intergroup coordination process, continued from the previous page.

√	Output	State	References

	Critical dependencies	❑ are negotiated (between the software engineering group, other engineering groups, customers, and end users). (L3-87, A1, 2)
		❑ (between engineering groups) are: (L3-89, A4)
		  ❑ identified,
		  ❑ negotiated, and
		  ❑ tracked according to a documented procedure.
		❑ are explicitly defined, including: (L3-89, A4, 1)
		  ❑ the item to be provided,
		  ❑ who will provide it,
		  ❑ when it will be provided, and
		  ❑ the criteria for acceptance.
		❑ are negotiated between the **software engineering group** and other **engineering groups** in the project and organization. (L3-89, A4, 2)
		❑ are tracked on a regular basis and corrective actions are taken when appropriate. (L3-89, A4, 5)	

	Intergroup issues not resolvable by the **individual representatives of the project engineering groups**	are handled according to a documented procedure. (L3-90, A6)	
	Joint recommendations to resolve problems	are developed by the **representatives of the (software engineering and other engineering) groups** to handle technical issues. (L3-88, A2, 2.2)	

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IC Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the intergroup coordination process, continued from the previous page.

√	Output	State	References
	Measurements (to determine the status of the intergroup coordination activities)	❑ are made. (L3-91, M1) ❑ are used. (L3-91, M1)	
	Need dates of critical dependency items	❑ are tied to the project schedule. (L3-89, A4, 3) ❑ are tied to the software schedule. (L3-89, A4, 3)	

	Plan used to communicate intergroup commitments and to coordinate and track the work performed	❑ is the baseline for: (L3-88, A3, 1)
		  ❑ the project schedule,
		  ❑ the contractual and technical aspects of the project, and
		  ❑ the assignment of responsibilities to the engineering groups.
		❑ is used to coordinate activities between the different engineering groups. (L3-88, A3, 2)
		❑ is readily available to the members of all engineering groups. (L3-88, A3, 3)
		❑ is updated to incorporate all intergroup commitments and changes to these commitments. (L3-88, A3, 4)
		❑ is updated as the work progresses to reflect progress and plan changes at the project level, particularly when major project milestones are completed and when plans change significantly. (L3-88, A3, 5)	

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IC Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the intergroup coordination process, continued from the previous page.

√	Output	State	References
	Output continued from previous page		
	Plan used to communicate intergroup commitments and to coordinate and track the work performed, continued	❑ is reviewed by all **engineering groups** and the **project manager**. (L3-89, A3, 6) ❑ is agreed to by all **engineering groups** and the **project manager**. (L3-89, A3, 6)	
	Problems (actual and potential)	are reported to the appropriate **managers**. (L3-89, A4, 5.3)	
	Process issues	are addressed by **representatives of the project's software engineering group** and **representatives of the other engineering groups**. (L3-88, A2, 2.3)	
	(Project engineering) groups' interpretation and implementation of the technical requirements	conform to the system requirements. (L3-90, A7, 3)	
	Project-level conflicts	are resolved by **representatives of the project's software engineering group** and **representatives of the other engineering groups**. (L3-88, A2, 2.1)	
	Project-level objectives	❑ are defined. (L3-84, C1, 1) ❑ are reviewed by all **affected groups**. (L3-84, C1, 1)	
	Recommendations for technical risks that involve more than one engineering group	are developed. (L3-88, A2, 1.4)	
	Results of **software quality assurance group** reviews and/or audits	are reported. (L3-92, V3)	

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IC Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the intergroup coordination process, continued from the previous page.

√	Output	State	References
	Specification of the system design	is coordinated by **representatives of the project's software engineering group** and **representatives of the other engineering groups**. (L3-87, A2, 1.1)	
	Specification of the system requirements	is coordinated by **representatives of the project's software engineering group** and **representatives of the other engineering groups**. (L3-87, A2, 1.1)	
	System design	❑ is technically reviewed by **representatives of the project's software engineering group** and **representatives of the other engineering groups**. (L3-87, A2, 1.1) ❑ is approved by **representatives of the project's software engineering group** and **representatives of the other engineering groups**. (L3-87, A2, 1.1) ❑ is tracked by **representatives of the project's software engineering group** and **representatives of the other engineering groups**. (L3-88, A2, 1.3)	
	System design issues	are clarified by **representatives of the project's software engineering group** and **representatives of the other engineering groups**. (L3-88, A2, 2.1)	

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IC Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the intergroup coordination process, continued from the previous page.

√	Output	State	References
	System requirements	❑ are defined. (L3-84, C1, 1) ❑ are reviewed by all **affected groups**. (L3-84, C1, 1) ❑ are established by the **software engineering group** and the other **engineering groups**, by participating with the **customer** and **end users**, as appropriate. (L3-86, A1) ❑ are technically reviewed by **representatives of the project's software engineering group** and **representatives of the other engineering groups**. (L3-87, A2, 1.1) ❑ are approved by **representatives of the project's software engineering group** and **representatives of the other engineering groups**. (L3-87, A2, 1.1) ❑ are clarified by **representatives of the project's software engineering group** and **representatives of the other engineering groups**. (L3-88, A2, 2.1)	
	System requirements issues	are clarified by **representatives of the project's software engineering group** and **representatives of the other engineering groups**. (L3-88, A2, 2.1)	

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IC Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the intergroup coordination process, continued from the previous page.

√	Output	State	References
	Technical issues	❑ are resolved by **representatives of the project's software engineering group** and **representatives of the other engineering groups**. (L3-87, A2) ❑ are handled by **representatives of the project's software engineering group** and **representatives of the other engineering groups**. (L3-88, A2, 2) ❑ are reviewed by **representatives of the project engineering groups**. (L3-90, A7, 5)	
	Work products	❑ are reviewed by **representatives of the receiving groups** to ensure that the work products meet their needs. (L3-90, A5) ❑ are reviewed and/or audited by the **software quality assurance group**. (L3-92, V3)	

General exit criteria

The CMM recommends that the conditions described in the table below be satisfied to exit the intergroup coordination process.

√	Condition	References
	The **engineering groups** coordinate their plans and activities. (L3-84, C1, 2)	
	The **software engineering group** and the other **engineering groups** participate with the **customer** and **end users**, as appropriate, to establish the system requirements. (L3-86, A1)	

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IC Process - Exit Criteria, Continued

General exit criteria, continued

The CMM recommends that the conditions described in the table below be satisfied to exit the intergroup coordination process, continued from the previous page.

√	Condition	References
	Representatives of the project's software engineering group work with **representatives of the other engineering groups** to monitor and coordinate technical activities and resolve technical issues. (L3-87, A2) The **representatives of these groups** monitor and coordinate technical activities by: (L3-87, A2, 1) ❑ coordinating the specification and providing the technical review and approval of the system requirements and system design; ❑ providing the project-level technical review and analysis needed to manage and control changes to the system requirements and project-level objectives throughout the project's life cycle; ❑ tracking and reviewing the design and development activities for hardware, software, and other system components; and ❑ assessing, developing recommendations for, and tracking technical risks that involve more than one engineering group.	
	A documented plan is used to communicate intergroup commitments and to coordinate and track the work performed. (L3-88, A3)	
	Representatives of the project engineering groups conduct periodic technical reviews and interchanges. (L3-90, A7)	
	The activities for intergroup coordination are reviewed with **senior management** on a periodic basis. (L3-91, V1)	
	The activities for intergroup coordination are reviewed with the **project manager** on both a periodic and event-driven basis. (L3-92, V2)	
	The **software quality assurance group** reviews and/or audits the activities and work products for intergroup coordination and reports the results. (L3-92, V3)	

IC Process - Reviews and Audits

Reviews and audits

The table below lists the recommended reviews and audits for the intergroup coordination process.

√	Review or Audit	Review Participants	References
	The system requirements and project-level objectives for the project are defined and reviewed by all **affected groups**. (L3-84, C1, 1)	**Affected groups**	
	Representatives of the project's software engineering group work with **representatives of the other engineering groups** to: (L3-87, A2) ❑ Provide the technical review and approval of the system requirements and system design. (L3-87, A2, 1.1) ❑ Provide the project-level technical review and analysis needed to manage and control changes to the system requirements and project-level objectives throughout the project's life cycle. (L3-87, A2, 1.2) ❑ Track and review the design and development activities for hardware, software, and other system components. (L3-88, A2, 1.3)	**Representatives of the project's software engineering group** **Representatives of the other engineering groups**	
	The documented plan used to communicate intergroup commitments and to coordinate and track the work performed is reviewed and agreed to by all **engineering groups** and the **project manager**. (L3-89, A3, 6)	**Engineering groups** **Project manager**	
	The agreement for each critical dependency is documented, reviewed, and approved by both the **receiving group** and the **group responsible for providing the critical dependency item**. (L3-89, A4, 4)	**Receiving group** **Group responsible for providing the critical dependency item**	
	Work products produced as input to other engineering groups are reviewed by **representatives of the receiving groups** to ensure that the work products meet their needs. (L3-90, A5)	**Representatives of the receiving groups**	

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Reviews and audits, continued

The table below lists the recommended reviews and audits for the intergroup coordination process, continued from the previous page.

√	Review or Audit	Review Participants	References
	Representatives of the project engineering groups conduct periodic technical reviews and interchanges. (L3-90, A7) In these meetings, the participants: ❑ Provide visibility of the needs and desires of the customer and end users, as appropriate. ❑ Monitor the technical activities of the project. ❑ Ensure that the groups' interpretation and implementation of the technical requirements conform to the system requirements. ❑ Review the commitments to determine whether they are being met. ❑ Review the technical risks and other technical issues.	**Representatives of the project engineering groups**	
	The activities for intergroup coordination are reviewed with **senior management** on a periodic basis. (L3-91, V1)	**Senior management**	
	The activities for intergroup coordination are reviewed with the **project manager** on both a periodic and event-driven basis. (L3-92, V2)	**Project manager**	
	The **software quality assurance group** reviews and/or audits the activities and work products for intergroup coordination and reports the results. (L3-92, V3) At a minimum, the reviews and/or audits verify: ❑ The procedure for identifying, negotiating, and tracking critical dependencies between the project engineering groups. ❑ The handling of intergroup issues.	**Software quality assurance group**	

IC Process - Work Products Managed and Controlled

Work products managed and controlled	There are no work products that are recommended to be managed and controlled in the intergroup coordination process.

IC Process - Measurements

Measurements

The table below lists the measurements recommended for the intergroup coordination process.

√	Measurements	References
	Measurements to determine the status of the intergroup coordination activities. (L3-91, M1) Examples of measurements include: ❑ Actual effort and other resources expended by the software engineering group for support to other engineering groups. ❑ Actual effort and other resources expended by the other engineering groups in support of the software engineering group. ❑ Actual completion of specific tasks and milestones by the software engineering group to support the activities of other engineering groups. ❑ Actual completion of specific tasks and milestones by the other engineering groups to support the activities of the software engineering group.	

IC Process - Documented Procedures

Documented procedures

The table below lists the activities for the intergroup coordination process recommended to be performed according to a documented procedure.

√	Documented Procedure(s)	References
	Critical dependencies between engineering groups are identified, negotiated, and tracked according to a documented procedure. (L3-89, A4) [Refer to Level 3 Procedure Checklists for additional information.]	
	Intergroup issues not resolvable by the **individual representatives of the project engineering groups** are handled according to a documented procedure. (L3-90, A6)	

IC Process - Training

Training

The table below lists the training recommended for the intergroup coordination process.

√	Training	References
	All **managers** in the organization receive required training in teamwork. (L3-85, Ab3)	
	All **task leaders** in each engineering group receive orientation in the processes, methods, and standards used by the other engineering groups. (L3-86, Ab4)	
	The members of the **engineering groups** receive orientation in working as a team. (L3-86, Ab5)	

IC Process - Tools

Tools

The table below lists the tools recommended for the intergroup coordination process.

√	Tools	References
	Support tools used by the different engineering groups. (L3-85, Ab2) Examples of support tools include: ❑ word processing systems, ❑ database systems, ❑ graphics tools, ❑ spreadsheet programs, ❑ problem tracking packages, and ❑ library management tools.	

Peer Reviews (PR) Process

PR Process - Overview

PR process purpose

The purpose of Peer Reviews is to remove defects from the software work products early and efficiently. An important corollary effect is to develop a better understanding of the software work products and of defects that might be prevented. (L3-93)

PR process description

Peer Reviews involve a methodical examination of software work products by the producers' peers to identify defects and areas where changes are needed. The specific products that will undergo a peer review are identified in the project's defined software process and scheduled as part of the software project planning activities, as described in Integrated Software Management.

This key process area covers the practices for performing peer reviews. The practices identifying the specific software work products that undergo peer review are contained in the key process areas that describe the development and maintenance of each software work product. (L3-93)

Section overview

The table below contains a description and the location of each checklist for this key process area.

Checklist	Description	Page
Roles	List of roles participating in process activities.	L3-Process-180
Entry Criteria	Description of when the process can start.	L3-Process-182
Inputs	Description of the work products used by the process.	L3-Process-183
Activities	Description of the activities of the process.	L3-Process-184
Outputs	Description of the work products produced by the process.	L3-Process-185
Exit Criteria	Description of when the process is complete.	L3-Process-186
Reviews and Audits	List of reviews and audits.	L3-Process-188
Work Products Managed and Controlled	List of work products to be managed and controlled.	L3-Process-189
Measurements	Description of process measurements.	L3-Process-190
Documented Procedures	List of the activities to be completed according to a documented procedure.	L3-Process-191

Training	List of training.	L3-Process-192
Tools	List of tools.	L3-Process-193

PR Process - Roles

Roles

The table below lists the roles and the activities in which they participate in the peer reviews process.

√	Role	Activities Participated in...	Reference
	Checklist developers' peers	The checklists are reviewed by the **checklist developers' peers** and potential users. (L3-98, A2, 5.2)	
	Checklist potential users	The checklists are reviewed by the **checklist** developers' peers and **potential users**. (L3-98, A2, 5.2)	
	Management	Results of the peer reviews are not used by **management** to evaluate the performance of individuals. (L3-94, C1, 5)	
	Manager	Issues in satisfying these (readiness and completion) criteria (for the peer reviews) are reported to the appropriate **managers**. (L3-98, A2, 4.1)	
	Peer review leader	❑ Peer reviews are led by trained **peer review leaders**. (L3-94, C1, 3) ❑ **Peer review leaders** receive required training in how to lead peer reviews. (L3-95, Ab2) ❑ Peer reviews are planned and led by trained **peer review leaders**. (L3-97, A2, 1) ❑ The **peer review leaders** are adequately trained for their roles. (L3-100, V1, 2)	

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PR Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the peer reviews process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Reviewer	❑ **Reviewers** who participate in peer reviews receive required training in the objectives, principles, and methods of peer reviews. (L3-96, Ab3) ❑ Review materials are distributed to the **reviewers** in advance so they can adequately prepare for the peer review. (L3-97, A2, 2) ❑ **Reviewers** have assigned roles in peer reviews. (L3-98, A2, 3) ❑ The **reviewers** are properly trained or experienced in their roles. (L3-100, V1, 3)	
	Software quality assurance (SQA) group	The **software quality assurance group** reviews and/or audits the activities and work products for peer reviews and reports the results. (L3-100, V1)	

PR Process - Entry Criteria

Input-based entry criteria

There are no input-based entry criteria in the peer reviews process.

General entry criteria

The CMM recommends that the conditions described in the table below be satisfied before entering the peer reviews process.

√	Condition	References
	The project follows a written organizational policy for performing peer reviews. (L3-94, C1) [Refer to Level 3 Policies for additional information regarding PR policy.]	
	Adequate resources and funding are provided for performing peer reviews on each software work product to be reviewed. (L3-95, Ab1) Resources and funding are provided to: ❑ Prepare and distribute the peer review materials. ❑ Lead the peer review. ❑ Review the materials. ❑ Participate in the peer review and any follow-up reviews required based on the defects identified in the peer review. ❑ Monitor the rework of the software work product based on the defects identified in the peer review. ❑ Collect and report the data resulting from the peer reviews.	
	Peer review leaders receive required training in how to lead peer reviews. (L3-95, Ab2)	
	Reviewers who participate in peer reviews receive required training in the objectives, principles, and methods of peer reviews. (L3-96, Ab3)	

PR Process - Inputs

Inputs

The table below lists the recommended inputs to the peer reviews process.

√	Input	Org. Input	References
	Checklists. (L3-98, A2, 5)		
	Peer review materials or review materials. (L3-95, Ab1, 1)		
	Software work product(s). (L3-94, C1, 4)		
	Standard set of software work products (identified in the organization's standard software process) that will undergo peer review. (L3-94, C1, 1)		

PR Process - Activities

Activities

The table below lists the recommended activities for the peer reviews process.

√	Activities	References
	Peer reviews are planned, and the plans are documented. (L3-97, A1)	
	Peer reviews are performed according to a documented procedure. (L3-97, A2) [Refer to Level 3 Procedure Checklists for additional information.]	
	Data on the conduct and results of the peer reviews are recorded. (L3-99, A3)	
	Measurements are made and used to determine the status of the peer review activities. (L3-99, M1)	
	The **software quality assurance group** reviews and/or audits the activities and work products for peer reviews and reports the results. (L3-100, V1) [Refer to PR Process Reviews and Audits for additional information.]	

PR Process - Outputs

Outputs

The table below lists the recommended outputs produced by the peer reviews process.

√	Output	Org. Outputs	References
	Actions identified in the peer reviews. (L3-98, A2, 6)		
	Checklists. (L3-98, A2, 5.1)		
	Completion criteria for the peer reviews. (L3-98, A2, 4)		
	Criteria for the review of the software work products. (L3-98, A2, 5)		
	Data on the conduct of the peer reviews. (L3-99, A3)		
	Data resulting from the peer reviews. (L3-95, Ab1, 6)		
	Defects identified in the peer review. (L3-95, Ab1, 4)		
	Issues in satisfying (readiness and completion) criteria for the peer reviews. (L3-98, A2, 4.1)		
	Measurements (to determine the status of the peer review activities). (L3-99, M1)		
	Plans for peer reviews. (L3-97, A1)		
	Readiness criteria for the peer reviews. (L3-98, A2, 4)		
	Results of peer reviews. (L3-94, C1, 5)		
	Results of **SQA group** reviews and/or audits of the activities and work products for peer reviews. (L3-100, V1)		
	Schedule of peer reviews. (L3-97, A1, 2)		
	Software work products that will undergo peer review. (L3-94, C1, 2)		

PR Process - Exit Criteria

Output-based entry criteria

The CMM recommends that outputs satisfy the states described in the table below to exit the peer reviews process.

√	Output	State	References
	Actions identified in the peer reviews	are tracked until they are resolved. (L3-98, A2, 6)	
	Checklists	❑ are used to identify criteria for the review of the software work products in a consistent manner. (L3-98, A2, 5) ❑ are tailored to the specific type of work product and peer review. (L3-98, A2, 5.1) ❑ are reviewed by the **checklist developers' peers** and **potential users**. (L3-98, A2, 5.2)	
	Completion criteria for the peer reviews	❑ are specified. (L3-98, A2, 4) ❑ are enforced. (L3-98, A2, 4)	
	Data on the conduct of the peer reviews	are recorded. (L3-99, A3)	
	Data resulting from the peer reviews	❑ are collected. (L3-95, Ab1, 6) ❑ are reported. (L3-95, Ab1, 6) ❑ are recorded. (L3-99, A3)	
	Issues in satisfying (readiness and completion) criteria for the peer reviews	are reported to the appropriate **managers**. (L3-98, A2, 4.1)	
	Measurements (to determine the status of the peer review activities)	❑ are made. (L3-99, M1) ❑ are used. (L3-99, M1)	
	Plans for peer reviews	❑ are documented. (L3-97, A1) ❑ identify the software work products that will undergo peer review. (L3-97, A1, 1) ❑ specify the schedule of peer reviews. (L3-97, A1, 2)	
	Readiness criteria for the peer reviews	❑ are specified. (L3-98, A2, 4) ❑ are enforced. (L3-98, A2, 4)	

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PR Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the peer reviews process, continued from the previous page.

√	Output	State	References
	Results of the peer reviews	are not used by **management** to evaluate the performance of individuals. (L3-94, C1, 5)	
	Results of **SQA group** reviews and/or audits of the activities and work products for peer reviews	are reported. (L3-100, V1)	
	Schedule of peer reviews	are specified in the plans for peer reviews. (L3-97, A1, 2)	
	Software work products that will undergo peer review	❑ are identified by each project. (L3-94, C1, 2) ❑ include the set identified in the organization's standard software process. (L3-97, A1, 1.1)	

General exit criteria

The CMM recommends that the conditions described in the table below be satisfied to exit the peer reviews process.

√	Condition	References
	Peer reviews are planned, and the plans are documented. (L3-97, A1)	
	Peer reviews are performed according to a documented procedure. (L3-97, A2)	
	Data on the conduct and results of the peer reviews are recorded. (L3-99, A3)	
	The **software quality assurance group** reviews and/or audits the activities and work products for peer reviews and reports the results. (L3-100, V1)	

PR Process - Reviews and Audits

Reviews and audits

The table below lists the recommended reviews and audits for the peer reviews process.

√	Review or Audit	Review Participants	References
	The checklists are reviewed by the **checklist developers' peers** and **potential users**. (L3-98, A2, 5.2)	**Checklist developers' peers** **Checklist potential users**	
	The **software quality assurance group** reviews and/or audits the activities and work products for peer reviews and reports the results. (L3-100, V1) At a minimum, the reviews and/or audits verify that: ❑ The planned peer reviews are conducted. ❑ The **peer review leaders** are adequately trained for their roles. ❑ The **reviewers** are properly trained or experienced in their roles. ❑ The process for preparing for the peer reviews, conducting the peer reviews, and performing the follow-up actions are followed. ❑ Reporting of peer review data is complete, accurate, and timely.	**Software quality assurance group**	

PR Process - Work Products Managed and Controlled

Work products managed and controlled	There are no work products recommended to be managed and controlled in the peer reviews process.

PR Process - Measurements

Measurements

The table below lists the measurements recommended for the peer reviews process.

√	Measurements	References
	Data on the conduct and results of the peer reviews. (L3-99, A3)	
	Measurements to determine the status of the peer review activities. (L3-99, M1) Examples of measurements include: ❑ Number of peer reviews performed compared to the plan. ❑ Overall effort expended on peer reviews compared to the plan. ❑ Number of work products reviewed compared to the plan.	

PR Process - Documented Procedures

Documented procedures

The table below lists the activities for the peer reviews process recommended to be performed according to a documented procedure.

√	Documented Procedure(s)	References
	Peer reviews are performed according to a documented procedure. (L3-97, A2) [Refer to Level 3 Procedure Checklists for additional information.]	

PR Process - Training

Training

The table below lists the training recommended for the peer reviews process.

√	Training	References
	Peer review leaders receive required training in how to lead peer reviews. (L3-95, Ab2)	
	Reviewers who participate in peer reviews receive required training in the objectives, principles, and methods of peer reviews. (L3-96, Ab3)	

PR Process - Tools

Tools	There are no tools recommended in the peer reviews process.

Level 3 Procedure Checklists

Overview

Introduction This section describes all the explicit documented procedures in the Capability Maturity Model for maturity level 3.

Purpose The purpose of the procedure checklists is to provide:

- Guidance in identifying which procedures are recommended by the CMM at level 3.
- Criteria that an organization can use to evaluate its software procedures to determine if those procedures are consistent with the CMM at level 3.
- Information that can be used to develop software procedures that are consistent with the CMM at level 3.

In this section This section covers the following documented procedures:

CMM Level 3 Procedures	See Page
Organization process focus procedures	L3-Procedures-2
Organization process definition procedure	L3-Procedures-3
Training program procedure	L3-Procedures-4
Integrated software management procedures	L3-Procedures-5
Software product engineering procedures	L3-Procedures-12
Intergroup coordination procedures	L3-Procedures-13
Peer reviews procedure	L3-Procedures-14

Note: The CMM does not recommend that any activities be performed according to a documented procedure for the organization process focus and software product engineering processes.

Organization Process Focus (OPF) Procedures

Documented procedures	The CMM does not recommend that any activities be performed according to a documented procedure for the organization process focus process.

Organization Process Definition (OPD) Procedure

Documented procedure

The table below lists the recommended documented procedure for the organization process definition process.

√	Documented Procedure	References
	The organization's standard software process is developed and maintained according to a documented procedure. (L3-15, A1) This procedure typically specifies that: ❑ The organization's standard software process satisfies the software policies, process standards, and product standards imposed on the organization, as appropriate. ❑ The organization's standard software process satisfies the software process and product standards that are commonly imposed on the organization's projects by their customers, as appropriate. ❑ State-of-the-practice software engineering tools and methods are incorporated into the organization's standard software process, as appropriate. ❑ The internal process interfaces between the software disciplines are described. ❑ The external process interfaces between the software process and the processes of other affected groups are described. ❑ Changes proposed for the organization's standard software process are documented, reviewed, and approved by the **group responsible for the organization's software process activities (e.g., software engineering process group)** before they are incorporated. ❑ Plans for introducing changes to the software process of ongoing projects are defined as appropriate. ❑ The description of the organization's standard software process undergoes peer review when initially developed and whenever significant changes or additions are made. ❑ The description of the organization's standard software process is placed under configuration management.	

Training Program (TP) Procedure

Documented procedure

The table below lists the recommended documented procedure for the training program process.

√	Documented Procedure	References
	The organization's training plan is developed and revised according to a documented procedure. (L3-30, A2) This procedure typically specifies that: ❑ The plan uses the software projects' training needs identified in their training plans. ❑ The specific training to be provided is identified based on the skills needed by the organization and when those skills are needed. ❑ The organization's training plan is revised, as appropriate, to incorporate changes. ❑ The organization's training plan is reviewed by the **affected individuals** when it is initially released and whenever major revisions are made. ❑ The organization's training plan is managed and controlled. ❑ The organization's training plan is readily available to the **affected groups** and **individuals**.	

Integrated Software Management (ISM) Procedures

Documented procedures

The table below lists the recommended documented procedures for the integrated software management process.

√	Documented Procedures	References
	The project's defined software process is developed by tailoring the organization's standard software process according to a documented procedure. (L3-41, A1) This procedure typically specifies that: ❑ A software life cycle is: ❑ selected from among those approved by the organization, to satisfy the project's contractual and operational constraints; ❑ modified, if necessary, in ways permitted by the organization's tailoring guidelines and criteria; and ❑ documented according to the organization's standards. ❑ The description of the project's defined software process is documented. ❑ Tailoring of the organization's standard software process for the project is reviewed by the **group responsible for coordinating the organization's software process activities (e.g., software engineering process group)** and approved by **senior management**. ❑ Waivers for deviations from the organization's standard software process are documented and are reviewed and approved by **senior management**. ❑ Waivers for deviations from contractual software process requirements are documented and are reviewed and approved by **senior management** and the software project's **customer**, as appropriate. ❑ The description of the project's defined software process is managed and controlled.	

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Documented procedures, continued

The table below lists the recommended documented procedures for the integrated software management process, continued from the previous page.

√	Documented Procedures	References
	Each project's defined software process is revised according to a documented procedure. (L3-43, A2) This procedure typically specifies that: ❑ Changes derived from the following are documented and systematically reviewed: ❑ lessons learned from monitoring the software activities of the organization's projects, ❑ changes proposed by the software project, and ❑ process and work product measurement data. ❑ Changes to the project's defined software process are reviewed and approved before they are incorporated.	
	The project's software development plan, which describes the use of the project's defined software process, is developed and revised according to a documented procedure. (L3-44, A3)	

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Documented procedures, continued

The table below lists the recommended documented procedures for the integrated software management process, continued from the previous page.

√	Documented Procedures	References
	The size of the software work products (or size of changes to the software work products) is managed according to a documented procedure. (L3-47, A6) This procedure typically specifies that: ❑ A **group that is independent of the software engineering group** reviews the procedures for estimating the size of the software work products, and provides guidance in using historical data from the organization's software process database to establish credible estimates. ❑ The **individuals** who prepare the size estimates ensure that the procedures and data used in the estimates are appropriate. ❑ When the validity of a size estimate is questioned, a **team of peers and experts** reviews the estimate. ❑ A contingency factor is applied to the size estimate for each software element identified as a software risk. ❑ The rationale for the contingency is documented. ❑ The risks associated with reducing or eliminating the contingency are assessed and documented. ❑ Off-the-shelf or reusable software components are identified. ❑ Reuse measurements account for the reuse of requirements, design, code, test plan, and test procedures, etc. ❑ The effort to modify and incorporate reusable components is factored into the size estimates. ❑ Factors which could significantly affect the size of the software work products are identified and monitored closely. ❑ A size threshold is established for each managed software element which, when projected to be exceeded, requires action.	

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Documented procedures, continued

The table below lists the recommended documented procedures for the integrated software management process, continued from the previous page.

√	Documented Procedures	References
	The project's software effort and costs are managed according to a documented procedure. (L3-48, A7) This procedure typically specifies that: ❑ Software effort, cost, and staffing profile models, if used, are adapted to the project and use available historical data where appropriate. ❑ Referenced productivity and cost data are adjusted to incorporate project variables. ❑ The overall software effort and cost is allocated to individually managed tasks or stages as needed to manage the effort and cost effectively. ❑ When the software effort and cost status is reviewed and the estimates are revised, actual expenditures over time and against work completed are compared to the software development plan and used to refine the effort and cost estimates for remaining work. ❑ Parameter values of the models used in estimating software effort and costs are updated whenever major changes are made to the software requirements. ❑ Actual data on project productivity and other new software costs are used where appropriate. ❑ An effort and cost threshold is established for each individually managed software task or stage which, when projected to be exceeded, requires action.	

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Documented procedures, continued

The table below lists the recommended documented procedures for the integrated software management process, continued from the previous page.

√	Documented Procedures	References
	The project's critical computer resources are managed according to a documented procedure. (L3-50, A8) This procedure typically specifies that: ❑ Estimates for the project's critical computer resources are derived based on historical experience, simulations, prototyping, or analysis, as appropriate. ❑ Sources and rationale for estimates are documented. ❑ Similarities and differences between the project and the sources for historical data in terms of application domain and design approach are assessed and recorded. ❑ The reasoning used to judge the credibility of the estimates is recorded. ❑ The planned computer resources, the system requirements allocated to software, the software requirements, and/or the software design are adjusted to achieve the project's critical computer resource requirements. ❑ The available computer resources are allocated to the software components. ❑ The available capacity for the critical computer resources provides for a specified reserve capacity when the initial estimates are made. ❑ A threshold is established for each critical computer resource which, when projected to be exceeded, requires action.	

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Documented procedures, continued

The table below lists the recommended documented procedures for the integrated software management process, continued from the previous page.

√	Documented Procedures	References
	The critical dependencies and critical paths of the project's software schedule are managed according to a documented procedure. (L3-51, A9) This procedure typically specifies that: ❑ Milestones, tasks, commitments, critical dependencies, staffing, costs, and reviews are allocated in the schedule consistent with the project's defined software process. ❑ The software schedule identifies specific tasks and milestones whose completion can be objectively determined (i.e., a binary or yes/no determination). ❑ Critical dependencies are defined, negotiated, and reflected in the software schedule. ❑ Schedule critical paths are defined and reflected in the software schedule. ❑ The software project's critical dependencies and schedule critical paths are tracked on a regular basis. ❑ Specific documented threshold criteria are established for each critical path which, when projected to be exceeded, require action.	

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Documented procedures, continued

The table below lists the recommended documented procedures for the integrated software management process, continued from the previous page.

√	Documented Procedures	References

	The project's software risks are identified, assessed, documented, and managed according to a documented procedure. (L3-52, A10)
	This procedure typically specifies that:
	❑ A software risk management plan is documented and used to identify and manage the software risks.
	❑ Contingency planning is based on the project's defined software process and is performed throughout the project's software life cycle.
	❑ Alternatives for each software risk are defined, where possible, along with criteria for selecting among the alternatives.
	❑ The initial release and major revisions to the software risk management plan undergo peer review.
	❑ The software risk management plan is managed and controlled.
	❑ Software risks are tracked, reassessed, and replanned at selected project milestones, at designated risk checkpoints, and during the planning of significant changes that affect the software project.
	  ❑ Risk priorities and software risk management plans are reviewed and revised at these reassessment points.
	  ❑ Information obtained from monitoring the risks is used to refine the risk assessments and software risk management plans.
	❑ The **software engineering group** and other **affected groups** and **individuals** are included in the communications on the software risks, the software risk management plans, and the results of risk mitigation.	

Software Product Engineering (SPE) Procedures

Documented procedures	The CMM does not recommend that any activities be performed according to a documented procedure for the software product engineering process.

Intergroup Coordination (IC) Procedures

Documented procedures

The table below lists the recommended documented procedures for the intergroup coordination process.

√	Documented Procedures	References
	Critical dependencies between **engineering groups** are identified, negotiated, and tracked according to a documented procedure. (L3-89, A4) This procedure typically specifies that: ❑ Each critical dependency is explicitly defined, including: ❑ the item to be provided, ❑ who will provide it, ❑ when it will be provided, and ❑ the criteria for acceptance. ❑ Critical dependencies are negotiated between the **software engineering group** and other **engineering groups** in the project and organization. ❑ Need dates and availability dates of critical dependency items are tied to the project schedule and the software schedule. ❑ The agreement for each critical dependency is documented, reviewed, and approved by both the **receiving group** and the **group responsible for providing the critical dependency item**. ❑ Critical dependencies are tracked on a regular basis and corrective actions are taken when appropriate. ❑ Status and actual or projected completion are compared to the plan used to coordinate intergroup commitments. ❑ Effects of late and early completions are evaluated for impacts on future activities and milestones. ❑ Actual and potential problems are reported to the appropriate **managers**.	
	Intergroup issues not resolvable by the **individual representatives of the project engineering groups** are handled according to a documented procedure. (L3-90, A6)	

Peer Reviews (PR) Procedure

Documented procedure

The table below lists the recommended documented procedure for the peer reviews process.

√	Documented Procedure	References

	Peer reviews are performed according to a documented procedure. (L3-97, A2)
	This procedure typically specifies that:
	❑ Peer reviews are planned and led by trained **peer review leaders**.
	❑ Review materials are distributed to the **reviewers** in advance so they can adequately prepare for the peer review.
	❑ **Reviewers** have assigned roles in peer reviews.
	❑ Readiness and completion criteria for the peer reviews are specified and enforced.
	  ❑ Issues in satisfying these criteria are reported to the appropriate **managers**.
	❑ Checklists are used to identify criteria for the review of the software work products in a consistent manner.
	  ❑ The checklists are tailored to the specific type of work product and peer review.
	  ❑ The checklists are reviewed by the **checklist developers' peers** and **potential users**.
	❑ Actions identified in the peer reviews are tracked until they are resolved.
	❑ The successful completion of peer reviews, including the rework to address the items identified in the peer reviews, is used as a completion criterion for the associated task.	

Level 3 Summary

Overview

Section purpose

The purpose of this section is to provide checklists that provide a summary of the defined level (level 3). This section contains three perspectives of a CMM level.

- *Key process area (KPA) specific information*:
  KPA purpose
  KPA goals

- *Operational framework information (from a maturity level viewpoint)*:
  Policies
  Standards
  Process descriptions
  Procedures
  Training
  Tools

- *Other key process information (from a maturity level viewpoint)*:
  Reviews and audits
  Work products managed and controlled
  Measurements

Section overview

This section contains the following topics.

Topic	Page
Level 3 - KPA Purposes	L3-Summary-2
Level 3 - KPA Goals	L3-Summary-3
Level 3 - Policies	L3-Summary-4
Level 3 - Standards	L3-Summary-5
Level 3 - Process Descriptions	L3-Summary-6
Level 3 - Procedures	L3-Summary-9
Level 3 - Training	L3-Summary-11
Level 3 - Tools	L3-Summary-13
Level 3 - Reviews and Audits	L3-Summary-14
Level 3 - Work Products Managed and Controlled	L3-Summary-25
Level 3 - Measurements	L3-Summary-27

Level 3 - KPA Purposes

Level 3 KPA purposes

The following table describes the purpose of each key process area in the CMM at level 3.

√	KPA	Purpose of KPAs at Level 3
	OPF	The purpose of Organization Process Focus is to establish the organizational responsibility for software process activities that improve the organization's overall software process capability. (L3-1)
	OPD	The purpose of Organization Process Definition is to develop and maintain a usable set of software process assets that improve process performance across the projects and provide a basis for cumulative, long-term benefits to the organization. (L3-11)
	TP	The purpose of the Training Program key process area is to develop the skills and knowledge of individuals so they can perform their roles effectively and efficiently. (L3-25)
	ISM	The purpose of Integrated Software Management is to integrate the software engineering and management activities into a coherent, defined software process that is tailored from the organization's standard software process and related process assets, which are described in Organization Process Definition. (L3-37)
	SPE	The purpose of Software Product Engineering is to consistently perform a well-defined engineering process that integrates all the software engineering activities to produce correct, consistent software products effectively and efficiently. (L3-59)
	IC	The purpose of Intergroup Coordination is to establish a means for the software engineering group to participate actively with the other engineering groups so the project is better able to satisfy the customer's needs effectively and efficiently. (L3-83)
	PR	The purpose of Peer Reviews is to remove defects from the software work products early and efficiently. An important corollary effect is to develop a better understanding of the software work products and of defects that might be prevented. (L3-93)

Level 3 - KPA Goals

Level 3 KPA goals

The following table lists the goals that are described in the CMM for each key process area at level 3.

√	KPA	CMM Goals at Level 3	References
	OPF	Software process development and improvement activities are coordinated across the organization. (L3-1, G1)	
	OPF	The strengths and weaknesses of the software processes used are identified relative to the process standard. (L3-2, G2)	
	OPF	Organization-level process development and improvement activities are planned. (L3-2, G3)	
	OPD	A standard software process for the organization is developed and maintained. (L3-12, G1)	
	OPD	Information related to the use of the organization's standard software process by the software projects is collected, reviewed, and made available. (L3-12, G2)	
	TP	Training activities are planned. (L3-25, G1)	
	TP	Training for developing the skills and knowledge needed to perform software management and technical roles is provided. (L3-25, G2)	
	TP	**Individuals** in the **software engineering group** and **software-related groups** receive the training necessary to perform their roles. (L3-26, G3)	
	ISM	The project's defined software process is a tailored version of the organization's standard software process. (L3-38, G1)	
	ISM	The project is planned and managed according to the project's defined software process. (L3-38, G2)	
	SPE	The software engineering tasks are defined, integrated, and consistently performed to produce the software. (L3-60, G1)	
	SPE	Software work products are kept consistent with each other. (L3-60, G2)	
	IC	The customer's requirements are agreed to by all **affected groups**. (L3-84, G1)	
	IC	The commitments between the **engineering groups** are agreed to by the **affected groups**. (L3-84, G2)	
	IC	The **engineering groups** identify, track, and resolve intergroup issues. (L3-84, G3)	
	PR	Peer reviews are planned. (L3-93, G1)	

	PR	Defects in the software work products are identified and removed. (L3-93, G2)	

Level 3 - Policies

Level 3 policies The following table lists the recommended policies in the CMM at level 3.

√	KPA	Description	References
	OPF	Written organizational policy for coordinating software process development and improvement activities across the organization. (L3-2, C1)	
	OPD	Written policy for developing and maintaining a standard software process and related process assets. (L3-12, C1)	
	TP	Written policy for meeting the organization's training needs. (L3-26, C1)	
	ISM	Written organizational policy requiring that the software project be planned and managed using the organization's standard software process and related process assets. (L3-38, C1)	
	SPE	Written organizational policy for performing the software engineering activities. (L3-60, C1)	
	IC	Written organizational policy for establishing interdisciplinary engineering teams. (L3-84, C1)	
	PR	Written organizational policy for performing peer reviews. (L3-94, C1)	

Level 3 - Standards

Level 3 standards

The CMM recommends the contents of the following work products at level 3:

√	KPA	Standards at Level 3	References
	OPF	Action plan. (L3-6, A1)	
	OPF	Software development and improvement plan. (L3-7, A2)	
	OPD	Organization's standard software process. (L3-17, A2)	
	OPD	Software process element. (L3-17, A2, 2)	
	OPD	Tailoring guidelines and criteria (for projects' tailoring of the organization's standard software process). (L3-19, A4, 1)	
	TP	Software project's training plan. (L3-29, A1)	
	TP	Organization's training plan. (L3-32, A3)	
	TP	Organizational standards for training courses. (L3-33, A4)	
	ISM	Project's defined software process. (L3-44, A4)	
	SPE	Software design documentation. (L3-71, A3, 8.1)	
	SPE	Test plan. (L3-75, A7, 2)	
	IC	Documented plan for intergroup commitments. (L3-88, A3)	
	PR	Plans for peer reviews. (L3-97, A1)	

Reference

Refer to the Level 3 Standards Checklists for additional information regarding the content of each standard.

Level 3 - Process Descriptions

OPF process description

Organization Process Focus involves developing and maintaining an understanding of the organization's and projects' software processes and coordinating the activities to assess, develop, maintain, and improve these processes.

The organization provides the long-term commitments and resources to coordinate the development and maintenance of the software processes across current and future software projects via a group such as a software engineering process group. This group is responsible for the organization's software process activities. It is specifically responsible for the development and maintenance of the organization's standard software process and related process assets (as described in the Organization Process Definition key process area), and it coordinates the process activities with the software projects. (L3-1)

OPD process description

Organization Process Definition involves developing and maintaining the organization's standard software process, along with related process assets, such as descriptions of software life cycles, process tailoring guidelines and criteria, the organization's software process database, and a library of software process-related documentation.

These assets may be collected in many ways, depending on the organization's implementation of Organization Process Definition. For example, the descriptions of the software life cycles may be an integral part of the organization's standard software process or parts of the library of software process-related documentation may be stored in the organization's software process database.

The organization's software process assets are available for use in developing, implementing, and maintaining the projects' defined software processes. (The practices related to the development and maintenance of the project's defined software process are described in the Integrated Software Management key process area.) (L3-11)

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TP process description

Training Program involves first identifying the training needed by the organization, projects, and individuals, then developing or procuring training to address the identified needs.

Each software project evaluates its current and future skill needs and determines how these skills will be obtained. Some skills are effectively and efficiently imparted through informal vehicles (e.g., on-the-job training and informal mentoring), whereas other skills need more formal training vehicles (e.g., classroom training and guided self-study) to be effectively and efficiently imparted. The appropriate vehicles are selected and used.

This key process area covers the practices for the group performing the training function. The practices identifying the specific training topics (i.e., knowledge or skill needed) are contained in the Ability to Perform common feature of the individual key process areas. (L3-25)

ISM process description

Integrated Software Management involves developing the project's defined software process and managing the software project using this defined software process. The project's defined software process is tailored from the organization's standard software process to address the specific characteristics of the project.

The software development plan is based on the project's defined software process and describes how the activities of the project's defined software process will be implemented and managed. The management of the software project's size, effort, cost, schedule, staffing, and other resources is tied to the tasks of the project's defined software process.

Since the projects' defined software processes are all tailored from the organization's standard software process, the software projects can share process data and lessons learned.

The basic practices for estimating, planning, and tracking a software project are described in the Software Project Planning and Software Project Tracking and Oversight key process areas. They focus on recognizing problems when they occur and adjusting the plans and/or performance to address the problems. The practices of this key process area build on, and are in addition to, the practices of those two key process areas. The emphasis of Integrated Software Management shifts to anticipating problems and acting to prevent or minimize the effects of these problems. (L3-37)

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SPE process description

Software Product Engineering involves performing the engineering tasks to build and maintain the software using the project's defined software process (which is described in the Integrated Software Management key process area) and appropriate methods and tools.

The software engineering tasks include analyzing the system requirements allocated to software (these system requirements are described in the Requirements Management key process area), developing the software requirements, developing the software architecture, designing the software, implementing the software in the code, integrating the software components, and testing the software to verify that it satisfies the specified requirements (i.e., the system requirements allocated to software and the software requirements).

Documentation needed to perform the software engineering tasks (e.g., software requirements document, software design document, test plan, and test procedures) is developed and reviewed to ensure that each task addresses the results of predecessor tasks and the results produced are appropriate for the subsequent tasks (including the tasks of operating and maintaining the software). When changes are approved, affected software work products, plans, commitments, processes, and activities are revised to reflect the approved changes. (L3-59)

IC process description

Intergroup Coordination involves the software engineering group's participation with other project engineering groups to address system-level requirements, objectives, and issues. Representatives of the project's engineering groups participate in establishing the system-level requirements, objectives, and plans by working with the customer and end users, as appropriate. These requirements, objectives, and plans become the basis for all engineering activities.

The technical working interfaces and interactions between groups are planned and managed to ensure the quality and integrity of the entire system. Technical reviews and interchanges are regularly conducted with representatives of the project's engineering groups to ensure that all engineering groups are aware of the status and plans of all the groups, and that system and intergroup issues receive appropriate attention.

The software-specific practices related to these engineering tasks are described in the Requirements Management and Software Product Engineering key process areas. (L3-83)

PR process description

Peer Reviews involve a methodical examination of software work products by the producers' peers to identify defects and areas where changes are needed. The specific products that will undergo a peer review are identified in the project's defined software process and scheduled as part of the software project planning activities, as described in Integrated Software Management.

This key process area covers the practices for performing peer reviews. The practices identifying the specific software work products that undergo peer review are contained in the key process areas that describe the development and maintenance of each software work product. (L3-93)

Level 3 - Procedures

Level 3 procedures

The table below lists the activities that are recommended to be performed according to a documented procedure in the CMM at level 3. Refer to the Level 3 Procedure Checklists for additional information regarding the content of each documented procedure.

√	KPA	Documented Procedures	References
	OPF	There are no activities that are recommended to be performed according to a documented procedure in the organizational process focus process.	
	OPD	The organization's standard software process is developed and maintained according to a documented procedure. (L3-15, A1)	
	TP	The organization's training plan is developed and revised according to a documented procedure. (L3-30, A2)	
	ISM	The project's defined software process is developed by tailoring the organization's standard software process according to a documented procedure. (L3-41, A1)	
	ISM	Each project's defined software process is revised according to a documented procedure. (L3-43, A2)	
	ISM	The project's software development plan, which describes the use of the project's defined software process, is developed and revised according to a documented procedure. (L3-44, A3)	
	ISM	The size of the software work products (or size of changes to the software work products) is managed according to a documented procedure. (L3-47, A6)	
	ISM	The project's software effort and costs are managed according to a documented procedure. (L3-48, A7)	
	ISM	The project's critical computer resources are managed according to a documented procedure. (L3-50, A8)	
	ISM	The critical dependencies and critical paths of the project's software schedule are managed according to a documented procedure. (L3-51, A9)	
	ISM	The project's software risks are identified, assessed, documented, and managed according to a documented procedure. (L3-52, A10)	
	SPE	There are no activities that are recommended to be performed according to a documented procedure in the software product engineering process.	

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Level 3 - Procedures, Continued

Level 3 procedures, continued

The table below lists the activities that are recommended to be performed according to a documented procedure in the CMM at level 3, continued from the previous page.

√	KPA	Documented Procedures	References
	IC	Critical dependencies between engineering groups are identified, negotiated, and tracked according to a documented procedure. (L3-89, A4)	
	IC	Intergroup issues not resolvable by the **individual representatives of the project engineering groups** are handled according to a documented procedure. (L3-90, A6)	
	PR	Peer reviews are performed according to a documented procedure. (L3-97, A2)	

Level 3 - Training

Level 3 training The table below lists the training recommended in the CMM at level 3.

√	KPA	Training	References
	OPF	Members of the **group responsible for the organization's software process activities** receive required training to perform these activities. (L3-5, Ab3)	
	OPF	Members of the **software engineering group** and other **software-related groups** receive orientation on the organization's software process activities and their roles in those activities. (L3-6, Ab4)	
	OPF	Training for the organization's and projects' software processes is coordinated across the organization. (L3-8, A6)	
	OPD	The **individuals who develop and maintain the organization's standard software process and related process assets** receive required training to perform these activities. (L3-14, Ab2)	
	TP	Training is provided to build the skill base of the organization, to fill the specific needs of the projects, and to develop the skills of individuals. (L3-26, C1, 3)	
	TP	**Software managers** receive orientation on the training program. (L3-29, Ab4)	
	ISM	The **individuals responsible for developing the project's defined software process** receive required training in how to tailor the organization's standard software process and use the related process assets. (L3-39, Ab2)	
	ISM	The **software managers** receive required training in managing the technical, administrative, and personnel aspects of the software project based on the project's defined software process. (L3-40, Ab3)	
	SPE	Members of the **software engineering technical staff** receive required training to perform their technical assignments. (L3-63, Ab2)	
	SPE	Members of the **software engineering technical staff** receive orientation in related software engineering disciplines. (L3-64, Ab3)	
	SPE	The **project manager** and all **software managers** receive orientation in the technical aspects of the software project. (L3-64, Ab4)	
	IC	All **managers** in the organization receive required training in teamwork. (L3-85, Ab3)	

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Level 3 - Training, Continued

Level 3 training, continued

The table below lists the training recommended in the CMM at level 3, continued from the previous page.

√	KPA	Training	References
	IC	All **task leaders** in each engineering group receive orientation in the processes, methods, and standards used by the other engineering groups. (L3-86, Ab4)	
	IC	The members of the **engineering groups** receive orientation in working as a team. (L3-86, Ab5)	
	PR	**Peer review leaders** receive required training in how to lead peer reviews. (L3-95, Ab2)	
	PR	**Reviewers** who participate in peer reviews receive required training in the objectives, principles, and methods of peer reviews. (L3-96, Ab3)	

Level 3 - Tools

Level 3 tools The table below lists the tools recommended in the CMM for level 3.

√	KPA	Tools	References
	OPF	Tools to support the organization's software process activities. (L3-5, Ab2, 2)	
	OPD	Tools to support process development and maintenance. (L3-14, Ab1, 2)	
	OPD	State-of-the-practice software engineering tools. (L3-15, A1, 3)	
	OPD	Organization's software process database. (L3-20, A5)	
	TP	Tools to support the training program activities. (L3-28, Ab2, 2)	
	ISM	Organization's software process database. (L3-39, C1, 4)	
	SPE	Tools to build and maintain the software products. (L3-60, C1, 2)	
	SPE	Tools to support the software engineering tasks. (L3-61, Ab1, 2)	
	SPE	Software engineering tools. (L3-65, A1)	
	SPE	Tools to develop the documentation. (L3-76, A8, 1)	
	IC	Support tools used by the different engineering groups. (L3-85, Ab2)	
	PR	There are no tools specified in the peer reviews process.	

Level 3 - Reviews and Audits

Level 3 reviews and audits

The table below lists the recommended reviews and audits in the CMM at level 3.

√	KPA	Review or Audit	Review Participants	References
	OPF	The plan for organizational software process development and improvement activities undergoes peer review when initially released and whenever major revisions are made. (L3-7, A2, 5)	**Not specified in the CMM**	
	OPF	The plan for organizational software process development and improvement activities is reviewed and agreed to by the organization's **software managers** and **senior managers**. (L3-7, A2, 6)	**Software managers** **Senior managers**	
	OPF	The activities for software process development and improvement are reviewed with **senior management** on a periodic basis. (L3-10, V1)	**Senior management**	
	OPF	Progress and status of the activities to develop and improve the software process are reviewed against the plan. (L3-10, V1, 1)	**Not specified in the CMM**	
	OPD	Changes proposed for the organization's standard software process are documented, reviewed, and approved by the **group responsible for the organization's software process activities (e.g., software engineering process group)** before they are incorporated. (L3-16, A1, 6)	**Group responsible for the organiza-tion's software process activities**	
	OPD	The description of the organization's standard software process undergoes peer review when initially developed and whenever significant changes or additions are made. (L3-16, A1, 8)	**Not specified in the CMM**	
	OPD	Changes proposed for the descriptions of software life cycles are documented, reviewed, and approved by the **group responsible for the organization's software process activities (e.g., software engineering process group)** before they are incorporated. (L3-18, A3, 2)	**Group responsible for the organiza-tion's software process activities**	

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Level 3 - Reviews and Audits, Continued

Level 3 reviews and audits, continued

The table below lists the recommended reviews and audits in the CMM at level 3, continued from the previous page.

√	KPA	Review or Audit	Review Participants	References
	OPD	The descriptions of the software life cycles undergo peer review when initially documented and whenever significant changes or additions are made. (L3-19, A3, 3)	**Not specified in the CMM**	
	OPD	Changes proposed for the tailoring guidelines and criteria are documented, reviewed, and approved by the **group responsible for the organization's software process activities (e.g., software engineering process group)** before they are incorporated. (L3-20, A4, 2)	**Group responsible for the organiza-tion's software process activities**	
	OPD	The data entered into the (organization's software process) database are reviewed to ensure the integrity of the database contents. (L3-21, A5, 2)	**Not specified in the CMM**	
	OPD	Candidate (software process-related) documentation items are reviewed and appropriate items that may be useful in the future are included in the library. (L3-21, A6, 1)	**Not specified in the CMM**	
	OPD	Revisions made to (software process-related) documentation items currently in the library are reviewed, and the library contents are updated as appropriate. (L3-22, A6, 3)	**Not specified in the CMM**	
	OPD	The use of each (software process-related) documentation item is reviewed periodically, and the results are used to maintain the library contents. (L3-22, A6, 5)	**Not specified in the CMM**	

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Level 3 - Reviews and Audits, Continued

Level 3 reviews and audits, continued

The table below lists the recommended reviews and audits in the CMM at level 3, continued from the previous page.

√	KPA	Review or Audit	Review Participants	References
	OPD	The **software quality assurance group** reviews and/or audits the organization's activities and work products for developing and maintaining the organization's standard software process and related process assets and reports the results. (L3-23, V1)	**Software quality assurance group**	
	TP	The organization's training plan is reviewed by the **affected individuals** when it is initially released and whenever major revisions are made. (L3-31, A2, 4)	**Affected individuals**	
	TP	The materials for the training course are reviewed. (L3-33, A4, 2)	**Not specified in the CMM**	
	TP	The training program activities are reviewed with **senior management** on a periodic basis. (L3-35, V1)	**Senior management**	
	TP	The training program is independently evaluated on a periodic basis for consistency with, and relevance to, the organization's needs. (L3-36, V2)	**Not specified in the CMM**	
	TP	The training program activities and work products are reviewed and/or audited and the results are reported. (L3-36, V3)	**Not specified in the CMM**	
	ISM	Tailoring of the organization's standard software process for the project is reviewed by the **group responsible for coordinating the organization's software process activities (e.g., software engineering process group)** and approved by **senior management**. (L3-42, A1, 3)	**Group responsible for the organiza-tion's software process activities** **Senior management**	

	ISM	Waivers for deviations from the organization's standard software process are documented and are reviewed and approved by **senior management**. (L3-42, A1, 3.1)	**Senior management**	

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Level 3 - Reviews and Audits, Continued

Level 3 reviews and audits, continued

The table below lists the recommended reviews and audits in the CMM at level 3, continued from the previous page.

√	KPA	Review or Audit	Review Participants	References
	ISM	Waivers for deviations from contractual software process requirements are documented and are reviewed and approved by **senior management** and the software project's **customer**, as appropriate. (L3-42, A1, 4)	**Senior management** **Customer**	
	ISM	Changes derived from the following are documented and systematically reviewed: (L3-43, A2, 1) ❑ lessons learned from monitoring the software activities of the organization's projects, ❑ changes proposed by the software project, and ❑ process and work product measurement data.	**Not specified in the CMM**	
	ISM	Changes to the project's defined software process are reviewed and approved before they are incorporated. (L3-43, A2, 2)	**Not specified in the CMM**	
	ISM	Technical and management lessons learned from monitoring the activities of other projects in the organization are systematically reviewed and used to estimate, plan, track, and replan the software project. (L3-45, A4, 6)	**Not specified in the CMM**	
	ISM	A **group that is independent of the software engineering group** reviews the procedures for estimating the size of the software work products, and provides guidance in using historical data from the organization's software process database to establish credible estimates. (L3-47, A6, 1)	**Group that is independent of the software engineering group**	
	ISM	When the validity of a size estimate is questioned, a **team of peers and experts** reviews the estimate. (L3-48, A6, 1.2)	**Team of peers and experts**	

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Level 3 - Reviews and Audits, Continued

Level 3 reviews and audits, continued

The table below lists the recommended reviews and audits in the CMM at level 3, continued from the previous page.

√	KPA	Review or Audit	Review Participants	References
	ISM	When the software effort and cost status is reviewed and the estimates are revised, actual expenditures over time and against work completed are compared to the software development plan and used to refine the effort and cost estimates for remaining work. (L3-49, A7, 4)	**Not specified in the CMM**	
	ISM	The initial release and major revisions to the software risk management plan undergo peer review. (L3-54, A10, 4)	**Not specified in the CMM**	
	ISM	Risk priorities and software risk management plans are reviewed and revised at these reassessment points (at selected project milestones, at designated risk checkpoints, and during the planning of significant changes that affect the software project). (L3-55, A10, 6.1)	**Not specified in the CMM**	
	ISM	Reviews of the software project are periodically performed to determine the actions needed to bring the software project's performance and results in line with the current and projected needs of the business, customer, and end users, as appropriate. (L3-55, A11)	**Not specified in the CMM**	
	ISM	The activities for managing the software project are reviewed with **senior management** on a periodic basis. (L3-56, V1)	**Senior management**	
	ISM	The activities for managing the software project are reviewed with the **project manager** on both a periodic and event-driven basis. (L3-57, V2)	**Project manager**	
	ISM	The **software quality assurance group** reviews and/or audits the activities and work products for managing the software project and reports the results. (L3-57, V3)	**Software quality assurance group**	

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Level 3 - Reviews and Audits, Continued

Level 3 reviews and audits, continued

The table below lists the recommended reviews and audits in the CMM at level 3, continued from the previous page.

√	KPA	Review or Audit	Review Participants	References
	SPE	The **individuals involved in developing the software requirements** review the allocated requirements to ensure that issues affecting the software requirements analysis are identified and resolved. (L3-66, A2, 1)	**Individuals involved in developing the software requirements**	
	SPE	Problems with the software requirements are identified and reviewed with the **group responsible for the system requirements**; appropriate changes are made to the allocated requirements and to the software requirements. (L3-67, A2, 4.1)	**Group responsible for the system requirements**	
	SPE	The software requirements document undergoes peer review before it is considered complete. (L3-68, A2, 8)	**Not specified in the CMM**	
	SPE	The software requirements document is reviewed and approved. (L3-68, A2, 9)	**Not specified in the CMM**	
	SPE	The software requirements document is reviewed with the **customer** and **end users**, as appropriate. (L3-68, A2, 10)	**Customer** **End users**	
	SPE	Design criteria are developed and reviewed. (L3-69, A3, 1)	**Not specified in the CMM**	
	SPE	The **individuals involved in the software design** review the software requirements to ensure that issues affecting the software design are identified and resolved. (L3-69, A3, 2)	**Individuals involved in the software design**	
	SPE	The software architecture is reviewed to ensure that architecture issues affecting the software detailed design are identified and resolved. (L3-70, A3, 6)	**Not specified in the CMM**	

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Level 3 - Reviews and Audits, Continued

Level 3 reviews and audits, continued

The table below lists the recommended reviews and audits in the CMM at level 3, continued from the previous page.

√	KPA	Review or Audit	Review Participants	References
	SPE	The software design document undergoes peer review before the design is considered complete. (L3-71, A3, 9)	**Not specified in the CMM**	
	SPE	The **individuals involved in coding** review the software requirements and software design to ensure that issues affecting the coding are identified and resolved. (L3-71, A4, 1)	**Individuals involved in coding**	
	SPE	Each code unit undergoes peer review and is unit tested before the unit is considered complete. (L3-72, A4, 4)	**Not specified in the CMM**	
	SPE	Testing criteria are developed and reviewed with the **customer** and the **end users**, as appropriate. (L3-72, A5, 1)	**Customer** **End users**	
	SPE	The test plan, test procedures, and test cases undergo peer review before they are considered ready for use. (L3-74, A5, 6)	**Not specified in the CMM**	
	SPE	The integration test cases and test procedures are reviewed with the **individuals responsible for the software requirements, software design, and system and acceptance testing**. (L3-75, A6, 2)	**Individuals responsible for the software require-ments, software design, and system and acceptance testing**	
	SPE	System and acceptance testing are documented in a test plan, which is reviewed with, and approved by, the **customer** and **end users**, as appropriate. (L3-75, A7, 2)	**Customer** **End users**	

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Level 3 - Reviews and Audits, Continued

Level 3 reviews and audits, continued

The table below lists the recommended reviews and audits in the CMM at level 3, continued from the previous page.

√	KPA	Review or Audit	Review Participants	References
	SPE	The test cases are documented and are reviewed with, and approved by, the **customer** and **end users**, as appropriate, before the testing begins. (L3-76, A7, 4)	**Customer** **End users**	
	SPE	Preliminary versions of the documentation (that will be used to operate and maintain the software) are developed and made available early in the software life cycle for the **customer**, **end users**, and **software maintainers**, as appropriate, to review and provide feedback. (L3-77, A8, 3)	**Customer** **End users** **Software maintainers**	
	SPE	The documentation (that will be used to operate and maintain the software) undergoes peer review. (L3-77, A8, 5)	**Not specified in the CMM**	
	SPE	The final documentation (that will be used to operate and maintain the software) is reviewed and approved by the **customer**, **end users**, and **software maintainers**, as appropriate. (L3-77, A8, 7)	**Customer** **End users** **Software maintainers**	
	SPE	The activities for software product engineering are reviewed with **senior management** on a periodic basis. (L3-80, V1)	**Senior management**	
	SPE	The activities for software product engineering are reviewed with the **project manager** on both a periodic and event-driven basis. (L3-80, V2)	**Project manager**	
	SPE	The **software quality assurance group** reviews and/or audits the activities and work products for software product engineering and reports the results. (L3-81, V3)	**Software quality assurance group**	
	IC	The system requirements and project-level objectives for the project are defined and reviewed by all **affected groups**. (L3-84, C1, 1)	**Affected groups**	

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Level 3 - Reviews and Audits, Continued

Level 3 reviews and audits, continued

The table below lists the recommended reviews and audits in the CMM at level 3, continued from the previous page.

√	KPA	Review or Audit	Review Participants	References
	IC	**Representatives of the project's software engineering group** and **representatives of the other engineering groups** provide the technical review and approval of the system requirements and system design. (L3-87, A2, 1.1)	**Representatives of the project's software engineering group** **Representatives of the other engineering groups**	
	IC	**Representatives of the project's software engineering group** and **representatives of the other engineering groups** provide the project-level technical review and analysis needed to manage and control changes to the system requirements and project-level objectives throughout the project's life cycle. (L3-87, A2, 1.2)	**Representatives of the project's software engineering group** **Representatives of the other engineering groups**	
	IC	**Representatives of the project's software engineering group** and **representatives of the other engineering groups** track and review the design and development activities for hardware, software, and other system components. (L3-88, A2, 1.3)	**Representatives of the project's software engineering group** **Representatives of the other engineering groups**	
	IC	The documented plan used to communicate intergroup commitments and to coordinate and track the work performed is reviewed and agreed to by all **engineering groups** and the **project manager**. (L3-89, A3, 6)	**Engineering groups** **Project manager**	

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Level 3 - Reviews and Audits, Continued

Level 3 reviews and audits, continued

The table below lists the recommended reviews and audits in the CMM at level 3, continued from the previous page.

√	KPA	Review or Audit	Review Participants	References
	IC	The agreement for each critical dependency is documented, reviewed, and approved by both the **receiving group** and the **group responsible for providing the critical dependency item**. (L3-89, A4, 4)	**Receiving group (of the critical dependency item)** **Group responsible for providing the critical dependency item**	
	IC	Work products produced as input to other engineering groups are reviewed by **representatives of the receiving groups** to ensure that the work products meet their needs. (L3-90, A5)	**Representa-tives of the receiving groups**	
	IC	**Representatives of the project engineering groups** conduct periodic technical reviews and interchanges. (L3-90, A7)	**Representa-tives of the project engineering groups**	
	IC	The activities for intergroup coordination are reviewed with **senior management** on a periodic basis. (L3-91, V1)	**Senior management**	
	IC	The activities for intergroup coordination are reviewed with the **project manager** on both a periodic and event-driven basis. (L3-92, V2)	**Project manager**	
	IC	The **software quality assurance group** reviews and/or audits the activities and work products for intergroup coordination and reports the results. (L3-92, V3)	**Software quality assurance group**	

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Level 3 - Reviews and Audits, Continued

Level 3 reviews and audits, continued

The table below lists the recommended reviews and audits in the CMM at level 3, continued from the previous page.

√	KPA	Review or Audit	Review Participants	References
	PR	The checklists are reviewed by the **checklist developers' peers** and **potential users**. (L3-98, A2, 5.2)	**Checklist developers' peers** **Checklist potential users**	
	PR	The **software quality assurance group** reviews and/or audits the activities and work products for peer reviews and reports the results. (L3-100, V1)	**Software quality assurance group**	

Level 3 - Work Products Managed and Controlled

Level 3 work products managed and controlled

The table below lists the work products that are recommended to be managed and controlled in the CMM at level 3.

√	KPA	Work Products Managed and Controlled	References
	OPF	There are no work products recommended to be managed and controlled in the organizational process focus process.	
	OPD	Description of the organization's standard software process.* (L3-17, A1, 9)	
	OPD	Descriptions of the software life cycles. (L3-19, A3, 4)	
	OPD	Tailoring guidelines and criteria (for the project's tailoring of the organization's standard software process. (L3-20, A4, 3)	
	OPD	Organization's software process database. (L3-21, A5, 3)	
	OPD	Library of software process-related documentation. (L3-21, A6, 6)	
	TP	The organization's training plan. (L3-31, A2, 5)	
	TP	The materials for the training courses. (L3-34, A4, 3)	
	ISM	Description of the project's defined software process. (L3-42, A1, 5)	
	ISM	Software risk management plan. (L3-54, A10, 5)	
	SPE	Tools used to develop and maintain the software products.* (L3-66, A1, 4)	
	SPE	Software requirements document.* (L3-69, A2, 11)	
	SPE	Software design document.* (L3-71, A3, 10)	
	SPE	Code.* (L3-72, A4, 5)	
	SPE	Test plans, test procedures, and test cases. (L3-74, A5, 7)	
	SPE	Test results. (L3-76, A7, 8)	
	SPE	Documentation (that will be used to operate and maintain the software). (L3-77, A8, 6)	
	SPE	Documentation tracing the allocated requirements through the software requirements, design, code, and test cases. (L3-78, A10, 3)	

*Indicates that the CMM recommends that this item must be placed under configuration management

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Level 3 - Work Products Managed and Controlled, Continued

Level 3 work products managed and controlled, continued

The table below lists the work products that are recommended to be managed and controlled in the CMM at level 3, continued from the previous page.

√	KPA	Work Products Managed and Controlled	References
	IC	There are no work products recommended to be managed and controlled in the intergroup coordination process.	
	PR	There are no work products recommended to be managed and controlled in the peer reviews process.	

Level 3 - Measurements

Level 3 measurements

The table below describes the recommended measurements in the CMM at level 3.

√	KPA	Description	References
	OPF	Measurements to determine the status of the organization's process development and improvement activities. (L3-9, M1)	
	OPD	Data on the resulting work products (from the software processes). (L3-20, A5, 1)	
	OPD	Data on the software processes. (L3-20, A5, 1)	
	OPD	Measurements to determine the status of the organization's process definition activities. (L3-22, M1)	
	TP	Measurements to determine the status of the training program activities. (L3-34, M1)	
	TP	Measurements to determine the quality of the training program. (L3-35, M2)	
	ISM	Project measurement data. (L3-39, C1, 4)	
	ISM	Process and work product measurement data. (L3-43, A2, 1.3)	
	ISM	Measurement data needed to manage the software project. (L3-44, A4, 1)	
	ISM	Software planning data, replanning data, and actual measured data. (L3-47, A5, 3)	
	ISM	Reuse measurements (reuse of requirements, design, code, test plan, and test procedures, etc.). (L3-48, A6, 3.1)	
	ISM	Measurements to determine the effectiveness of the integrated software management activities. (L3-56, M1)	
	SPE	Data on defects identified in peer reviews. (L3-78, A9)	
	SPE	Data on defects identified in testing. (L3-78, A9)	
	SPE	Measurements to determine the functionality and quality of the software products. (L3-79, M1)	
	SPE	Measurements to determine the status of the software product engineering activities. (L3-80, M2)	
	IC	Measurements to determine the status of the intergroup coordination activities. (L3-91, M1)	
	PR	Data on the conduct and results of the peer reviews. (L3-99, A3)	

	PR	Measurements to determine the status of the peer review activities. (L3-99, M1)	

Chapter 6. Managed Level (Level 4)

Overview

Introduction This chapter contains the checklists for level 4 of the CMM.

In this chapter This chapter contains the following sections:

Section Title	Page
Level 4 Policy Checklists	L4-Policy-1
Level 4 Standards Checklists	L4-Standards-1
Level 4 Process Checklists	L4-Process-1
Level 4 Procedure Checklists	L4-Procedures-1
Level 4 Summary	L4-Summary-1

Level 4 Policy Checklists

Overview

Introduction

This section describes the explicit policies found in the Capability Maturity Model at maturity level 4.

Purpose

The purpose of the policy checklists is to provide:

- Guidance in identifying which policies are recommended by the CMM at level 4.
- Criteria that an organization can use to evaluate its software policies to determine if they are consistent with the CMM at level 4.
- Information that can be used to develop software policies so that they are consistent with the CMM at level 4.

Checklist description

Each checklist contains two subsections: the KPA policies and the KPA goals. The table below describes these two subsections of a policy checklist.

Subsection	Description
Policy checklist	This subsection contains criteria that the organizational policy can be evaluated against. These criteria must be addressed by organizational policy to be consistent with the CMM.
Policy goals	This subsection is a reminder to policy designers and evaluators to keep in mind the KPA goals when developing the policies for each KPA. The goals can be thought of as the results of implementing an effective policy.

In this section

This section covers the following policies:

Policies	See Page
Quantitative process management policies	L4-Policy-2
Software quality management policy	L4-Policy-3

Quantitative Process Management (QPM) Policies

QPM policy 1 checklist

The project follows a written organizational policy for measuring and quantitatively controlling the performance of the project's defined software process (L4-2, C1). This policy typically specifies that:

√	Description	References
	Each project implements a documented plan to bring the project's defined software process under quantitative control. (L4-2, C1, 1)	
	Sensitive data relating to individuals' performance are protected, and access to these data is appropriately controlled. (L4-3, C1, 2)	

QPM policy 2 checklist

The organization follows a written policy for analyzing the process capability of the organization's standard software process (L4-3, C2). This policy typically specifies that:

√	Description	References
	The projects' measurements of process performance are analyzed to establish and maintain a process capability baseline for the organization's standard software process. (L4-3, C2, 1)	
	The process capability baseline for the organization's standard software process is used by the software projects in establishing their process performance goals. (L4-4, C2, 2)	

QPM policy goals

Implementation of effective quantitative process management policies has the following results:

√	Results of Effectively Implementing QPM Policies	References
	The quantitative process management activities are planned. (L4-2, G1)	
	The process performance of the project's defined software process is controlled quantitatively. (L4-2, G2)	
	The process capability of the organization's standard software process is known in quantitative terms. (L4-2, G3)	

Software Quality Management (SQM) Policy

SQM policy checklist

The project follows a written organizational policy for managing software quality (L4-20, C1). This policy typically specifies that:

√	Description	References
	The project's software quality management activities support the organization's commitment to improve the quality of the software products. (L4-20, C1, 1)	
	The project defines and collects the measurements used for software quality management based on the project's defined software process. (L4-20, C1, 2)	
	The project defines the quality goals for the software products and monitors its progress towards them. (L4-20, C1, 3)	
	Responsibilities for software quality management are defined and assigned to the **software engineering group** and other **software-related groups**. (L4-21, C1, 4)	
	Criteria are established to enable the **groups** (**software engineering group** and other **software-related groups**) to determine their success in achieving the quality goals for the software products. (L4-21, C1, 4.1)	

SQM policy goals

Implementation of an effective software quality management policy has the following results:

√	Results of Effectively Implementing SQM Policy	References
	The project's software quality management activities are planned. (L4-20, G1)	
	Measurable goals for software product quality and their priorities are defined. (L4-20, G2)	
	Actual progress toward achieving the quality goals for the software products is quantified and managed. (L4-20, G3)	

Level 4 Standards Checklists

Overview

Introduction

This section describes the recommended content of selected work products in the CMM at maturity level 4.

Definition

A *standards checklist* describes the content of a work product as recommended by the CMM.

Purpose

The purpose of the standards checklists is to provide:

- Guidance in identifying the contents of standard work products that are recommended by the CMM at level 4.
- Criteria that an organization can use to evaluate its software standards to determine if they are consistent with the CMM at level 4.
- Information that can be used to develop software standards that are consistent with the CMM at level 4.

What the standards checklists are not

The standards checklists contain only what is recommended by the CMM, and *are not complete standards in themselves.* For example, the standard for the software development plan (SDP) contains only content recommended by the CMM. Other sources for the content of a SDP should also be considered, such as ANSI/IEEE Std 1058.1-1987, DOD-STD-2167, DI-MCCR-80030, etc.

In this section

This section covers the following standards:

Standard	KPA	See Page
Project's quantitative process management plan	QPM	L4-Standards-2
Project's software quality plan	SQM	L4-Standards-3

Project's Quantitative Process Management Plan

Standard checklist

The following table contains what the CMM describes as the recommended content of a project's quantitative process management plan:

√	Recommended Content
	The goals and objectives of the quantitative process management activities. (L4-7, A2, 1)
	The software tasks or other software activities that will be measured and analyzed. (L4-8, A2, 2)
	The instrumentation of the project's defined software process. (L4-8, A2, 3)
	The quantitative process management activities to be performed and the schedule for these activities. (L4-8, A2, 4)
	The groups and individuals responsible for the quantitative process management activities. (L4-8, A2, 5)
	The resources required to perform the quantitative process management activities, including staff and tools. (L4-8, A2, 6)
	The procedures to be followed in performing the quantitative process management activities. (L4-8, A2, 7)

Project's Software Quality Plan

Standard checklist

The following table contains what the CMM describes as the recommended content of a project's software quality plan:

√	Recommended Content
	The points in the process where software quality is measured. (L4-26, A2, 1)
	The high-leverage quality goals for the software products. (L4-26, A2, 2)
	The actions that the software project will implement to improve on past quality performance. (L4-26, A2, 3)
	The activities to measure software product quality. (L4-26, A2, 4)
	Quality goals for software work products, as appropriate. (L4-26, A2, 5)
	The actions that will be taken when the software product quality is projected not to meet the quality goals. (L4-26, A2, 6)

Level 4 Process Checklists

Overview

Section purpose

The purpose of the process checklists is to provide:

- Guidance in identifying which processes are required by the CMM at level 4.
- Criteria that an organization can use to evaluate its software processes to determine if they are consistent with the CMM at level 4.
- Information that can be used to develop software processes that are consistent with the CMM at level 4.

In this section

This section contains checklists for the following key process areas:

Key Process Area	See Page
Quantitative Process Management	L4-Process-3
Software Quality Management	L4-Process-31

Quantitative Process Management (QPM) Process

QPM Process - Overview

QPM process purpose

The purpose of Quantitative Process Management is to control the process performance of the software project quantitatively. Software process performance represents the actual results achieved from following a software process. (L4-1)

QPM process description

Quantitative Process Management involves establishing goals for the performance of the project's defined software process, which is described in the Integrated Software Management key process area, taking measurements of the process performance, analyzing these measurements, and making adjustments to maintain process performance within acceptable limits. When the process performance is stabilized within acceptable limits, the project's defined software process, the associated measurements, and the acceptable limits for the measurements are established as a baseline and used to control process performance quantitatively.

The organization collects process performance data from the software projects and uses these data to characterize the process capability (i.e., the process performance a new project can expect to attain) of the organization's standard software process, which is described in the Organization Process Definition key process area. Process capability describes the range of expected results from following a software process (i.e., the most likely outcomes that are expected from the next software project the organization undertakes). These process capability data are, in turn, used by the software projects to establish and revise their process performance goals and to analyze the performance of the projects' defined software processes. (L4-1)

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Section overview

The table below contains a description and the location of each checklist for this key process area.

Checklist	Description	Page
Roles	List of roles participating in process activities.	L4-Process-5
Entry Criteria	Description of when the process can start.	L4-Process-9
Inputs	Description of the work products used by the process.	L4-Process-11
Activities	Description of the activities of the process.	L4-Process-13
Outputs	Description of the work products produced by the process.	L4-Process-15
Exit Criteria	Description of when the process is complete.	L4-Process-17
Reviews and Audits	List of reviews and audits.	L4-Process-23
Work Products Managed and Controlled	List of work products to be managed and controlled.	L4-Process-25
Measurements	Description of process measurements.	L4-Process-26
Documented Procedures	List of the activities to be completed according to a documented procedure.	L4-Process-27
Training	List of training.	L4-Process-28
Tools	List of tools.	L4-Process-29

QPM Process - Roles

Roles

The table below lists the roles and the activities in which they participate in the quantitative process management process.

√	Role	Activities Participated in...	Reference
	Group responsible for the organization's software process activities (e.g., software engineering process group)	❑ The (group that is responsible for coordinating the quantitative process management activities for the organization) is either part of the **group responsible for the organization's software process activities (e.g., software engineering process group)** or its activities are closely coordinated with that group. (L4-4, Ab1, 1) ❑ The project's quantitative process management plan is reviewed by the **group responsible for the organization's software process activities (e.g., the software engineering process group)**. (L4-7, A1, 3)	
	Group responsible for coordinating the quantitative process management activities for the organization	The **group that is responsible for coordinating the quantitative process management activities for the organization** is either part of the group responsible for the organization's software process activities (e.g., software engineering process group) or its activities are closely coordinated with that group. (L4-4, Ab1, 1)	
	Individuals implementing or supporting quantitative process management	The **individuals implementing or supporting quantitative process management** receive required training to perform these activities. (L4-6, Ab4)	
	Managers of software-related groups	The **managers** and task leaders **of the** software engineering groups and other **software-related groups** perform the project's quantitative process management activities. (L4-4, Ab2, 1)	

	Managers of the software engineering groups	The **managers** and task leaders **of the software engineering groups** and other software-related groups perform the project's quantitative process management activities. (L4-4, Ab2, 1)	

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QPM Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the quantitative process management process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Project manager	The **project manager**, senior managers, software managers, and software task leaders receive specialized reports (documenting the results of the software project's quantitative process management activities) on request. (L4-12, A6, 4) The software project's activities for quantitative process management are reviewed with the **project manager** on both a periodic and event-driven basis. (L4-16, V2)	
	Senior management	❑ The software managers, software task leaders, and **senior management** receive regular reports (documenting the results of the software project's quantitative process management activities) appropriate for their needs. (L4-12, A6, 2) ❑ The activities for quantitative process management are reviewed with **senior management** on a periodic basis. (L4-15, V1)	
	Senior manager	The project manager, **senior managers**, software managers, and software task leaders receive specialized reports (documenting the results of the software project's quantitative process management activities) on request. (L4-12, A6, 4)	
	Software engineering group **or** **Members of the software engineering group**	The **members of the software engineering group** and other software-related groups receive orientation on the goals and value of quantitative process management. (L4-6, Ab5)	

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QPM Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the quantitative process management process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Software manager	❑ The **software managers**, software task leaders, and senior management receive regular reports (documenting the results of the software project's quantitative process management activities) appropriate for their needs. (L4-12, A6, 2) ❑ The project manager, senior managers, **software managers**, and software task leaders receive specialized reports (documenting the results of the software project's quantitative process management activities) on request. (L4-12, A6, 4)	
	Software-related groups **or** **Members of software-related groups**	The **members of the** software engineering group and other **software-related groups** receive orientation on the goals and value of quantitative process management. (L4-6, Ab5)	
	Software quality assurance (SQA) group	❑ The **software quality assurance group** receives regular reports (documenting the results of the software project's quantitative process management activities) appropriate to its needs. (L4-12, A6, 3) ❑ The **software quality assurance group** reviews and/or audits the activities and work products for quantitative process management and reports the results. (L4-16, V3)	

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QPM Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the quantitative process management process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Software task leaders	❑ The software managers, **software task leaders**, and senior management receive regular reports (documenting the results of the software project's quantitative process management activities) appropriate for their needs. (L4-12, A6, 2) ❑ The project manager, senior managers, software managers, and **software task leaders** receive specialized reports (documenting the results of the software project's quantitative process management activities) on request. (L4-12, A6, 4)	
	Task leaders of other software-related groups	The managers and **task leaders of the** software engineering groups and **other software-related groups** perform the project's quantitative process management activities. (L4-4, Ab2, 1)	
	Task leaders of the software engineering groups	The managers and **task leaders of the software engineering groups** and other software-related groups perform the project's quantitative process management activities. (L4-4, Ab2, 1)	

QPM Process - Entry Criteria

Input-based entry criteria

The CMM recommends that inputs satisfy the states described in the table below before entering the quantitative process management process.

√	Input	State	References
	Project's quantitative process management plan	is documented. (L4-2, C1, 1)	
	Sensitive data relating to individuals' performance	❑ are protected. (L4-3, C1, 2) ❑ (access to) is appropriately controlled. (L4-3, C1, 2)	

General entry criteria

The CMM recommends that the conditions described in the table below be satisfied before entering the quantitative process management process.

√	Condition	References
	The project follows a written organizational policy for measuring and quantitatively controlling the performance of the project's defined software process. (L4-2, C1) [Refer to Level 4 Policies for additional information regarding QPM policy.]	
	The organization follows a written policy for analyzing the process capability of the organization's standard software process. (L4-3, C2) [Refer to Level 4 Policies for additional information regarding QPM policy.]	
	A **group that is responsible for coordinating the quantitative process management activities for the organization** exists. (L4-4, Ab1) ❑ The **group that is responsible for coordinating the quantitative process management activities for the organization** is either part of the **group responsible for the organization's software process activities (e.g., software engineering process group)** or its activities are closely coordinated with that group. (L4-4, Ab1, 1)	
	Adequate resources and funding are provided for the quantitative process management activities. (L4-4, Ab2)	
	An organization-wide measurement program exists. (L4-5, Ab2, 2)	
	Tools to support quantitative process management are made available. (L4-5, Ab2, 3)	

	Support exists for collecting, recording, and analyzing data for selected process and product measurements. (L4-5, Ab3)	

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QPM Process - Entry Criteria, Continued

General entry criteria, continued

The CMM recommends that the conditions described in the table below be satisfied before entering the quantitative process management process, continued from the previous page.

√	Condition	References
	The **individuals implementing or supporting quantitative process management** receive required training to perform these activities. (L4-6, Ab4)	
	The **members of the software engineering group** and **other software-related groups** receive orientation on the goals and value of quantitative process management. (L4-6, Ab5)	

QPM Process - Inputs

Inputs

The table below lists the recommended inputs to the quantitative process management process.

√	Input	Org. Input	References
	Actual process performance. (L4-12, A5, 7)		
	Defined acceptable limits for each measurement. (L4-12, A5, 7)		
	Description of the project's defined software process. (L4-7, A1, 1.6)		
	Expected mean values for each measurement. (L4-11, A5, 6)		
	Expected variance values for each measurement. (L4-11, A5, 6)		
	Goals of the organization's measurement program. (L4-17, V3, 3.4)		
	Goals of the quantitative process management activities. (L4-7, A2, 1)		
	Measured performance of other projects' defined software processes. (L4-7, A1, 1.5)		
	Objectives of the organization's measurement program. (L4-17, V3, 3.4)		
	Objectives of the quantitative process management activities. (L4-7, A2, 1)		
	Organization's measurement goals. (L4-9, A4, 1)		
	Organization's measurement objectives. (L4-9, A4, 1)		
	Organization's standard software process. (L4-7, A1, 1.3)		
	Organization's strategic goals for product development cycle time. (L4-6, A1, 1.1)		
	Organization's strategic goals for product quality. (L4-6, A1, 1.1)		
	Organization's strategic goals for productivity. (L4-6, A1, 1.1)		
	Process capability baseline of the organization's standard software process. (L4-3, C2, 1)		

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QPM Process - Inputs, Continued

Inputs, continued

The table below lists the recommended inputs to the quantitative process management process, continued from the previous page.

√	Input	Org. Input	References
	Process capability trends for the organization's standard software process. (L4-13, A7, 4)		
	Project's defined software process. (L4-2, C1)		
	Project's goals for product development cycle time. (L4-7, A1, 1.4)		
	Project's goals for software product's quality. (L4-7, A1, 1.4)		
	Project's goals for productivity. (L4-7, A1, 1.4)		
	Project's measurement of process performance. (L4-3, C2, 1)		
	Project's quantitative process management plan. (L4-2, C1, 1)		
	Schedule for quantitative process management activities to be performed. (L4-8, A2, 4)		
	Sensitive data relating to individuals' performance. (L4-3, C1, 2)		
	Software project's measurement goals. (L4-9, A4, 1)		
	Software project's measurement objectives. (L4-9, A4, 1)		

QPM Process - Activities

Activities

The table below lists the recommended activities for the quantitative process management process.

√	Activities	References
	The software project's plan for quantitative process management is developed according to a documented procedure. (L4-6, A1) [Refer to Level 4 Procedure Checklists for additional information.]	
	The software project's quantitative process management activities are performed in accordance with the project's quantitative process management plan. (L4-7, A2)	
	The strategy for the data collection and the quantitative analyses to be performed are determined based on the project's defined software process. (L4-8, A3)	
	The measurement data used to control the project's defined software process quantitatively are collected according to a documented procedure. (L4-9, A4) [Refer to Level 4 Procedure Checklists for additional information.]	
	The project's defined software process is analyzed and brought under quantitative control according to a documented procedure. (L4-10, A5) [Refer to Level 4 Procedure Checklists for additional information.]	
	Reports documenting the results of the software project's quantitative process management activities are prepared and distributed. (L4-12, A6)	
	The process capability baseline for the organization's standard software process is established and maintained according to a documented procedure. (L4-13, A7) [Refer to Level 4 Procedure Checklists for additional information.]	
	Measurements are made and used to determine the status of the activities for quantitative process management. (L4-15, M1)	
	The activities for quantitative process management are reviewed with **senior management** on a periodic basis. (L4-15, V1)	

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QPM Process - Activities, Continued

Activities, continued

The table below lists the recommended activities for the quantitative process management process, continued from the previous page.

√	Activities	References
	The software project's activities for quantitative process management are reviewed with the **project manager** on both a periodic and event-driven basis. (L4-16, V2)	
	The **software quality assurance group** reviews and/or audits the activities and work products for quantitative process management and reports the results. (L4-16, V3) [Refer to QPM Process Reviews and Audits for additional information.]	

QPM Process - Outputs

Outputs

The table below lists the recommended outputs produced by the quantitative process management process.

√	Output	Org. Output	References
	Acceptable limits for each measurement. (L4-11, A5, 5)		
	Actual measurement data. (L4-12, A5, 8.2)		
	Actual values of each measurement. (L4-11, A5, 6)		
	Changes to the organization's standard software process. (L4-15, A7, 7)		
	Data collection points. (L4-9, A3, 3)		
	Data for selected process measurements or measurement data on the process activities throughout the project's defined software process. (L4-5, Ab3)		
	Data for selected product measurements. (L4-5, Ab3)		
	Definitions of measurement data (used to control the project's defined software process quantitatively). (L4-9, A4, 2)		
	Expected values for mean (for each measurement). (L4-11, A5, 4)		
	Expected values for variance (for each measurement). (L4-11, A5, 4)		
	Goals of the quantitative process management activities. (L4-7, A2, 1)		
	Intended use and analysis of each measurement. (L4-9, A4, 2)		
	Measurement data used to control the project's defined software process quantitatively. (L4-9, A4)		
	Measurements (to determine the status of the quantitative process management activities). (L4-15, M1)		
	Objectives of the quantitative process management activities. (L4-7, A2, 1)		
	Process capability baseline of the organization's standard software process. (L4-3, C2, 1)		

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QPM Process - Outputs, Continued

Outputs, continued

The table below lists the recommended outputs produced by the quantitative process management process, continued from the previous page.

√	Output	Org. Output	References
	Process control points at which (each measurement that is used to control the project's defined software process quantitatively) will be collected. (L4-9, A4, 2)		
	Projects' measurements of process performance. (L4-3, C2, 1)		
	Project's process performance baseline. (L4-11, A5, 5)		
	Project's process performance goals. (L4-4, C2, 2)		
	Project's software process data. (L4-13, A7, 1)		
	Project's quantitative process management plan. (L4-6, A1)		
	Quantitative process management data. (L4-16, V3, 3)		
	Reports documenting the results of the software project's quantitative process management activities. (L4-12, A6)		
	Results of software quality assurance group reviews and/or audits of the activities and work products for quantitative process management. (L4-16, V3)		
	Results of the data analysis. (L4-12, A6, 1)		
	Schedule for quantitative process management activities to be performed. (L4-8, A2, 4)		
	Strategy for the data collection and the quantitative analyses to be performed. (L4-8, A3)		

QPM Process - Exit Criteria

Output-based exit criteria

The CMM recommends that outputs satisfy the states described in the table below to exit the quantitative process management process.

√	Output	State	References
	Acceptable limits for each measurement	❑ are defined. (L4-11, A5, 5) ❑ have baselines established when the project's defined software process is controlled quantitatively. (L4-12, A5, 8.3)	
	Actual measurement data	have baselines established when the project's defined software process is controlled quantitatively. (L4-12, A5, 8.2)	
	Actual values of each measurement	are compared to the expected values of the mean and variance. (L4-11, A5, 6)	
	Changes to the organization's standard software process	❑ are tracked. (L4-15, A7, 7) ❑ are analyzed to assess their effects on the process capability baseline. (L4-15, A7, 7)	
	Data for selected process measurements or Measurement data on the process activities throughout the project's defined software process	❑ are identified. (L4-11, A5, 2) ❑ are collected. (L4-11, A5, 2) ❑ are analyzed. (L4-11, A5, 2) ❑ appropriately characterize the process they represent. (L4-11, A5, 3)	
	Definitions of measurement data (used to control the project's defined software process quantitatively)	❑ are defined. (L4-9, A4, 2) ❑ have baselines established when the project's defined software process is controlled quantitatively. (L4-12, A5, 8.1)	
	Expected values (for mean for each measurement)	are specified for each measurement. (L4-11, A5, 4)	
	Expected values (for variance for each measurement)	are specified for each measurement. (L4-11, A5, 4)	

	Intended use and analysis of each measurement	is defined. (L4-9, A4, 2)	

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QPM Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the quantitative process management process, continued from the previous page.

√	Output	State	References
	Measurement data used to control the project's defined software process quantitatively	❑ are collected according to a documented procedure. (L4-9, A4) ❑ support the organization's and the software project's measurement goals and objectives. (L4-9, A4, 1) ❑ are defined. (L4-9, A4, 2) ❑ are chosen from the entire software life cycle (e.g., both the development and post-development stages). (L4-9, A4, 3) ❑ cover the properties of the key software process activities and major software work products. (L4-10, A4, 4) ❑ are uniformly collected across the software projects when the data relate to the organization's standard software process. (L4-10, A4, 5) ❑ are a natural result of the software activities where possible. (L4-10, A4, 6) ❑ are selected to support predefined analysis activities. (L4-10, A4, 7) ❑ are independently assessed for validity. (L4-10, A4, 8) ❑ are stored in the organization's software process database as appropriate. (L4-10, A4, 9)	
	Measurements (to determine the status of the activities for quantitative process management)	❑ are made. (L4-15, M1) ❑ are used. (L4-15, M1)	

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QPM Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the quantitative process management process, continued from the previous page.

√	Output	State	References
	Process capability baseline of the organization's standard software process	❑ is established according to a documented procedure. (L4-13, A7) ❑ is maintained according to a documented procedure. (L4-13, A7) ❑ is documented. (L4-13, A7, 3) ❑ is managed and controlled. (L4-14, A7, 5)	
	Process control points at which (each measurement that is used to control the project's defined software process quantitatively) will be collected	are defined. (L4-9, A4, 2)	
	Projects' measurements of process performance	are analyzed to establish and maintain a process capability baseline for the organization's standard software process. (L4-3, C2, 1)	
	Project's process performance baseline	❑ is established. (L4-11, A5, 5) ❑ is managed and controlled. (L4-12, A5, 9) ❑ is incorporated, as appropriate, into the process capability baseline for the organization's standard software process. (L4-13, A7, 2) ❑ (new) is established for a software project substantially different from past projects as part of tailoring the organization's standard software process. (L4-14, A7, 6)	
	Project's process performance goals	are established. (L4-4, C2, 2)	

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QPM Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the quantitative process management process, continued from the previous page.

√	Output	State	References
	Project's software process data	as summarized in its process performance baseline, are recorded in the organization's software process database. (L4-13, A7, 1)	

	Project's quantitative process management plan	❑ is developed according to a documented procedure. (L4-6, A1)
		❑ is based on: (L4-6, A1, 1)
		  ❑ the organization's strategic goals for product quality, productivity, and product development cycle time;
		  ❑ the organization's measurement program;
		  ❑ the organization's standard software process;
		  ❑ the project's goals for the software product's quality, productivity, and product development cycle time;
		  ❑ the measured performance of other projects' defined software processes; and
		  ❑ the description of the project's defined software process.
		❑ undergoes peer review. (L4-7, A1, 2)
		❑ is reviewed by the **group responsible for the organization's software process activities (e.g., the software engineering process group)**. (L4-7, A1, 3)
		❑ is managed and controlled. (L4-7, A1, 4)	

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QPM Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the quantitative process management process, continued from the previous page.

√	Output	State	References
	Reports documenting the results of the software project's quantitative process management activities	❑ are prepared. (L4-12, A6) ❑ are distributed. (L4-12, A6)	
	Results of **software quality assurance group** reviews and/or audits of the activities and work products for quantitative process management	are reported. (L4-16, V3)	
	Results of the data analysis	are reviewed with those affected by the data before they are reported to anyone else. (L4-12, A6, 1)	
	Strategy for the data collection and the quantitative analyses to be performed	are determined based on the project's defined software process. (L4-8, A3)	

General Exit Criteria

The CMM recommends that the conditions described in the table below be satisfied to exit the quantitative process management process.

√	Condition	References
	Each project implements a documented plan to bring the project's defined software process under quantitative control. (L4-2, C1, 1)	
	The process capability baseline for the organization's standard software process is used by the software projects in establishing their process performance goals. (L4-4, C2, 2)	
	The software project's quantitative process management activities are performed in accordance with the project's quantitative process management plan. (L4-7, A2)	

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QPM Process - Exit Criteria, Continued

General exit criteria, continued

The CMM recommends that the conditions described in the table below be satisfied to exit the quantitative process management process, continued from the previous page.

√	Condition	References
	The strategy for the data collection and the quantitative analyses to be performed are determined based on the project's defined software process. (L4-8, A3) The attributes of the project's defined software process that are considered include: ❑ The tasks, the activities, and their relationships to each other. ❑ The software work products and their relationships to each other and to the project's defined software process. ❑ The process control points and data collection points.	
	The project's defined software process is analyzed and brought under quantitative control according to a documented procedure. (L4-10, A5)	
	The **software managers**, **software task leaders**, and **senior management** receive regular reports appropriate for their needs. (L4-12, A6, 2)	
	The **software quality assurance group** receives regular reports (documenting the results of the software project's quantitative process management activities) appropriate to its needs. (L4-12, A6, 3)	
	The **project manager**, **senior managers**, **software managers**, and **software task leaders** receive specialized reports (documenting the results of the software project's quantitative process management activities) on request. (L4-12, A6, 4)	
	Process capability trends for the organization's standard software process are examined to predict likely problems or opportunities for improvements. (L4-13, A7, 4)	
	The activities for quantitative process management are reviewed with **senior management** on a periodic basis. (L4-15, V1)	
	The software project's activities for quantitative process management are reviewed with the **project manager** on both a periodic and event-driven basis. (L4-16, V2)	
	The **software quality assurance group** reviews and/or audits the activities and work products for quantitative process management and reports the results. (L4-16, V3)	

QPM Process - Reviews and Audits

Reviews and audits

The table below lists the recommended reviews and audits for the quantitative process management process.

√	Review or Audit	Review Participants	References
	The project's quantitative process management plan undergoes peer review. (L4-7, A1, 2)	**Not specified in the CMM**	
	The project's quantitative process management plan is reviewed by the **group responsible for the organization's software process activities (e.g., the software engineering process group)**. (L4-7, A1, 3)	**Group responsible for the organization's software process activities (e.g., the software engineering process group)**	
	The results of the data analysis are reviewed with those affected by the data before they are reported to anyone else. (L4-12, A6, 1)	**Not specified in the CMM**	
	The activities for quantitative process management are reviewed with **senior management** on a periodic basis. (L4-15, V1)	**Senior management**	
	The software project's activities for quantitative process management are reviewed with the **project manager** on both a periodic and event-driven basis. (L4-16, V2)	**Project manager**	

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QPM Process - Reviews and Audits, Continued

Reviews and audits, continued

The table below lists the recommended reviews and audits for the quantitative process management process, continued from the previous page.

√	Review or Audit	Review Participants	References
	The **software quality assurance group** reviews and/or audits the activities and work products for quantitative process management and reports the results. (L4-16, V3) At a minimum, the reviews and/or audits verify that: ❑ The plans for the quantitative process management activities are followed. ❑ The procedures for quantitative process management are followed. ❑ The collection and analysis of quantitative process management data are performed as required, including verification that: ❑ the needed data exist, ❑ the needed data are collected, ❑ the data collected are needed, ❑ the data collected support the goals and objectives of the organization's measurement program, ❑ the cost of collecting the data is justified by the usefulness of the data, ❑ the data are collected at the correct point in the software life cycle, ❑ the data are accurate and correct, ❑ the data are timely, and ❑ the confidentiality of the data is properly protected.	**Software quality assurance group**	

QPM Process - Work Products Managed and Controlled

Work products managed and controlled

The table below lists the work products that are recommended to be managed and controlled during the quantitative process management process.

√	Work Products Managed and Controlled	References
	Project's quantitative process management plan. (L4-7, A1, 4)	
	Process performance baseline for the software project. (L4-12, A5, 9)	
	Process capability baseline for the organization's standard software process. (L4-14, A7, 5)	

QPM Process - Measurements

Measurements

The table below lists the measurements recommended for the quantitative process management process.

√	Measurements	References
	Measurements to determine the status of the activities for quantitative process management. (L4-15, M1) Examples of measurements include: ❑ The cost over time for the quantitative process management activities, compared to the plan. ❑ The accomplishment of schedule milestones for quantitative press management activities, compared to the approved plan (e.g., establishing the process measurements to be used on the project, determining how the process data will be collected, and collecting the process data).	

QPM Process - Documented Procedures

Documented procedures

The table below lists the activities for the quantitative process management process recommended to be performed according to a documented procedure.

√	Documented Procedure(s)	References
	The software project's plan for quantitative process management is developed according to a documented procedure. (L4-6, A1) [Refer to Level 4 Procedure Checklists for additional information.]	
	The measurement data used to control the project's defined software process quantitatively are collected according to a documented procedure. (L4-9, A4) [Refer to Level 4 Procedure Checklists for additional information.]	
	The project's defined software process is analyzed and brought under quantitative control according to a documented procedure. (L4-10, A5) [Refer to Level 4 Procedure Checklists for additional information.]	
	The process capability baseline for the organization's standard software process is established and maintained according to a documented procedure. (L4-13, A7) [Refer to Level 4 Procedure Checklists for additional information.]	

QPM Process - Training

Training

The table below lists the training recommended for the quantitative process management process.

√	Training	References
	The **individuals implementing or supporting quantitative process management** receive required training to perform these activities. (L4-6, Ab4)	
	The **members of the software engineering group** and **other software-related groups** receive orientation on the goals and value of quantitative process management. (L4-6, Ab5)	

QPM Process - Tools

Tools

The table below lists the tools recommended for the quantitative process management process.

√	Tools	References
	Tools to support quantitative process management. (L4-5, Ab2, 3) Examples of support tools include: ❑ software source code analyzers, ❑ automated test coverage analyzers, ❑ database systems, ❑ quantitative analysis packages, and ❑ problem tracking packages.	
	Organization's software process database. (L4-10, A4, 9)	

Software Quality Management (SQM) Process

SQM Process - Overview

SQM process purpose

The purpose of Software Quality Management is to develop a quantitative understanding of the quality of the project's software products and achieve specific quality goals. (L4-19)

SQM process description

Software Quality Management involves defining quality goals for the software products, establishing plans to achieve these goals, and monitoring and adjusting the software plans, software work products, activities, and quality goals to satisfy the needs and desires of the customer and end user for high quality products.

The practices of Software Quality Management build on the practices of the Integrated Software Management and Software Product Engineering key process areas, which establish and implement the project's defined software process, and the Quantitative Process Management key process area, which establishes a quantitative understanding of the ability of the project's defined software process to achieve the desired results.

Quantitative goals are established for the software products based on the needs of the organization, the customer, and the end users. So that these goals may be achieved, the organization establishes strategies and plans, and the project specifically adjusts its defined software process, to accomplish the quality goals. (L4-19)

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Section overview

The table below contains a description and the location of each checklist for this key process area.

Checklist	Description	Page
Roles	List of roles participating in process activities.	L4-Process-33
Entry Criteria	Description of when the process can start.	L4-Process-36
Inputs	Description of the work products used by the process.	L4-Process-37
Activities	Description of the activities of the process.	L4-Process-39
Outputs	Description of the work products produced by the process.	L4-Process-42
Exit Criteria	Description of when the process is complete.	L4-Process-44
Reviews and Audits	List of reviews and audits.	L4-Process-50
Work Products Managed and Controlled	List of work products to be managed and controlled.	L4-Process-51
Measurements	Description of process measurements.	L4-Process-52
Documented Procedures	List of the activities to be completed according to a documented procedure.	L4-Process-53
Training	List of training.	L4-Process-54
Tools	List of tools.	L4-Process-55

SQM Process - Roles

Roles

The table below lists the roles and the activities in which they participate in the software quality management process.

√	Role	Activities Participated in...	Reference
	Affected groups	❑ The software quality plan is reviewed by **affected groups** and individuals. (L4-24, A1, 8) ❑ The software quality plan is available to all **affected groups** and individuals. (L4-25, A1, 11)	
	Affected individuals	❑ The software quality plan is reviewed by **affected** groups and **individuals**. (L4-24, A1, 8) ❑ The software quality plan is available to all **affected** groups and **individuals**. (L4-25, A1, 11)	
	Customer	The **customer** and end users participate in quality tradeoff decisions, as appropriate. (L4-30, A4, 5.3)	
	End users	The customer and **end users** participate in quality tradeoff decisions, as appropriate. (L4-30, A4, 5.3)	
	Individuals implementing and supporting software quality management	The **individuals implementing and supporting software quality management** receive required training to perform their activities. (L4-22, Ab2)	
	Project manager	The activities for software quality management are reviewed with the **project manager** on both a periodic and event-driven basis. (L4-31, V2)	
	Senior management	❑ **Senior management** reviews the software quality plans. (L4-25, A1, 9) ❑ The activities for software quality management are reviewed with **senior management** on a periodic basis. (L4-31, V1)	

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SQM Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the software quality management process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Software engineering group **or** **Members of the software engineering group**	❑ Responsibilities for software quality management are defined and assigned to the **software engineering group** and other software-related groups. (L4-21, C1, 4) ❑ Criteria are established to enable the **groups** to determine their success in achieving the quality goals for the software products. (L4-21, C1, 4.1) ❑ The **members of the software engineering group** and other software-related groups receive required training in software quality management. (L4-22, Ab3)	
	Software-related groups **or** **Members of the software-related groups**	❑ Responsibilities for software quality management are defined and assigned to the software engineering group and other **software-related groups**. (L4-21, C1, 4) ❑ Criteria are established to enable the **groups** to determine their success in achieving the quality goals for the software products. (L4-21, C1, 4.1) ❑ The **members of the** software engineering group and other **software-related groups** receive required training in software quality management. (L4-22, Ab3)	
	Specialty engineers in areas such as safety and reliability	**Specialty engineers in areas such as safety and reliability** are available to help set the software quality goals and review progress towards the goals. (L4-21, Ab1, 1)	
	Software quality assurance (SQA) group	The **software quality assurance group** reviews and/or audits the activities and work products for software quality management and reports the results. (L4-32, V3)	

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SQM Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the software quality management process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Subcontractor	The software project's quantitative quality goals for the products are allocated appropriately to the **subcontractors** delivering software products to the project. (L4-30, A5)	
	Team performing the software task	The software tasks are planned and performed to address the project's software quality goals. At the beginning of a software task, **the team performing the task**: (L4-29, A4, 1) ❑ reviews the quality goals for the software product, ❑ determines the quality goals applicable to the software task, ❑ identifies its plans to achieve the software quality goals, and ❑ reviews changes made to the process to meet the software quality goals.	

SQM Process - Entry Criteria

Input-based entry criteria

There are no input-based entry criteria in the software quality management process.

General entry criteria

The CMM recommends that the conditions described in the table below be satisfied before entering the software quality management process.

√	Condition	References
	The project follows a written organizational policy for managing software quality. (L4-20, C1) [Refer to Level 4 Policies for additional information regarding SQM policy.]	
	Adequate resources and funding are provided for managing the quality of the software products. (L4-21, Ab1)	
	Specialty engineers in areas such as safety and reliability are available to help set the software quality goals and review progress towards the goals. (L4-21, Ab1, 1)	
	Tools to support predicting, measuring, tracking, and analyzing software quality are made available. (L4-21, Ab1, 2)	
	The **individuals implementing and supporting software quality management** receive required training to perform their activities. (L4-22, Ab2)	
	The **members of the software engineering group** and other **software-related groups** receive required training in software quality management. (L4-22, Ab3)	

SQM Process - Inputs

Inputs

The table below lists the recommended inputs to the software quality management process.

√	Input	Org. Input	References
	Alternative software quality goals. (L4-30, A4, 5.2)		
	Characteristic(s) of software product quality (that describe how well the software product will perform or how well it can be developed and maintained). (L4-27, A3, 3)		
	Cost for achieving the software quality goals. (L4-30, A4, 5.1)		
	Desired values (for each characteristic of software product quality). (L4-27, A3, 3)		
	Long-term business strategies. (L4-30, A4, 5.2)		
	Plans (software quality) for previous or current projects in the organization. (L4-24, A1, 5)		
	Points in the process where software quality is measured. (L4-26, A2, 1)		
	Products' quantitative quality goals. (L4-29, A4)		
	Project's defined software process. (L4-20, C1, 2)		
	Project's software quality goals. (L4-29, A4, 1)		
	Project's software quality plan or software quality plan. (L4-25, A2) [Refer to Level 4 Standards for additional information regarding the project's software quality plan.]		
	Quality goals for the software life-cycle stages. (L4-29, A3, 6)		
	Quality goals for the software products. (L4-21, C1, 4.1)		
	Quality measurements (of the project's software products). (L4-30, A4, 3)		

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SQM Process - Inputs, Continued

Inputs, continued

The table below lists the recommended inputs to the software quality management process, continued from the previous page.

√	Input	Org. Input	References
	Quality plans of the organization. (L4-24, A1, 4)		
	Required values (for each characteristic of software product quality). (L4-27, A3, 3)		
	Short-term priorities. (L4-30, A4, 5.2)		
	Significant changes to the allocated requirements. (L4-24, A1, 6)		
	Software plans. (L4-30, A4, 5.4)		
	Software project's quantitative quality goals for the products. (L4-30, A5)		
	Software quality goals. (L4-23, A1, 2)		
	Software quality needs of the customer. (L4-23, A1, 1)		
	Software quality needs of the end users. (L4-23, A1, 1)		
	Software quality needs of the organization. (L4-23, A1, 1)		
	Software quality priorities of the customer. (L4-23, A1, 2)		
	Software quality priorities of the end users. (L4-23, A1, 2)		
	Software quality priorities of the organization. (L4-23, A1, 2)		
	Software work products or work products. (L4-30, A4, 5.4)		
	Subcontractor delivered software products (to the project). (L4-30, A5)		
	System requirements allocated to software or allocated requirements. (L4-23, A1, 2)		

SQM Process - Activities

Activities

The table below lists the recommended activities for the software quality management process.

√	Activities	References
	The project's software quality plan is developed and maintained according to a documented procedure. (L4-23, A1) [Refer to Level 4 Procedure Checklists for additional information.]	
	The project's software quality plan is the basis for the project's activities for software quality management. (L4-25, A2)	
	The project's quantitative quality goals for the software products are defined, monitored, and revised throughout the software life cycle. (L4-27, A3) ❑ Characteristics of product quality that describe how well the software product will perform or how well it can be developed and maintained are identified. ❑ The measurements used to quantify the characteristics of software product quality are identified. ❑ For each characteristic of software product quality, measurable, numeric values, based on the required and desired values, are selected as quality goals for the product. ❑ Quality goals for the software products are documented in the project's software quality plan. ❑ Quality goals for each software life-cycle stage are defined and documented. ❑ Quality goals for the software products and software life-cycle stages are revised as understanding of the products and understanding of the organization's, customer's, and end users' needs evolve.	

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SQM Process - Activities, Continued

Activities, continued

The table below lists the recommended activities for the software quality management process, continued from the previous page.

√	Activities	References
	The quality of the project's software products is measured, analyzed, and compared to the products' quantitative quality goals on an event-driven basis. (L4-29, A4) ❑ The software tasks are planned and performed to address the project's software quality goals. At the beginning of a software task, **the team performing the task**: ❑ reviews the quality goals for the software product, ❑ determines the quality goals applicable to the software task, ❑ identifies its plans to achieve the software quality goals, and ❑ reviews changes made to the process to meet the software quality goals. ❑ The quality of the software work products of each software life-cycle stage are measured. ❑ The quality measurements are analyzed and compared to the software quality goals to determine whether the quality goals are satisfied. ❑ Appropriate actions, consistent with the software quality plan, are taken to bring the quality measures of the products in line with the software quality goals. ❑ When it is determined that the software quality goals conflict (that is, one goal cannot be achieved without compromising another goal), actions are taken to resolve the conflict. ❑ The cost for achieving the software quality goals is analyzed. ❑ Alternative software quality goals are considered in light of long-term business strategies as well as short-term priorities. ❑ The **customer** and **end users** participate in quality tradeoff decisions, as appropriate. ❑ The software work products and plans are revised, as appropriate, to reflect the results of the tradeoffs.	
	The software project's quantitative quality goals for the products are allocated appropriately to the **subcontractors** delivering software products to the project. (L4-30, A5)	

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SQM Process - Activities, Continued

Activities, continued

The table below lists the recommended activities for the software quality management process, continued from the previous page.

√	Activities	References
	Measurements are made and used to determine the status of the software quality management activities. (L4-31, M1)	
	The activities for software quality management are reviewed with **senior management** on a periodic basis. (L4-31, V1)	
	The activities for software quality management are reviewed with the **project manager** on both a periodic and event-driven basis. (L4-31, V2)	
	The **software quality assurance group** reviews and/or audits the activities and work products for software quality management and reports the results. (L4-32, V3) [Refer to SQM Process Reviews and Audits for additional information.]	

SQM Process - Outputs

Outputs

The table below lists the recommended outputs produced by the software quality management process.

√	Output	Org. Output	References
	Capability of the project's defined software process to satisfy the software quality goals. (L4-24, A1, 3)		
	Characteristics of product quality that describe how well the software product will perform or how well it can be developed and maintained. (L4-27, A3, 1)		
	Criteria to enable the **groups** (the **software engineering group** and other **software-related groups**) to determine their success in achieving the quality goals for the software products. (L4-21, C1, 4.1)		
	Measurements to determine the status of the software quality management activities. (L4-31, M1)		
	Measurements used for software quality management. (L4-20, C1, 2)		
	Measurements used to quantify the characteristics of software product quality. (L4-27, A3, 2)		
	Numeric values (for each characteristic of software product quality). (L4-27, A3, 3)		
	Plans to achieve the software quality goals. (L4-29, A4, 1.3)		
	Project's quantitative quality goals for the software products. (L4-27, A3)		
	Project's software quality plan. (L4-23, A1) [Refer to SPF Standards for additional information regarding the project's software quality plan.]		
	Quality goals applicable to the software task. (L4-29, A4, 1.2)		
	Quality goals for each software life-cycle stage. (L4-28, A3, 5)		
	Quality goals for the software products. (L4-20, C1, 3)		

	Quality of the project's software products. (L4-29, A4)		

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SQM Process - Outputs, Continued

Outputs, continued

The table below lists the recommended outputs produced by the software quality management process, continued from the previous page.

√	Output	Org. Output	References
	Quality of the software work products of each software life-cycle stage. (L4-29, A4, 2)		
	Responsibilities for software quality management. (L4-21, C1, 4)		
	Results (of **SQA group** reviews and/or audits of the activities and work products for software quality management). (L4-32, V3)		
	Results of the quality tradeoff decisions made when software quality goals conflict. (L4-30, A4, 5.3)		

SQM Process - Exit Criteria

Output-based exit criteria

The CMM recommends that outputs satisfy the states described in the table below to exit the software quality management process.

√	Output	Search Criteria/ Notes	References
	Capability of the project's defined software process to satisfy the software quality goals	❑ is assessed. (L4-24, A1, 3) ❑ is documented. (L4-24, A1, 3)	
	Characteristics of product quality (that describe how well the software product will perform or how well it can be developed and maintained)	are identified. (L4-27, A3, 1)	
	Criteria to enable the **group**s (the **software engineering group** and other **software-related groups**) to determine their success in achieving the quality goals for the software products	are established. (L4-21, C1, 4.1)	
	Measurements (to determine the status of the software quality management activities)	❑ are made. (L4-31, M1) ❑ are used. (L4-31, M1)	
	Measurements used for software quality management	❑ are defined. (L4-20, C1, 2) ❑ are collected. (L4-20, C1, 2) ❑ are based on the project's defined software process. (L4-20, C1, 2)	
	Measurements used to quantify the characteristics of software product quality	are identified. (L4-27, A3, 2)	

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SQM Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the software quality management process, continued from the previous page.

√	Output	State	References
	Numeric values (for each characteristic of software product quality)	❑ are measurable. (L4-27, A3, 3) ❑ are based on the required and desired values. (L4-27, A3, 3) ❑ are selected as quality goals for the product. (L4-27, A3, 3)	
	Plans to achieve the software quality goals	are identified by the **team performing the software task**. (L4-29, A4, 1.3)	
	Project's quantitative quality goals for the software products	❑ are defined. (L4-27, A3) ❑ are monitored throughout the software life cycle. (L4-27, A3) ❑ are revised throughout the software life cycle. (L4-27, A3)	

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SQM Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the software quality management process, continued from the previous page.

√	Output	State	References
	Project's software quality plan	❑ is developed according to a documented procedure. (L4-23, A1) ❑ is maintained according to a documented procedure. (L4-23, A1) ❑ satisfies the quality plans of the organization, as appropriate. (L4-24, A1, 4) ❑ is based on plans for previous or current projects in the organization, as appropriate. (L4-24, A1, 5) ❑ is updated at the start of the project. (L4-24, A1, 6) ❑ is updated at major project milestones. (L4-24, A1, 6) ❑ is updated whenever the allocated requirements change significantly. (L4-24, A1, 6) ❑ undergoes peer review. (L4-24, A1, 7) ❑ is reviewed by **affected groups** and **individuals**. (L4-24, A1, 8) ❑ is reviewed by **senior management**. (L4-25, A1, 9) ❑ is managed and controlled. (L4-25, A1, 10) ❑ is available to all **affected groups** and **individuals**. (L4-25, A1, 11)	

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SQM Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the software quality management process, continued from the previous page.

√	Output	State	References
	Quality goals applicable to the software task	are determined by the **team performing the software task**. (L4-29, A4, 1.2)	
	Quality goals for each software life-cycle stage	❑ are defined. (L4-28, A3, 5) ❑ are documented. (L4-28, A3, 5)	
	Quality goals for the software products	❑ are defined by the project. (L4-20, C1, 3) ❑ are documented in the project's software quality plan. (L4-28, A3, 4)	
	Quality of the project's software products	❑ is measured on an event-driven basis. (L4-29, A4) ❑ is analyzed on an event-driven basis. (L4-29, A4) ❑ is compared to the products' quantitative quality goals on an event-driven basis. (L4-29, A4)	
	Quality of the software work products of each software life-cycle stage	are measured. (L4-29, A4, 2)	
	Responsibilities for software quality management	❑ are defined. (L4-21, C1, 4) ❑ are assigned to the **software engineering group** and other **software-related groups**. (L4-21, C1, 4)	
	Results (of **SQA group** reviews and/or audits of the activities and work products for software quality management)	are reported. (L4-32, V3)	

SQM Process - Exit Criteria, Continued

General exit criteria

The CMM recommends that the conditions described in the table below be satisfied to exit the software quality management process.

√	Condition	References
	The project's software quality management activities support the organization's commitment to improve the quality of the software products. (L4-20, C1, 1)	
	The project defines the quality goals for the software products and monitors its progress towards them. (L4-20, C1, 3)	
	An understanding of the software quality needs of the organization, customer, and end users is developed as appropriate. (L4-23, A1, 1)	
	The software quality needs and priorities of the organization, customer, and end user are traceable to the system requirements allocated to software and the software quality goals. (L4-23, A1, 2)	
	The project's software quality plan is the basis for the project's activities for software quality management. (L4-25, A2)	
	Quality goals for the software products and software life-cycle stages are revised as understanding of the products and understanding of the organization's, customer's, and end users' needs evolve. (L4-29, A3, 6)	
	The software tasks are planned and performed to address the project's software quality goals. At the beginning of a software task, **the team performing the task**: (L4-29, A4, 1) ❑ Reviews the quality goals for the software product. (L4-29, A4, 1.1) ❑ Reviews changes made to the process to meet the software quality goals. (L4-29, A4, 1.4)	
	The quality measurements are analyzed and compared to the software quality goals to determine whether the quality goals are satisfied. (L4-30, A4, 3)	
	Appropriate actions, consistent with the software quality plan, are taken to bring the quality measures of the products in line with the software quality goals. (L4-30, A4, 4)	

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SQM Process - Exit Criteria, Continued

General exit criteria, continued

The CMM recommends that the conditions described in the table below be satisfied to exit the software quality management process, continued from the previous page.

√	Condition	References
	When it is determined that the software quality goals conflict (that is, one goal cannot be achieved without compromising another goal), actions are taken to resolve the conflict. (L4-30, A4, 5) ❑ The cost for achieving the software quality goals is analyzed. ❑ Alternative software quality goals are considered in light of long-term business strategies as well as short-term priorities. ❑ The **customer** and **end users** participate in quality tradeoff decisions, as appropriate. ❑ The software work products and plans are revised, as appropriate, to reflect the results of the tradeoffs.	
	The software project's quantitative quality goals for the products are allocated appropriately to the **subcontractors** delivering software products to the project. (L4-30, A5)	
	The activities for software quality management are reviewed with **senior management** on a periodic basis. (L4-31, V1)	
	The activities for software quality management are reviewed with the **project manager** on both a periodic and event-driven basis. (L4-31, V2)	
	The **software quality assurance group** reviews and/or audits the activities and work products for software quality management and reports the results. (L4-32, V3)	

SQM Process - Reviews and Audits

Reviews and audits

The table below lists the recommended reviews and audits for the software quality management process.

√	Review or Audit	Review Participants	References
	Specialty engineers in areas such as safety and reliability are available to help set the software quality goals and review progress towards the goals. (L4-21, Ab1, 1)	**Specialty engineers in areas such as safety and reliability**	
	The software quality plan undergoes peer review. (L4-24, A1, 7)	**Not specified in CMM**	
	The software quality plan is reviewed by **affected groups and individuals**. (L4-24, A1, 8)	**Affected groups and individuals**	
	Senior management reviews the software quality plans. (L4-25, A1, 9)	**Senior management**	
	The software tasks are planned and performed to address the project's software quality goals. At the beginning of a software task, **the team performing the task**: (L4-29, A4, 1) ❑ Reviews the quality goals for the software product. (L4-29, A4, 1.1) ❑ Reviews changes made to the process to meet the software quality goals. (L4-29, A4, 1.4)	**Team performing the software task**	
	The activities for software quality management are reviewed with **senior management** on a periodic basis. (L4-31, V1)	**Senior management**	
	The activities for software quality management are reviewed with the **project manager** on both a periodic and event-driven basis. (L4-31, V2)	**Project manager**	

	The **software quality assurance group** reviews and/or audits the activities and work products for software quality management and reports the results. (L4-32, V3) At a minimum, the reviews and/or audits verify: ❑ The preparation of the project's software quality plan. ❑ The process for establishing and tracking the software quality goals.	**Software quality assurance group**	

SQM Process - Work Products Managed and Controlled

Work products managed and controlled

The table below lists the work products that are recommended to be managed and controlled during the software quality management process.

√	Work Products Managed and Controlled	References
	Project's software quality plan. (L4-25, A1, 10)	

SQM Process - Measurements

Measurements

The table below lists the measurements recommended for the software quality management process.

√	Measurements	References
	Measurements used for software quality management based on the project's defined software process. (L4-20, C1, 2)	
	Software quality. (L4-26, A2, 1)	
	Software product quality. (L4-26, A2, 4)	
	Measurements used to quantify the characteristics of software product quality. (L4-27, A3, 2)	
	Quality of the project's software products. (L4-29, A4)	
	Quality of the software work products of each software life-cycle stage. (L4-29, A4, 4)	
	Measurements to determine the status of the software quality management activities. (L4-31, M1) Examples of measurements include: ❑ The cost of poor quality (based on known quality measurements to whatever degree of accuracy they can be collected). ❑ The costs for achieving the quality goals.	

SQM Process - Documented Procedures

Documented procedures

The table below lists the software quality management process activities that are recommended to be performed according to a documented procedure.

√	Documented Procedure(s)	References
	The project's software quality plan is developed and maintained according to a documented procedure. (L4-23, A1) [Refer to Level 4 Procedure Checklists for additional information.]	

SQM Process - Training

Training

The table below lists the training recommended for the software quality management process.

√	Training	References
	The **individuals implementing and supporting software quality management** receive required training to perform their activities. (L4-22, Ab2)	
	The **members of the software engineering group and other software-related groups** receive required training in software quality management. (L4-22, Ab3)	

SQM Process - Tools

Tools

The table below lists the tools recommended for the software quality management process.

√	Tools	References
	Tools to support predicting, measuring, tracking, and analyzing software quality. (L4-21, Ab1, 2) Examples of support tools include: ❑ data collection tools, ❑ database systems, ❑ spreadsheet programs, ❑ software life-cycle simulators, ❑ quantitative analysis tools, and ❑ code audit tools.	

Level 4 Procedure Checklists

Overview

Introduction This section describes all the explicit documented procedures in the Capability Maturity Model for maturity level 4.

Purpose The purpose of the procedure checklists is to provide:

- Guidance in identifying which procedures are recommended by the CMM at level 4.
- Criteria that an organization can use to evaluate its software procedures to determine if those procedures are consistent with the CMM at level 4.
- Information that can be used to develop software procedures that are consistent with the CMM at level 4.

In this section This section covers the following documented procedures:

CMM Level 4 Procedures	See Page
Quantitative process management procedures	L4-Procedures-2
Software quality management procedure	L4-Procedures-6

Quantitative Process Management (QPM) Procedures

Documented procedures

The table below lists the recommended documented procedures for the quantitative process management process.

√	Documented Procedures	References
	The software project's plan for quantitative process management is developed according to a documented procedure. (L4-6, A1) This procedure typically specifies that: ❑ The quantitative process management plan is based on: ❑ the organization's strategic goals for product quality, productivity, and product development cycle time; ❑ the organization's measurement program; ❑ the organization's standard software process; ❑ the project's goals for the software product's quality, productivity, and product development cycle time; ❑ the measured performance of other projects' defined software processes; and ❑ the description of the project's defined software process. ❑ The plan undergoes peer review. ❑ The plan is reviewed by the **group responsible for the organization's software process activities (e.g., the software engineering process group)**. ❑ The plan is managed and controlled.	

Continued on next page

Documented procedures, continued

The table below lists the recommended documented procedures for the quantitative process management process, continued from the previous page.

√	Documented Procedures	References
	The measurement data used to control the project's defined software process quantitatively are collected according to a documented procedure. (L4-9, A4) This procedure typically specifies that: ❑ The measurement data collected support the organization's and the software project's measurement goals and objectives. ❑ The specific measurement data to be collected, their precise definitions, the intended use and analysis of each measurement, and the process control points at which they will be collected are defined. ❑ The measurements are chosen from the entire software life cycle (e.g., both the development and post-development stages). ❑ The measurements cover the properties of the key software process activities and major software work products. ❑ The measurement data that relate to the organization's standard software process are uniformly collected across the software projects. ❑ The measurements to be controlled are a natural result of the software activities where possible. ❑ The measurements are selected to support predefined analysis activities. ❑ The validity of the measurement data is independently assessed. ❑ The collected measurement data are stored in the organization's software process database as appropriate.	

Continued on next page

Documented procedures, continued

The table below lists the recommended documented procedures for the quantitative process management process, continued from the previous page.

√	Documented Procedures	References
	The project's defined software process is analyzed and brought under quantitative control according to a documented procedure. (L4-10, A5) This procedure typically specifies that: ❑ The specific data analysis activities are predefined. ❑ Measurement data on the process activities throughout the project's defined software process are identified, collected, and analyzed. ❑ The selected measurements appropriately characterize the process they represent. ❑ The expected values for mean and variance are specified for each measurement. ❑ The acceptable limits for each measurement are defined and the project's process performance baseline is established. ❑ The actual values of each measurement are compared to the expected values of the mean and variance. ❑ Adjustments are made to bring the actual process performance in line with the defined acceptable limits, as appropriate. ❑ When the project's defined software process is controlled quantitatively, baselines are established for: ❑ the definition of the measurements, ❑ the actual measurement data, and ❑ the acceptable limits for the measurements. ❑ The process performance baseline for the software project is managed and controlled.	

Continued on next page

Documented procedures, continued

The table below lists the recommended documented procedures for the quantitative process management process, continued from the previous page.

√	Documented Procedures	References
	The process capability baseline for the organization's standard software process is established and maintained according to a documented procedure. (L4-13, A7) This procedure typically specifies that: ❑ The project's software process data, as summarized in its process performance baseline, are recorded in the organization's software process database. ❑ The process performance baseline for each project's defined software process is incorporated, as appropriate, into the process capability baseline for the organization's standard software process. ❑ The process capability baseline for the organization's standard software process is documented. ❑ Process capability trends for the organization's standard software process are examined to predict likely problems or opportunities for improvements. ❑ The process capability baseline for the organization's standard software process is managed and controlled. ❑ When a software project that is substantially different from past projects is undertaken, a new process performance baseline is established for that project as part of tailoring the organization's standard software process. ❑ Changes to the organization's standard software process are tracked and analyzed to assess their effects on the process capability baseline.	

Software Quality Management (SQM) Procedure

Documented procedure

The table below lists the recommended documented procedure for the software quality management process.

√	Documented Procedure	References
	The project's software quality plan is developed and maintained according to a documented procedure. (L4-23, A1) This procedure typically specifies that: ❑ An understanding of the software quality needs of the organization, customer, and end users is developed as appropriate. ❑ The software quality needs and priorities of the organization, customer, and end user are traceable to the system requirements allocated to software and the software quality goals. ❑ The capability of the project's defined software process to satisfy the software quality goals is assessed and documented. ❑ The software quality plan satisfies the quality plans of the organization, as appropriate. ❑ The software quality plan is based on plans for previous or current projects in the organization, as appropriate. ❑ The software quality plan is updated at the start of the project, at major project milestones, and whenever the allocated requirements change significantly. ❑ The software quality plan undergoes peer review. ❑ The software quality plan is reviewed by **affected groups** and **individuals**. ❑ **Senior management** reviews the software quality plans. ❑ The software quality plan is managed and controlled. ❑ The software quality plan is available to all **affected groups** and **individuals**.	

Level 4 Summary

Overview

Section purpose

The purpose of this section is to provide checklists that provide a summary of the managed level (level 4). This section contains three perspectives of a CMM level.

- *Key process area (KPA) specific information*:
  KPA purpose
  KPA goals

- *Operational framework information (from a maturity level viewpoint)*:
  Policies
  Standards
  Process descriptions
  Procedures
  Training
  Tools

- *Other key process information (from a maturity level viewpoint)*:
  Reviews and audits
  Work products managed and controlled
  Measurements

Section overview

This section contains the following topics.

Topic	Page
Level 4 - KPA Purposes	L4-Summary-2
Level 4 - KPA Goals	L4-Summary-3
Level 4 - Policies	L4-Summary-4
Level 4 - Standards	L4-Summary-5
Level 4 - Process Descriptions	L4-Summary-6
Level 4 - Procedures	L4-Summary-7
Level 4 - Training	L4-Summary-8
Level 4 - Tools	L4-Summary-9
Level 4 - Reviews and Audits	L4-Summary-10
Level 4 - Work Products Managed and Controlled	L4-Summary-12
Level 4 - Measurements	L4-Summary-13

Level 4 - KPA Purposes

Level 4 KPA purposes

The following table describes the purpose of each key process area in the CMM at level 4.

↓	KPA	Purpose of KPAs at Level 4
	QPM	The purpose of Quantitative Process Management is to control the process performance of the software project quantitatively. Software process performance represents the actual results achieved from following a software process. (L4-1)
	SQM	The purpose of Software Quality Management is to develop a quantitative understanding of the quality of the project's software products and achieve specific quality goals. (L4-19)

Level 4 - KPA Goals

Level 4 KPA goals

The following table lists the goals that are described in the CMM for each key process area at level 4.

↓	KPA	CMM Goals at Level 4	References
	QPM	The quantitative process management activities are planned. (L4-2, G1)	
	QPM	The process performance of the project's defined software process is controlled quantitatively. (L4-2, G2)	
	QPM	The process capability of the organization's standard software process is known in quantitative terms. (L4-2, G3)	
	SQM	The project's software quality management activities are planned. (L4-20, G1)	
	SQM	Measurable goals for software product quality and their priorities are defined. (L4-20, G2)	
	SQM	Actual progress toward achieving the quality goals for the software products is quantified and managed. (L4-20, G3)	

Level 4 - Policies

Level 4 policies The following table lists the recommended policies in the CMM at level 4.

√	KPA	Description	References
	QPM	Written organizational policy for measuring and quantitatively controlling the performance of the project's defined software process. (L4-2, C1)	
	QPM	Written policy for analyzing the process capability of the organization's standard software process. (L4-3, C2)	
	SQM	Written organizational policy for managing software quality. (L4-20, C1)	

Level 4 - Standards

Level 4 standards

The CMM recommends the contents of the following work products at level 4:

√	KPA	Standards at Level 4	References
	QPM	Projects' quantitative process management plan. (L4-7, A2)	
	SQM	Project's software quality plan. (L4-25, A2)	

Reference

Refer to the Level 4 Standards Checklists for additional information regarding the content of each standard.

Level 4 - Process Descriptions

QPM process description

Quantitative Process Management involves establishing goals for the performance of the project's defined software process, which is described in the Integrated Software Management key process area, taking measurements of the process performance, analyzing these measurements, and making adjustments to maintain process performance within acceptable limits. When the process performance is stabilized within acceptable limits, the project's defined software process, the associated measurements, and the acceptable limits for the measurements are established as a baseline and used to control process performance quantitatively.

The organization collects process performance data from the software projects and uses these data to characterize the process capability (i.e., the process performance a new project can expect to attain) of the organization's standard software process, which is described in the Organization Process Definition key process area. Process capability describes the range of expected results from following a software process (i.e., the most likely outcomes that are expected from the next software project the organization undertakes). These process capability data are, in turn, used by the software projects to establish and revise their process performance goals and to analyze the performance of the projects' defined software processes. (L4-1)

SQM process description

Software Quality Management involves defining quality goals for the software products, establishing plans to achieve these goals, and monitoring and adjusting the software plans, software work products, activities, and quality goals to satisfy the needs and desires of the customer and end user for high quality products.

The practices of Software Quality Management build on the practices of the Integrated Software Management and Software Product Engineering key process areas, which establish and implement the project's defined software process, and the Quantitative Process Management key process area, which establishes a quantitative understanding of the ability of the project's defined software process to achieve the desired results.

Quantitative goals are established for the software products based on the needs of the organization, the customer, and the end users. So that these goals may be achieved, the organization establishes strategies and plans, and the project specifically adjusts its defined software process, to accomplish the quality goals. (L4-19)

Level 4 - Procedures

Level 4 procedures

The table below lists the activities that are recommended to be performed according to a documented procedure in the CMM at level 4. Refer to the Level 4 Procedure Checklists for additional information regarding the content of each documented procedure.

√	KPA	Documented Procedures	References
	QPM	The software project's plan for quantitative process management is developed according to a documented procedure. (L4-6, A1)	
	QPM	The measurement data used to control the project's defined software process quantitatively are collected according to a documented procedure. (L4-9, A4)	
	QPM	The project's defined software process is analyzed and brought under quantitative control according to a documented procedure. (L4-10, A5)	
	QPM	The process capability baseline for the organization's standard software process is established and maintained according to a documented procedure. (L4-13, A7)	
	SQM	The project's software quality plan is developed and maintained according to a documented procedure. (L4-23, A1)	

Level 4 - Training

Level 4 training The table below lists the training recommended in the CMM at level 4.

√	KPA	Training	References
	QPM	The **individuals implementing or supporting quantitative process management** receive required training to perform these activities. (L4-6, Ab4)	
	QPM	The **members of the software engineering group** and **other software-related groups** receive orientation on the goals and value of quantitative process management. (L4-6, Ab5)	
	SQM	The **individuals implementing and supporting software quality management** receive required training to perform their activities. (L4-22, Ab2)	
	SQM	The **members of the software engineering group and other software-related groups** receive required training in software quality management. (L4-22, Ab3)	

Level 4 - Tools

Level 4 tools The table below lists the tools recommended in the CMM for level 4.

√	KPA	Tools	References
	QPM	Tools to support quantitative process management. (L4-5, Ab2, 3)	
	QPM	Organization's software process database. (L4-10, A4, 9)	
	SQM	Tools to support predicting, measuring, tracking, and analyzing software quality. (L4-21, Ab1, 2)	

Level 4 - Reviews and Audits

Level 4 reviews and audits

The table below lists the recommended reviews and audits in the CMM at level 4.

√	KPA	Review or Audit	Review Participants	References
	QPM	The project's quantitative process management plan undergoes peer review. (L4-7, A1, 2)	**Not specified in the CMM**	
	QPM	The project's quantitative process management plan is reviewed by the **group responsible for the organization's software process activities (e.g., the software engineering process group)**. (L4-7, A1, 3)	**Group responsible for the organization's software process activities (e.g., the software engineering process group)**	
	QPM	The results of the data analysis are reviewed with those affected by the data before they are reported to anyone else. (L4-12, A6, 1)	**Not specified in the CMM**	
	QPM	The activities for quantitative process management are reviewed with **senior management** on a periodic basis. (L4-15, V1)	**Senior management**	
	QPM	The software project's activities for quantitative process management are reviewed with the **project manager** on both a periodic and event-driven basis. (L4-16, V2)	**Project manager**	
	QPM	The **software quality assurance group** reviews and/or audits the activities and work products for quantitative process management and reports the results. (L4-16, V3)	**Software quality assurance group**	
	SQM	**Specialty engineers in areas such as safety and reliability** are available to help set the software quality goals and review progress towards the goals. (L4-21, Ab1, 1)	**Specialty engineers in areas such as safety and reliability**	
	SQM	The software quality plan undergoes peer review. (L4-24, A1, 7)	**Not specified in CMM**	
	SQM	The software quality plan is reviewed by **affected groups and individuals**. (L4-24, A1, 8)	**Affected groups and individuals**	

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Level 4 - Reviews and Audits, Continued

Level 4 reviews and audits, continued

The table below lists the recommended reviews and audits in the CMM at level 4, continued from the previous page.

☟	KPA	Review or Audit	Review Participants	References
	SQM	**Senior management** reviews the software quality plans. (L4-25, A1, 9)	**Senior management**	
	SQM	The software tasks are planned and performed to address the project's software quality goals. At the beginning of a software task, **the team performing the task**: (L4-29, A4, 1) ❑ Reviews the quality goals for the software product. (L4-29, A4, 1.1) ❑ Reviews changes made to the process to meet the software quality goals. (L4-29, A4, 1.4)	**Team performing the software task**	
	SQM	The activities for software quality management are reviewed with **senior management** on a periodic basis. (L4-31, V1)	**Senior management**	
	SQM	The activities for software quality management are reviewed with the **project manager** on both a periodic and event-driven basis. (L4-31, V2)	**Project manager**	
	SQM	The **software quality assurance group** reviews and/or audits the activities and work products for software quality management and reports the results. (L4-32, V3)	**Software quality assurance group**	

Level 4 - Work Products Managed and Controlled

Level 4 work products managed and controlled

The table below lists the work products that are recommended to be managed and controlled in the CMM at level 4.

√	KPA	Work Products Managed and Controlled	References
	QPM	Project's quantitative process management plan. (L4-7, A1, 4)	
	QPM	Process performance baseline for the software project. (L4-12, A5, 9)	
	QPM	Process capability baseline for the organization's standard software process. (L4-14, A7, 5)	
	SQM	Software quality plan. (L4-25, A1, 10)	

Level 4 - Measurements

Level 4 measurements

The table below describes the recommended measurements in the CMM at level 4.

√	KPA	Description	References
	QPM	Measurements to determine the status of the activities for quantitative process management. (L4-15, M1)	
	SQM	Measurements used for software quality management based on the project's defined software process. (L4-20, C1, 2)	
	SQM	Software quality. (L4-26, A2, 1)	
	SQM	Software product quality. (L4-26, A2, 4)	
	SQM	Measurements used to quantify the characteristics of software product quality. (L4-27, A3, 2)	
	SQM	Quality of the project's software products. (L4-29, A4)	
	SQM	Quality of the software work products of each software life-cycle stage. (L4-29, A4, 4)	
	SQM	Measurements to determine the status of the software quality management activities. (L4-31, M1)	

Chapter 7. Optimizing Level (Level 5)

Overview

Introduction This chapter contains the checklists for Level 5 of the CMM.

In this chapter This chapter contains the following sections:

Section Title	Page
Level 5 Policy Checklists	L5-Policy-1
Level 5 Standards Checklists	L5-Standards-1
Level 5 Process Checklists	L5-Process-1
Level 5 Procedure Checklists	L5-Procedures-1
Level 5 Summary	L5-Summary-1

Level 5 Policy Checklists

Overview

Introduction

This section describes the explicit policies found in the Capability Maturity Model at maturity level 5.

Purpose

The purpose of the policy checklists is to provide:

- Guidance in identifying which policies are recommended by the CMM at level 5.
- Criteria that an organization can use to evaluate its software policies to determine if they are consistent with the CMM at level 5.
- Information that can be used to develop software policies so that they are consistent with the CMM at level 5.

Checklist description

Each checklist contains two subsections: the KPA policies and the KPA goals. The table below describes these two subsections of a policy checklist.

Subsection	Description
Policy checklist	This subsection contains criteria that the organizational policy can be evaluated against. These criteria must be addressed by organizational policy to be consistent with the CMM.
Policy goals	This subsection is a reminder to policy designers and evaluators to keep in mind the KPA goals when developing the policies for each KPA. The goals can be thought of as the results of implementing an effective policy.

In this section

This section covers the following policies:

Policies	See Page
Defect prevention policies	L5-Policy-2
Technology change management policy	L5-Policy-3
Process change management policy	L5-Policy-4

Defect Prevention (DP) Policies

DP policy 1 checklist

The organization follows a written policy for defect prevention activities (L5-2, C1). This policy typically specifies that:

√	Description	References
	Long-term plans and commitments are established for funding, staffing, and other resources for defect prevention. (L5-2, C1, 1)	
	The resources needed are allocated for the defect prevention activities. (L5-2, C1, 2)	
	Defect prevention activities are implemented across the organization to improve the software processes and products. (L5-2, C1, 3)	
	The results of the defect prevention activities are reviewed to ensure the effectiveness of those activities. (L5-2, C1, 4)	
	Management and technical actions identified as a result of the defect prevention activities are addressed. (L5-2, C1, 5)	

DP policy 2 checklist

The project follows a written organizational policy for defect prevention activities (L5-2, C2). This policy typically specifies that:

√	Description	References
	Defect prevention activities are included in each project's software development plan. (L5-3, C2, 1)	
	The resources needed are allocated for the defect prevention activities. (L5-3, C2, 2)	
	Project management and technical actions identified as a result of the defect prevention activities are addressed. (L5-3, C2, 3)	

DP policy goals

Implementation of effective defect prevention policies has the following results:

√	Results of Effectively Implementing DP Policies	References
	Defect prevention activities are planned. (L5-2, G1)	
	Common causes of defects are sought out and identified. (L5-2, G2)	
	Common causes of defects are prioritized and systematically eliminated. (L5-2, G3)	

Technology Change Management (TCM) Policy

TCM policy checklist

The organization follows a written policy for improving its technology capability (L5-18, C1). This policy typically specifies that:

√	Description	References
	Objectives for technology change management are established and documented. (L5-18, C1, 1)	
	A documented plan addresses the objectives for technology change management. (L5-19, C1, 2)	

TCM policy goals

Implementation of an effective technology change management policy has the following results:

√	Results of Effectively Implementing TCM Policy	References
	Incorporation of technology changes are planned. (L5-18, G1)	
	New technologies are evaluated to determine their effect on quality and productivity. (L5-18, G2)	
	Appropriate new technologies are transferred into normal practice across the organization. (L5-18, G3)	

Process Change Management (PCM) Policy

PCM policy checklist

The organization follows a written policy for implementing software process improvements (L5-32, C1). This policy typically specifies that:

√	Description	References
	The organization has quantitative, measurable goals for software process improvement and tracks performance against these goals. (L5-32, C1, 1)	
	The organization's process improvements are directed toward improving product quality, increasing productivity, and decreasing the cycle time for product development. (L5-32, C1, 2)	
	All of the organization's **staff** and **managers** are expected to participate in improving the software processes. (L5-32, C1, 3)	

PCM policy goals

Implementation of an effective process change management policy has the following results:

√	Results of Effectively Implementing PCM Policy	References
	Continuous process improvement is planned. (L5-32, G1)	
	Participation in the organization's software process improvement activities is organization wide. (L5-32, G2)	
	The organization's standard software process and the projects' defined software processes are improved continuously. (L5-32, G3)	

Level 5 Standards Checklists

Overview

Introduction

This section describes the recommended content of selected work products in the CMM at maturity level 5.

Definition

A *standard checklist* describes the content of a work product as recommended by the CMM.

Purpose

The purpose of the standards checklists is to provide:

- Guidance in identifying the contents of standard work products that are recommended by the CMM at level 5.
- Criteria that an organization can use to evaluate its software standards to determine if they are consistent with the CMM at level 5.
- Information that can be used to develop software standards that are consistent with the CMM at level 5.

What the standards checklists are not

The standards checklists contain only what is recommended by the CMM, and *are not complete standards in themselves.* For example, the standard for the software development plan (SDP) contains only content recommended by the CMM. Other sources for the content of a SDP should also be considered, such as ANSI/IEEE Std 1058.1-1987, DOD-STD-2167, DI-MCCR-80030, etc.

In this section

This section covers the following standards:

Standard	KPA	See Page
Project plan for defect prevention activities	DP	L5-Standards-2
Plan for technology change management	TCM	L5-Standards-3
Plan for pilot efforts to improve technology	TCM	L5-Standards-4
Software process improvement plan	PCM	L5-Standards-5

Project Plan for Defect Prevention Activities

Standard checklist

The following table contains what the CMM describes as the recommended content of a project plan for defect prevention activities. This plan:

√	Recommended Content
	Identifies the defect prevention activities (e.g., task kick-off and causal analysis meetings) that will be held. (L5-5, A1, 1)
	Specifies the schedule of defect prevention activities. (L5-5, A1, 2)
	Covers the assigned responsibilities and resources required, including staff and tools. (L5-5, A1, 3)

Plan for Technology Change Management

Standard checklist

The following table contains what the CMM describes as the recommended content of a plan for technology change management. This plan:

√	Recommended Content
	Covers the assigned responsibilities and resources required, including staff and tools. (L5-23, A1, 1)
	Defines the long-term technical strategy for automating and improving the organization's standard software process and enhancing the organization's market position. (L5-23, A1, 2)
	Identifies the procedures to be followed in performing the organization's technology change management activities. (L5-23, A1, 3)
	Describes the approach for introducing new technologies to address specific needs of the organization and projects. (L5-24, A1, 4) ❑ Process areas that are potential areas for technology changes are identified. ❑ Approaches for identifying opportunities for technology changes are identified. ❑ The specific planned or candidate technologies are identified. ❑ Where appropriate, the life span for the planned technologies is estimated, from introduction to replacement. ❑ The make/buy tradeoff studies are documented. ❑ Approaches for assessing unproven candidate technologies are defined. ❑ The acquisition and installation procedures are defined. ❑ The initial training, continuing training, and consultation support are defined.

Plan for Pilot Efforts to Improve Technology

Standard checklist

The following table contains what the CMM describes as the recommended content of a plan for pilot efforts to improve technology:

√	Recommended Content
	Objectives for the pilot effort. (L5-27, A6, 2.1)
	Evaluation criteria for the pilot effort. (L5-27, A6, 2.1)
	Activities for the pilot effort. (L5-27, A6, 2.1)

Software Process Improvement Plan

Standard checklist

The following table contains what the CMM describes as the recommended content of a software process improvement plan:

√	Recommended Content
	The resources required, including staff and tools. (L5-38, A4, 1)
	The highest priority process areas for improvement. (L5-38, A4, 2)
	Measurable short-term and long-term goals for software process performance and improvement. (L5-38, A4, 3)
	Teams and their assignments for addressing improvements for specific process areas. (L5-38, A4, 4)
	The procedures for: (L5-38, A4, 5) ❑ the senior managers overseeing the software process improvement activities; ❑ the software managers planning and coordinating the software process improvement activities; ❑ individuals and teams identifying, evaluating, and introducing appropriate software process improvements; and ❑ the teams developing software process improvements for assigned process areas.
	The administrative and support plans required to maintain continuous process improvement. (L5-38, A4, 6) ❑ Appropriate administrative procedures are included to encourage participation in and facilitate the software process improvement activities. ❑ **Administrative personnel** are included in oversight and review of the software process improvement activities. ❑ The roles and contributions of employees to continuous process improvement are recognized.

Level 5 Process Checklists

Overview

Section purpose

The purpose of the process checklists is to provide:

- Guidance in identifying which processes are required by the CMM at level 5.
- Criteria that an organization can use to evaluate its software processes to determine if they are consistent with the CMM at level 5.
- Information that can be used to develop software processes that are consistent with the CMM at level 5.

In this section

This section contains checklists for the following key process areas:

Key Process Area	See Page
Defect Prevention	L5-Process-3
Technology Change Management	L5-Process-35
Process Change Management	L5-Process-77

Defect Prevention (DP) Process

DP Process - Overview

DP process purpose

The purpose of Defect Prevention is to identify the cause of defects and prevent them from recurring. (L5-1)

DP process description

Defect Prevention involves analyzing defects that were encountered in the past and taking specific actions to prevent the occurrence of those types of defects in the future. The defects may have been identified on other projects as well as in earlier stages or tasks of the current project. Defect prevention activities are also one mechanism for spreading lessons learned between projects.

Trends are analyzed to track the types of defects that have been encountered and to identify defects that are likely to recur. Based on an understanding of the project's defined software process and how it is implemented (as described in the Integrated Software Management and Software Product Engineering key process areas), the root causes of the defects and the implications of the defects for future activities are determined.

Both the project and the organization take specific actions to prevent recurrence of the defects. Some of the organizational actions may be handled as described in the Process Change Management key process area. (L5-1)

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Section overview

The table below contains a description and the location of each checklist for this key process area.

Checklist	Description	Page
Roles	List of roles participating in process activities.	L5-Process-5
Entry Criteria	Description of when the process can start.	L5-Process-9
Inputs	Description of the work products used by the process.	L5-Process-10
Activities	Description of the activities of the process.	L5-Process-12
Outputs	Description of the work products produced by the process.	L5-Process-16
Exit Criteria	Description of when the process is complete.	L5-Process-20
Reviews and Audits	List of reviews and audits.	L5-Process-27
Work Products Managed and Controlled	List of work products to be managed and controlled.	L5-Process-29
Measurements	Description of process measurements.	L5-Process-30
Documented Procedures	List of the activities to be completed according to a documented procedure.	L5-Process-31
Training	List of training.	L5-Process-32
Tools	List of tools.	L5-Process-33

DP Process - Roles

Roles

The table below lists the roles and the activities in which they participate in the defect prevention process.

√	Roles	Activities Participated in...	Reference
	Causal analysis meeting leader	The (causal analysis meetings) are led by a **person trained in conducting causal analysis meetings**. (L5-7, A3, 2)	
	Project manager	The software project's activities for defect prevention are reviewed with the **project manager** on both a periodic and event-driven basis. (L5-15, V2)	
	Senior management	The organization's activities for defect prevention are reviewed with **senior management** on a periodic basis. (L5-14, V1)	
	Software engineering group **or** **Members of the software engineering group**	❑ **Members of the software engineering group** and other software-related groups receive required training to perform their defect prevention activities. (L5-4, Ab4) ❑ **Members of the software engineering group** and software-related groups receive feedback on the status and results of the organization's and project's defect prevention activities on a periodic basis. (L5-12, A8)	
	Software engineering manager	The **software engineering managers** and technical staff are trained for their defect prevention roles. (L5-15, V3, 1)	
	Software-related groups **or** **Members of the software-related groups**	❑ **Members of the** software engineering group and other **software-related groups** receive required training to perform their defect prevention activities. (L5-4, Ab4) ❑ **Members of the** software engineering group and **software-related groups** receive feedback on the status and results of the organization's and project's defect prevention activities on a periodic basis. (L5-12, A8)	

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DP Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the defect prevention process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Software quality assurance (SQA) group	The **software quality assurance group** reviews and/or audits the activities and work products for defect prevention and reports the results. (L5-15, V3)	
	Submitters of the action proposals	Each of the teams assigned to coordinate defect prevention activities document their rationale for decisions and provide the decision and the rationale to the **submitters of the action proposals**. (L5-9, A4, 6)	
	Team performing the software task **or** **Members of the team performing the software task**	❑ At the beginning of a software task, the **members of the team performing the task** meet to prepare for the activities of that task and the related defect prevention activities. (L5-6, A2) ❑ Each **team that performs a software task** conducts causal analysis meetings. (L5-7, A3, 1)	

	Teams assigned to coordinate defect prevention activities (the organization-level team or the teams for each software project)	❑ Each of the **teams assigned to coordinate defect prevention activities** meets on a periodic basis to review and coordinate implementation of action proposals from the causal analysis meetings. (L5-8, A4)
		❑ The **teams**:
		  ❑ Review the output from the causal analysis meetings and select action proposals that will be addressed.
		  ❑ Review action proposals that have been assigned to them by other teams coordinating defect prevention activities in the organization and select action proposals that will be addressed.
		  ❑ Review actions taken by the other teams in the organization to assess whether these actions can be applied to their activities and processes.	

Role continues on next page

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DP Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the defect prevention process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Teams assigned to coordinate defect prevention activities (the organization-level team or the teams for each software project), continued	❑ The **teams**: (L5-8, A4) ❑ Perform a preliminary analysis of the action proposals and set their priorities. ❑ Reassign action proposals to teams at another level in the organization, as appropriate. ❑ Document their rationale for decisions and provide the decision and the rationale to the submitters of the action proposals. ❑ Assign responsibility for implementing the action items resulting from the action proposals. ❑ Implementation of the action items includes making immediate changes to the activities that are within the purview of the **team** and arranging for other changes. ❑ Members of the **team** usually implement the action items, but, in some cases, the **team** can arrange for someone else to implement an action item. ❑ Review results of defect prevention experiments and take actions to incorporate the results of successful experiments into the rest of the project or organization, as appropriate. ❑ Track the status of the action proposals and action items.	
	Role continues on next page		

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DP Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the defect prevention process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Teams assigned to coordinate defect prevention activities (the organization-level team or the teams for each software project), continued	❑ The **teams**: (L5-8, A4) ❑ Document software process improvement proposals for the organization's standard software process and the projects' defined software processes as appropriate. ❑ Review and verify completed action items before they are closed. ❑ Ensure that significant efforts and successes in preventing defects are recognized. ❑ Defect prevention data are documented and tracked across the **teams coordinating defect prevention activities**. (L5-11, A5)	
	Teams at another level in the organization	The teams assigned to coordinate defect prevention activities reassign action proposals (from the causal analysis meetings) to **teams at another level in the organization**, as appropriate. (L5-9, A4, 5)	
	Technical staff	The software engineering managers and **technical staff** are trained for their defect prevention roles. (L5-15, V3, 1)	

DP Process - Entry Criteria

Input-based entry criteria

There are no input-based entry criteria in the defect prevention process.

General entry criteria

The CMM recommends that the conditions described in the table below be satisfied before entering the defect prevention process.

√	Condition	References
	The organization follows a written policy for defect prevention activities (L5-2, C1). [Refer to Level 5 Policies for additional information regarding DP policy.]	
	An **organization-level team to coordinate defect prevention activities** exists. (L5-3, Ab1)	
	The **organization-level team to coordinate defect prevention activities** is either part of the **group responsible for the organization's software process activities** (e.g., **software engineering process group**) or its activities are closely coordinated with that group. (L5-3, Ab1, 1)	
	A **team to coordinate defect prevention activities for the software project** exists. (L5-3, Ab2)	
	This **team** is closely tied to the **team responsible for developing and maintaining the project's defined software process**. (L5-3, Ab2, 1)	
	Adequate resources and funding are provided for defect prevention activities at the project and organization levels. (L5-4, Ab3)	
	Defect prevention activities are planned into each person's responsibilities, as appropriate. (L5-4, Ab3, 1)	
	Management participation in the defect prevention activities is planned. (L5-4, Ab3, 2)	
	Each software project is represented on the **team coordinating defect prevention activities for the organization**, as appropriate. (L5-4, Ab3, 3)	
	Tools to support defect prevention activities are made available. (L5-4, Ab3, 4)	
	Members of the software engineering group and **other software-related groups** receive required training to perform their defect prevention activities. (L5-4, Ab4)	

DP Process - Inputs

Inputs

The table below lists the recommended inputs to the defect prevention process.

√	Input	Org. Input	References
	Action items resulting from the action proposals (from the causal analysis meetings). (L5-9, A4, 7)		
	Action proposals from the causal analysis meetings. (L5-8, A4)		
	Categories of root causes. (L5-7, A3, 4)		
	Changes to software methods. (L5-6, A2, 1)		
	Completed action items (resulting from action proposals from the causal analysis meetings). (L5-10, A4, 11)		
	Inputs required and available for the (software) task. (L5-6, A2, 2)		
	List of errors that are commonly made or introduced during the current stage. (L5-6, A2, 6)		
	Methods to be used to evaluate the outputs. (L5-6, A2, 4)		
	Methods to be used to verify adherence to the software process. (L5-6, A2, 5)		
	Organization's standard software process. (L5-10, A4, 10)		
	Output from the causal analysis meetings. (L5-9, A4, 1)		
	Outputs to be produced with examples, if available. (L5-6, A2, 3)		
	Projects' defined software processes. (L5-3, Ab2, 1)		
	Recommended preventive actions (for errors that are commonly made or introduced during the current stage). (L5-6, A2, 6)		
	Results of defect prevention experiments. (L5-10, A4, 8)		
	Results of successful (defect prevention) experiments. (L5-10, A4, 8)		
	Software methods. (L5-6, A2, 1)		

	Software product quality goals for the software project. (L5-7, A2, 9)		

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DP Process - Inputs, Continued

Inputs, continued

The table below lists the recommended inputs to the defect prevention process, continued from the previous page.

√	Input	Org. Input	References
	Software product quality goals for the software task. (L5-7, A2, 9)		
	Software products. (L5-2, C1, 3)		
	Task schedule. (L5-6, A2, 8)		
	Team assignments. (L5-6, A2, 7)		
	Work products for defect prevention. (L5-15, V3)		

DP Process - Activities

Activities

The table below lists the recommended activities for the defect prevention process.

√	Activities	References
	The software project develops and maintains a plan for its defect prevention activities. (L5-5, A1) ❑ This plan undergoes peer review. (L5-5, A1, 4)	
	At the beginning of a software task, the **members of the team performing the task** meet to prepare for the activities of that task and the related defect prevention activities. (L5-6, A2) These kick-off meetings cover: ❑ The software process, standards, procedures, methods, and tools applicable to the task, with an emphasis on recent changes. ❑ The inputs required and available for the task. ❑ The outputs to be produced with examples, if available. ❑ The methods to be used to evaluate the outputs. ❑ The methods to be used to verify adherence to the software process. ❑ A list of errors that are commonly made or introduced during the current stage and recommended preventive actions for these errors. ❑ The team assignments. ❑ The task schedule. ❑ The software product quality goals for the task and software project.	
	Causal analysis meetings are conducted according to a documented procedure. (L5-7, A3) [Refer to Level 5 Procedure Checklists for additional information.]	

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DP Process - Activities, Continued

Activities, continued

The table below lists the recommended activities for the defect prevention process, continued from the previous page.

√	Activities	References
	Each of the **teams assigned to coordinate defect prevention activities** meets on a periodic basis to review and coordinate implementation of action proposals from the causal analysis meetings. (L5-8, A4) ❑ The **teams**: ❑ Review the output from the causal analysis meetings and select action proposals that will be addressed. ❑ Review action proposals that have been assigned to them by other **teams coordinating defect prevention activities in the organization** and select action proposals that will be addressed. ❑ Review actions taken by the other **teams in the organization** to assess whether these actions can be applied to their activities and processes. ❑ Perform a preliminary analysis of the action proposals and set their priorities. ❑ Reassign action proposals to **teams at another level in the organization**, as appropriate. ❑ Document their rationale for decisions and provide the decision and the rationale to the **submitters of the action proposals**. ❑ Assign responsibility for implementing the action items resulting from the action proposals. ❑ Implementation of the action items includes making immediate changes to the activities that are within the purview of the **team** and arranging for other changes. ❑ Members of the **team** usually implement the action items, but, in some cases, the **team** can arrange for someone else to implement an action item. ❑ Review results of defect prevention experiments and take actions to incorporate the results of successful experiments into the rest of the project or organization, as appropriate. ❑ Track the status of the action proposals and action items.	
	Activity continued on next page	

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Activities, continued

The table below lists the recommended activities for the defect prevention process, continued from the previous page.

√	Activities	References
	Activity continued from previous page	
	❑ Review results of defect prevention experiments and take actions to incorporate the results of successful experiments into the rest of the project or organization, as appropriate. ❑ Track the status of the action proposals and action items. ❑ Document software process improvement proposals for the organization's standard software process and the projects' defined software processes as appropriate. ❑ Review and verify completed action items before they are closed. ❑ Ensure that significant efforts and successes in preventing defects are recognized.	
	Defect prevention data are documented and tracked across the **teams coordinating defect prevention activities**. (L5-11, A5) ❑ Action proposals identified in causal analysis meetings are documented. ❑ Action items resulting from action proposals are documented. ❑ The defect prevention data are managed and controlled.	
	Revisions to the organization's standard software process resulting from defect prevention actions are incorporated according to a documented procedure. (L5-12, A6)	
	Revisions to the project's defined software process resulting from defect prevention actions are incorporated according to a documented procedure. (L5-12, A7)	
	Members of the software engineering group and **software-related groups** receive feedback on the status and results of the organization's and project's defect prevention activities on a periodic basis. (L5-12, A8)	
	Measurements are made and used to determine the status of the defect prevention activities. (L5-13, M1)	
	The organization's activities for defect prevention are reviewed with **senior management** on a periodic basis. (L5-14, V1)	

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DP Process - Activities, Continued

Activities, continued

The table below lists the recommended activities for the defect prevention process, continued from the previous page.

√	Activities	References
	The software project's activities for defect prevention are reviewed with the **project manager** on both a periodic and event-driven basis. (L5-15, V2)	
	The **software quality assurance group** reviews and/or audits the activities and work products for defect prevention and reports the results. (L5-15, V3)	

DP Process - Outputs

Outputs

The table below lists the recommended outputs produced by the defect prevention process.

√	Output	Org. Output	References
	Action items resulting from action proposals. (L5-11, A5, 2)		
	Action proposals (from the causal analysis meetings). (L5-9, A4, 1)		
	Actual cost of completed defect prevention activities. (L5-15, V1, 6)		
	Commitments for funding, staffing, and other resources for defect prevention. (L5-2, C1, 1)		
	Common causes of defects. (L5-8, A3, 6)		
	Decision(s) (for action proposals). (L5-9, A4, 6)		
	Defect prevention data. (L5-11, A5)		
	Defects. (L5-7, A3, 3)		
	Feedback on the status and results of the organization's and project's defect prevention activities. (L5-12, A8)		
	Frequency distribution of actions in the major action categories. (L5-14, V1, 2)		
	Frequency distribution of defects in the major defect categories. (L5-13, A8, 2)		
	Inputs required and available for the (software) task. (L5-6, A2, 2)		
	List of errors that are commonly made or introduced during the current stage. (L5-6, A2, 6)		
	Long-term plans for funding, staffing, and other resources for defect prevention. (L5-2, C1, 1)		
	Management actions identified as a result of the defect prevention activities. (L5-2, C1, 5)		
	Measurements (to determine the status of defect prevention activities). (L5-13, M1)		
	Methods to be used to evaluate the outputs. (L5-6, A2, 4)		

	Methods to be used to verify adherence to the software process. (L5-6, A2, 5)		

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DP Process - Outputs, Continued

Outputs, continued

The table below lists the recommended outputs produced by the defect prevention process, continued from the previous page.

√	Output	Org. Output	References
	Number of defects uncovered. (L5-7, A3, 1.2)		
	Outputs to be produced with examples, if available. (L5-6, A2, 3)		
	Plan for (the software project's) defect prevention activities. (L5-5, A1) [Refer to Level 5 Standards for additional information regarding this plan.]		
	Priorities (for action proposals). (L5-9, A4, 4)		
	Project management actions identified as a result of the defect prevention activities. (L5-3, C2, 3)		
	Project technical actions identified as a result of the defect prevention activities. (L5-3, C2, 3)		
	Project's software development plan. (L5-3, C2, 1)		
	Projected cost of planned defect prevention activities. (L5-15, V1, 6)		
	Proposed actions to prevent the future occurrence of identified defects and similar defects. (L5-8, A3, 5)		
	Rationale for decisions (about implementing action proposals from the causal analysis meetings). (L5-9, A4, 6)		
	Recommended preventive actions (for errors that are commonly made or introduced during the current stage of a software task). (L5-6, A2, 6)		
	Results (of the SQA group reviews and/or audits of the activities and work products for defect prevention). (L5-15, V3)		
	Results of the (causal analysis) meeting. (L5-8, A3, 7)		
	Results of the defect prevention activities. (L5-2, C1, 4)		

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DP Process - Outputs, Continued

Outputs, continued

The table below lists the recommended outputs produced by the defect prevention process, continued from the previous page.

√	Output	Org. Output	References
	Revisions to the organization's standard software process resulting from defect prevention actions. (L5-12, A6)		
	Revisions to the project's defined software process resulting from defect prevention actions. (L5-12, A7)		
	Root causes (of defects). (L5-7, A3, 3)		
	Schedule of defect prevention activities. (L5-5, A1, 2)		
	Significant innovations to address the major defect categories. (L5-13, A8, 3)		
	Software methods. (L5-6, A2, 1)		
	Software process improvement proposals for the organization's standard software process. (L5-10, A4, 10)		
	Software process improvement proposals for the projects' defined software processes. (L5-10, A4, 10)		
	Software product quality goals for the software project. (L5-7, A2, 9)		
	Software product quality goals for the task. (L5-7, A2, 9)		
	Software products. (L5-7, A3, 1.3)		
	Summary of the effectiveness of and savings attributable to the defect prevention activities. (L5-15, V1, 5)		
	Summary of the major action categories. (L5-14, V1, 2)		
	Summary of the major defect categories. (L5-13, A8, 1)		
	Summary status of the action proposals and action items. (L5-13, A8, 4)		
	Summary status of the proposed, open, and completed action items. (L5-15, V1, 4)		
	Task schedule. (L5-6, A2, 8)		

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DP Process - Outputs, Continued

Outputs, continued

The table below lists the recommended outputs produced by the defect prevention process, continued from the previous page.

√	Output	Org. Output	References
	Team assignments. (L5-6, A2, 7)		
	Technical actions identified as a result of the defect prevention activities. (L5-2, C1, 5)		

DP Process - Exit Criteria

Output-based exit criteria

The CMM recommends that outputs satisfy the states described in the table below to exit the defect prevention process.

√	Output	State	References
	Action items resulting from action proposals	are documented. (L5-11, A5, 2)	
	Action proposals (from the causal analysis meetings)	are selected. (L5-9, A4, 1)	
	Changes to software methods	are covered in kick-off meetings at the beginning of a software task. (L5-6, A2, 1)	
	Commitments for funding, staffing, and other resources for defect prevention	are established. (L5-2, C1, 1)	
	Common causes of defects	❑ are identified. (L5-8, A3, 6) ❑ are documented. (L5-8, A3, 6)	
	Decision(s) (for action proposals)	are provided to the **submitters of the action proposals**. (L5-9, A4, 6)	
	Defect prevention data	❑ are documented. (L5-11, A5) ❑ are tracked across the **teams coordinating defect prevention activities**. (L5-11, A5) ❑ are managed and controlled. (L5-11, A5, 3)	
	Defects	❑ are identified. (L5-7, A3, 3) ❑ are analyzed to determine their root causes. (L5-7, A3, 3) ❑ are assigned to categories of root causes. (L5-7, A3, 4)	

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DP Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the defect prevention process, continued from the previous page.

√	Output	State	References

	Feedback on the status and results of the organization's and project's defect prevention activities	❑ is received by **members of the software engineering group** on a periodic basis. (L5-12, A8)
		❑ is received by **members of the software-related groups** on a periodic basis. (L5-12, A8)
		❑ provides (L5-12, A8):
		  ❑ A summary of the major defect categories.
		  ❑ The frequency distribution of defects in the major defect categories.
		  ❑ Significant innovations and actions taken to address the major defect categories.
		  ❑ A summary status of the action proposals and action items.	

	Inputs required and available for the (software) task	are covered in kick-off meetings at the beginning of a software task. (L5-6, A2, 2)	
	List of errors that are commonly made or introduced during the current stage	are covered in kick-off meetings at the beginning of a software task. (L5-6, A2, 6)	
	Long-term plans for funding, staffing, and other resources for defect prevention	are established. (L5-2, C1, 1)	
	Management actions identified as a result of the defect prevention activities	are addressed. (L5-2, C1, 5)	
	Measurements (to determine the status of the defect prevention activities)	❑ are made. (L5-13, M1) ❑ are used. (L5-13, M1)	

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DP Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the defect prevention process, continued from the previous page.

√	Output	State	References
	Methods to evaluate the outputs (of a software task)	are covered in kick-off meetings at the beginning of a software task. (L5-6, A2, 4)	
	Methods to verify adherence to the software process	are covered in kick-off meetings at the beginning of a software task. (L5-6, A2, 5)	
	Outputs to be produced with examples, if available	are covered in kick-off meetings at the beginning of a software task. (L5-6, A2, 3)	
	Plan for (the software project's) defect prevention activities	❑ is developed by the software project. (L5-5, A1) ❑ is maintained by the software project. (L5-5, A1) ❑ undergoes peer review. (L5-5, A1, 4)	
	Priorities (for action proposals)	are set. (L5-9, A4, 4)	
	Project management actions identified as a result of the defect prevention activities	are addressed. (L5-3, C2, 3)	
	Project technical actions identified as a result of the defect prevention activities	are addressed. (L5-3, C2, 3)	
	Project's software development plan	includes defect prevention activities. (L5-3, C2, 1)	
	Proposed actions to prevent the future occurrence of identified defects and similar defects	❑ are developed. (L5-8, A3, 5) ❑ are documented. (L5-8, A3, 5)	
	Rationale for decisions (about implementing action proposals from causal analysis meetings)	❑ are documented. (L5-9, A4, 6) ❑ are provided to the **submitters of the action proposals**. (L5-9, A4, 6)	

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DP Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the defect prevention process, continued from the previous page.

√	Output	State	References
	Recommended preventive actions (for errors that are commonly made or introduced during the current stage of a software task)	are covered in kick-off meetings at the beginning of a software task. (L5-6, A2, 6)	
	Results (of the SQA group reviews and/or audits of the activities and work products for defect prevention)	are reported. (L5-15, V3)	
	Results of the (causal analysis) meeting	are recorded for use by the organization and other projects. (L5-8, A3, 7)	
	Results of the defect prevention activities	are reviewed to ensure the effectiveness of those activities. (L5-2, C1, 4)	
	Revisions to the organization's standard software process resulting from defect prevention actions	are incorporated according to a documented procedure. (L5-12, A6)	
	Revisions to the project's defined software process resulting from defect prevention actions	are incorporated according to a documented procedure. (L5-12, A7)	
	Root causes (of defects)	are determined. (L5-7, A3, 3)	
	Software methods	are covered in kick-off meetings at the beginning of a software task. (L5-6, A2, 1)	
	Software process improvement proposals for the organization's standard software process	are documented, as appropriate. (L5-10, A4, 10)	

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DP Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the defect prevention process, continued from the previous page.

√	Output	State	References
	Software process improvement proposals for the projects' defined software processes	are documented, as appropriate. (L5-10, A4, 10)	
	Software product quality goals for the software project	are covered in kick-off meetings at the beginning of a software task. (L5-6, A2, 9)	
	Software product quality goals for the task	are covered in kick-off meetings at the beginning of a software task. (L5-7, A2, 9)	
	Task schedule	is covered in kick-off meetings at the beginning of a software task. (L5-7, A2, 8)	
	Team assignments	are covered in kick-off meetings at the beginning of a software task. (L5-6, A2, 7)	
	Technical actions identified as a result of the defect prevention activities	are addressed. (L5-2, C1, 5)	

General exit criteria

The CMM recommends that the conditions described in the table below be satisfied to exit the defect prevention process.

√	Condition	References
	The resources needed are allocated for the (organization's) defect prevention activities. (L5-2, C1, 2)	
	Defect prevention activities are implemented across the organization to improve the software processes and products. (L5-2, C1, 3)	
	The resources needed are allocated for the (project's) defect prevention activities. (L5-3, C2, 2)	
	At the beginning of a software task, the **members of the team performing the task** meet to prepare for the activities of that task and the related defect prevention activities. (L5-6, A2)	

	Causal analysis meetings are conducted according to a documented procedure. (L5-7, A3)	

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DP Process - Exit Criteria, Continued

General exit criteria, continued

The CMM recommends that the conditions described in the table below be satisfied to exit the defect prevention process, continued from the previous page.

√	Condition	References
	Each of the **teams assigned to coordinate defect prevention activities** meets on a periodic basis to review and coordinate implementation of action proposals from the causal analysis meetings. (L5-8, A4) The **teams**: ❑ Review the output from the causal analysis meetings and select action proposals that will be addressed. (L5-9, A4, 1) ❑ Review action proposals that have been assigned to them by other **teams coordinating defect prevention activities in the organization** and select action proposals that will be addressed. (L5-9, A4, 2) ❑ Review actions taken by the other **teams in the organization** to assess whether these actions can be applied to their activities and processes. (L5-9, A4, 3) ❑ Perform a preliminary analysis of the action proposals and set their priorities. (L5-9, A4, 4) ❑ Reassign action proposals to **teams at another level in the organization**, as appropriate. (L5-9, A4, 5) ❑ Assign responsibility for implementing the action items resulting from the action proposals. (L5-9, A4, 7) ❑ Implementation of the action items includes making immediate changes to the activities that are within the purview of the **team** and arranging for other changes. (L5-10, A4, 7.1) ❑ Members of the **team** usually implement the action items, but, in some cases, the **team** can arrange for someone else to implement an action item. (L5-10, A4, 7.2) ❑ Review results of defect prevention experiments and take actions to incorporate the results of successful experiments into the rest of the project or organization, as appropriate. (L5-10, A4, 8) ❑ Track the status of the action proposals and action items. (L5-10, A4, 9) ❑ Review and verify completed action items before they are closed. (L5-10, A4, 11) ❑ Ensure that significant efforts and successes in preventing defects are recognized. (L5-10, A4, 12)	

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DP Process - Exit Criteria, Continued

General exit criteria, continued

The CMM recommends that the conditions described in the table below be satisfied to exit the defect prevention process, continued from the previous page.

√	Condition	References
	The organization's activities for defect prevention are reviewed with **senior management** on a periodic basis. (L5-14, V1)	
	The software project's activities for defect prevention are reviewed with the **project manager** on both a periodic and event-driven basis. (L5-15, V2)	
	The **software quality assurance group** reviews and/or audits the activities and work products for defect prevention and reports the results. (L5-15, V3)	

DP Process - Reviews and Audits

Reviews and audits

The table below lists the recommended reviews and audits for the defect prevention process.

√	Review or Audit	Review Participants	References
	The results of the defect prevention activities are reviewed to ensure the effectiveness of those activities. (L5-2, C1, 4)	**Not specified in the CMM**	
	The (software project's plan for defect prevention activities) undergoes peer review. (L5-5, A1, 4)	**Not specified in the CMM**	
	Each of the **teams assigned to coordinate defect prevention activities** meets on a periodic basis to review and coordinate implementation of action proposals from the causal analysis meetings. (L5-8, A4)	**Teams assigned to coordinate defect prevention activities**	
	The **teams assigned to coordinate defect prevention activities** review the output from the causal analysis meetings and select action proposals that will be addressed. (L5-9, A4, 1)	**Teams assigned to coordinate defect prevention activities**	
	The **teams assigned to coordinate defect prevention activities** review action proposals that have been assigned to them by other teams coordinating defect prevention activities in the organization and select action proposals that will be addressed. (L5-9, A4, 2)	**Teams assigned to coordinate defect prevention activities**	
	The **teams assigned to coordinate defect prevention activities** review actions taken by the other teams in the organization to assess whether these actions can be applied to their activities and processes. (L5-9, A4, 3)	**Teams assigned to coordinate defect prevention activities**	
	The **teams assigned to coordinate defect prevention activities** review results of defect prevention experiments and take actions to incorporate the results of successful experiments into the rest of the project or organization, as appropriate. (L5-10, A4, 8)	**Teams assigned to coordinate defect prevention activities**	

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Reviews and audits, continued

The table below lists the recommended reviews and audits for the defect prevention process, continued from the previous page.

√	Review or Audit	Review Participants	References
	The **teams assigned to coordinate defect prevention activities** review and verify completed action items before they are closed. (L5-10, A4, 11)	**Teams assigned to coordinate defect prevention activities**	
	The organization's activities for defect prevention are reviewed with **senior management** on a periodic basis. (L5-14, V1)	**Senior management**	
	The software project's activities for defect prevention are reviewed with the **project manager** on both a periodic and event-driven basis. (L5-15, V2)	**Project manager**	
	The **software quality assurance group** reviews and/or audits the activities and work products for defect prevention and reports the results. (L5-15, V3) At a minimum, the reviews and/or audits verify that: ❑ The **software engineering managers** and **technical staff** are trained for their defect prevention roles. (L5-15, V3, 1) ❑ The task kick-off meetings and causal analysis meetings are properly conducted. (L5-15, V3, 2) ❑ The process for reviewing action proposals and implementing action items is followed. (L5-15, V3, 3)	**Software quality assurance group**	

DP Process - Work Products Managed and Controlled

Work products managed and controlled

The table below lists the work products that are recommended to be managed and controlled during the defect prevention process.

√	Work Products Managed and Controlled	References
	Defect prevention data. (L5-11, A5, 3)	

DP Process - Measurements

Measurements The table below lists the measurements recommended for the defect prevention process.

√	Measurements	References
	Defect prevention data. (L5-11, A5)	
	Measurements to determine the status of the defect prevention activities. (L5-13, M1) Examples of measurements include: ❑ The costs of defect prevention activities (e.g., holding causal analysis meetings and implementing action items. ❑ The time and cost for identifying the defects and correcting them, compared to the estimated cost of not correcting the defects. ❑ Profiles measuring the number of action items proposed, open, and completed. ❑ The number of defects injected in each stage, cumulatively, and over releases of similar products. ❑ The number of defects.	

DP Process - Documented Procedures

Documented procedures

The table below lists the activities for the defect prevention process recommended to be performed according to a documented procedure.

√	Documented Procedure(s)	References
	Causal analysis meetings are conducted according to a documented procedure. (L5-7, A3) [Refer to Level 5 Procedure Checklists for additional information.]	
	Revisions to the organization's standard software process resulting from defect prevention actions are incorporated according to a documented procedure. (L5-12, A6)	
	Revisions to the project's defined software process resulting from defect prevention actions are incorporated according to a documented procedure. (L5-12, A7)	

DP Process - Training

Training

The table below lists the training recommended for the defect prevention process.

√	Training	References
	Members of the software engineering group and other **software-related groups** receive required training to perform their defect prevention activities. (L5-4, Ab4)	

DP Process - Tools

Tools

The table below lists the tools recommended for the defect prevention process.

√	Tools	References
	Tools to support defect prevention activities. (L5-4, Ab3, 4) Examples of support tools include: ❑ statistical analysis tools, and ❑ database systems.	

Technology Change Management (TCM) Process

TCM Process - Overview

TCM process purpose

The purpose of Technology Change Management is to identify new technologies (i.e., tools, methods, and processes) and track them into the organization in an orderly manner. (L5-17)

TCM process description

Technology Change Management involves identifying, selecting, and evaluating new technologies, and incorporating effective technologies into the organization. The objective is to improve software quality, increase productivity, and decrease the cycle time for product development.

The organization establishes a group (such as a software engineering process group or a technology support group) that works with the software projects to introduce and evaluate new technologies and manage changes to existing technologies. Particular emphasis is placed on technology changes that are likely to improve the capability of the organization's standard software process (as described in the Organization Process Definition key process area).

By maintaining an awareness of software-related technology innovations and systematically evaluating and experimenting with them, the organization selects appropriate technologies to improve the quality of its software and the productivity of its software activities. Pilot efforts are performed to assess new and unproven technologies before they are incorporated into normal practice. With appropriate sponsorship of the organization's management, the selected technologies are incorporated into the organization's standard software process and current projects, as appropriate.

Changes to the organization's standard software process (as described in the Organization Process Definition key process area) and the projects' defined software processes (as described in the Integrated Software Management key process area) resulting from these technology changes are handled as described in the Process Change Management key process area. (L5-17)

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Section overview

The table below contains a description and the location of each checklist for this key process area.

Checklist	Description	Page
Roles	List of roles participating in process activities.	L5-Process-37
Entry Criteria	Description of when the process can start.	L5-Process-44
Inputs	Description of the work products used by the process.	L5-Process-46
Activities	Description of the activities of the process.	L5-Process-48
Outputs	Description of the work products produced by the process.	L5-Process-52
Exit Criteria	Description of when the process is complete.	L5-Process-57
Reviews and Audits	List of reviews and audits.	L5-Process-69
Work Products Managed and Controlled	List of work products to be managed and controlled.	L5-Process-71
Measurements	Description of process measurements.	L5-Process-72
Documented Procedures	List of the activities to be completed according to a documented procedure.	L5-Process-73
Training	List of training.	L5-Process-74
Tools	List of tools.	L5-Process-75

TCM Process - Roles

Roles

The table below lists the roles and the activities in which they participate in the technology change management process.

√	Roles	Activities Participated in...	Reference
	Affected managers	The plan for technology change management is reviewed by the **affected managers**. (L5-24, A1, 6)	
	Group responsible for the organization's technology change management activities	❑ The **group responsible for the organization's technology change management activities** coordinates and helps to (L5-20, Ab1, 2): ❑ explore potential areas for applying new technology; ❑ select and plan for new technologies; ❑ acquire, install, and customize new technologies; ❑ communicate and coordinate with related research and development activities within the organization; and ❑ communicate with the technology suppliers on problems and enhancements. ❑ Experienced staff members with expertise in specialized areas are available to this **group responsible for the organization's technology change management activities** to help in evaluating, planning, and supporting initiatives for technology change management. (L5-21, Ab2, 1) ❑ Members of the **group responsible for the organization's technology change management activities** receive required training to perform these activities. (L5-23, Ab5) ❑ The **group responsible for the organization's technology change management activities** works with the software projects in identifying areas of technology change. (L5-24, A2)	
Role continued on next page			

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TCM Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the technology change management process, continued from the previous page.

√	Role	Activities Participated in...	Reference
		Role continued from previous page	
	Group responsible for the organization's technology change management activities, continued	❑ **The group responsible for the organization's technology change management activities**: (L5-24, A2) ❑ Solicits suggestions for technology changes. ❑ Identifies available new technologies that may be appropriate to the organization's and projects' needs. ❑ A periodic search is made to identify commercially available technologies that meet identified and anticipated needs. ❑ Systematic efforts are made to maintain awareness of leading relevant technical work and trends of new technologies. ❑ Systematic efforts are made to review the technologies used externally and to compare these technologies to those used within the organization. ❑ Areas where new technologies have been used successfully are identified, and data and documentation of experience with using them are collected and reviewed. ❑ Evaluates new technologies to determine their applicability to the organization's and projects' current and future needs.	
		Role continued on next page	

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Roles, continued

The table below lists the roles and the activities in which they participate in the technology change management process, continued from the previous page.

√	Role	Activities Participated in...	Reference
		Role continued from previous page	
	Group responsible for the organization's technology change management activities, continued	❑ The **group responsible for the organization's technology change management** systematically analyzes the organization's standard software process to identify areas that need or could benefit from new technology. (L5-25, A4) **The group responsible for the organization's technology change management activities**: (L5-25, A4) ❑ Analyzes the organization's standard software process to determine areas where new technologies would be most helpful. ❑ Identifies helpful technology changes and determines the economics of those changes. ❑ Defines the relationship of the identified technology to the organization's standard software process. ❑ Defines the expected outcomes of the technology change qualitatively and quantitatively, as appropriate. ❑ Determines the need for piloting each potential technology change. ❑ Determines the priority of the candidate new technologies. ❑ Documents results of the analysis activities.	
		Role continued on next page	

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Roles, continued

The table below lists the roles and the activities in which they participate in the technology change management process, continued from the previous page.

√	Role	Activities Participated in...	Reference
		Role continued from previous page	
	Group responsible for the organization's technology change management activities, continued	❑ The requirements and plans are reviewed by the managers of the affected groups and the **group responsible for technology change management activities.** (L5-26, A5, 4.4) ❑ The **group responsible for technology change management activities** provides consultation and assistance to the project implementing the pilot effort (for improving technology). (L5-27, A6, 4)	
	Managers of the affected groups	❑ The requirements and plans are reviewed by the **managers of the affected groups** and the group responsible for technology change management activities. (L5-26, A5, 4.4) ❑ The plan for conducting the pilot effort is reviewed and approved by the **managers of the affected groups**. (L5-27, A6, 3)	
	Organization's managers	❑ Senior management coordinates with the **organization's managers** in defining their goals and approaches for accomplishing the organization's strategy. (L5-19, C2, 3) ❑ Senior management coordinates with the **organization's managers** to secure the **managers'** and staff's support and participation. (L5-20, C3, 4.2)	

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TCM Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the technology change management process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Senior management	❑ **Senior management** sponsors the organization's activities for technology change management. (L5-19, C2) **Senior management**: ❑ Helps to define a strategy that addresses the organization's goals for product quality, productivity, and cycle time for product development. ❑ Helps to define a strategy that addresses the customer's and end users' needs and desires, as appropriate. ❑ Coordinates with the organization's managers in defining their goals and approaches for accomplishing the organization's strategy. ❑ Makes a commitment to the effort for technology change management that is visible throughout the organization. ❑ Establishes long-term plans and commitments for funding, staffing, and other resources.	
Role continued on next page			

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TCM Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the technology change management process, continued from the previous page.

√	Role	Activities Participated in...	Reference
		Role continued from previous page	
	Senior management, continued	❑ **Senior management** oversees the organization's technology change management activities. (L5-19, C3) **Senior management**: ❑ Helps to establish policies for technology change management and reviews and approves these policies. ❑ Allocates resources for technology change management activities. ❑ Helps relate organizational strategies and objectives to strategies for technology change management. ❑ Participates in establishing the plans for technology change management. ❑ **Senior management** coordinates requirements and issues for technology change management at all appropriate levels of the organization. ❑ **Senior management** coordinates with the organization's managers to secure the managers' and staff's support and participation. ❑ The organization's activities for technology change management are reviewed with **senior management** on a periodic basis. (L5-29, V1)	

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TCM Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the technology change management process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Software manager	**Software managers** and technical staff are kept informed of new technologies. (L5-25, A3)	
	Software quality assurance (SQA) group	The **software quality assurance group** reviews and/or audits the activities and work products for technology change management and reports the results. (L5-29, V2)	
	Staff	❑ Senior management coordinates with the organization's managers to secure the managers' and **staff's** support and participation. (L5-20, C3, 4.2) ❑ Experienced **staff** members with expertise in specialized areas are available to this group to help in evaluating, planning, and supporting initiatives for technology change management. (L5-21, Ab2, 1) ❑ Software managers and technical **staff** are kept informed of new technologies. (L5-25, A3)	
	Technology suppliers	The group responsible for the organization's technology change management activities coordinates and helps to communicate with the **technology suppliers** on problems and enhancements. (L5-21, Ab1, 2.5)	

TCM Process - Entry Criteria

Input-based entry criteria

The CMM recommends that inputs satisfy the states described in the table below before entering the technology change management process.

√	Input	State	References
	Data on the software processes	are available to support analyses performed to evaluate and select technology changes. (L5-22, Ab4)	
	Data on the software work products	are available to support analyses performed to evaluate and select technology changes. (L5-22, Ab4)	
	Needs of the organization (current and future)	❑ are identified. (L5-24, A2, 2.1) ❑ are anticipated. (L5-24, A2, 2.1)	
	Needs of the projects (current and future)	❑ are identified. (L5-24, A2, 2.1) ❑ are anticipated. (L5-24, A2, 2.1)	
	Selection criteria to identify the highest potential benefits (for selecting technologies)	❑ are predefined. (L5-26, A5, 3) ❑ are approved. (L5-26, A5, 3)	

General entry criteria

The CMM recommends that the conditions described in the table below be satisfied before entering the technology change management process.

√	Condition	References
	The organization follows a written policy for improving its technology capability. (L5-18, C1) [Refer to Level 5 Policies for additional information regarding TCM policy.]	
	Senior management sponsors the organization's activities for technology change management. (L5-19, C2)	
	A **group responsible for the organization's technology change management activities** exists. (L5-20, Ab1) ❑ The **group** is either part of the **group responsible for the organization's software process activities** (e.g., **software engineering process group**) or its activities are closely coordinated with that group. (L5-20, Ab1, 1)	
	Adequate resources and funding are provided to establish and staff a group responsible for the organization's technology change management activities. (L5-21, Ab2)	

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TCM Process - Entry Criteria, Continued

General entry criteria, continued

The CMM recommends that the conditions described in the table below be satisfied before entering the technology change management process, continued from the previous page.

√	Condition	References
	Experienced **staff** members with expertise in specialized areas are available to this **group (responsible for the organization's technology change management activities**) to help in evaluating, planning, and supporting initiatives for technology change management. (L5-21, Ab2, 1)	
	Tools to support technology change management are made available. (L5-21, Ab2, 2)	
	Support exists for collecting and analyzing data needed to evaluate technology changes. (L5-21, Ab3) This support includes the ability to: ❑ Record selected process and product data automatically. ❑ Support data analysis. ❑ Display selected data.	
	Members of the **group responsible for the organization's technology change management activities** receive required training to perform these activities. (L5-23, Ab5)	

TCM Process - Inputs

Inputs

The table below lists the recommended inputs to the technology change management process.

√	Input	Org. Input	References
	Advanced technologies. (L5-27, A6, 1)		
	Customer's needs and desires. (L5-19, C2, 2)		
	Data on the software processes. (L5-22, Ab4)		
	Data on the software work products. (L5-22, Ab4)		
	End users' needs and desires. (L5-19, C2, 2)		
	Information on advanced technologies already in use in parts of the organization. (L5-25, A3, 2)		
	Information on new technologies. (L5-25, A3, 1)		
	Information on the status of technologies being transferred into the organization. (L5-25, A3, 3)		
	Issues for technology change management. (L5-20, C3, 4.1)		
	Needs of the organization (current and future). (L5-24, A1, 4)		
	Needs of the projects (current and future). (L5-24, A1, 4)		
	New technology. (L5-20, Ab1, 2.1)		
	Objectives for technology change management. (L5-19, C1, 2)		
	Organization's goals for cycle time for product development. (L5-19, C2, 1)		
	Organization's goals for product quality. (L5-19, C2, 1)		
	Organization's goals for productivity. (L5-19, C2, 1)		
	Organization's standard software process. (L5-23, A1, 2)		

	Plans for technology change management. (L5-23, A1) [Refer to Level 5 Standards for additional information regarding this plan.]		

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TCM Process - Inputs, Continued

Inputs, continued

The table below lists the recommended inputs to the technology change management process, continued from the previous page.

√	Input	Org. Input	References
	Potential technology changes. (L5-26, A4, 5)		
	Requirements for technology change management. (L5-20, C3, 4.1)		
	Revisions to the plans for technology change management. (L5-29, V1, 4)		
	Selection criteria (for selecting technologies) to identify the highest potential benefits. (L5-26, A5, 3)		
	Suggestions for technology changes. (L5-24, A2, 1)		
	Technologies used externally (to the organization). (L5-25, A2, 2.3)		
	Technologies used within the organization. (L5-25, A2, 2.3)		
	Technology changes. (L5-21, Ab3)		
	Untried technologies. (L5-27, A6, 1)		

TCM Process - Activities

Activities

The table below lists the recommended activities for the technology change management process.

√	Activities	References
	The organization develops and maintains a plan for technology change management. (L5-23, A1)	
	The **group responsible for the organization's technology change management activities** works with the software projects in identifying areas of technology change. (L5-24, A2) This **group**: ❑ Solicits suggestions for technology changes. ❑ Identifies available new technologies that may be appropriate to the organization's and projects' needs. ❑ A periodic search is made to identify commercially available technologies that meet identified and anticipated needs. ❑ Systematic efforts are made to maintain awareness of leading relevant technical work and trends of new technologies. ❑ Systematic efforts are made to review the technologies used externally and to compare these technologies to those used within the organization. ❑ Areas where new technologies have been used successfully are identified, and data and documentation of experience with using them are collected and reviewed. ❑ Evaluates new technologies to determine their applicability to the organization's and projects' current and future needs.	
	Software managers and technical **staff** are kept informed of new technologies. (L5-25, A3) ❑ Information on new technologies is disseminated as appropriate. ❑ Information on advanced technologies already in use in parts of the organization is disseminated as appropriate. ❑ Information on the status of technologies being transferred into the organization is disseminated as appropriate.	

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TCM Process - Activities, Continued

Activities, continued

The table below lists the recommended activities for the technology change management process, continued from the previous page.

√	Activities	References
	The **group responsible for the organization's technology change management** systematically analyzes the organization's standard software process to identify areas that need or could benefit from new technology. (L5-25, A4) This **group**: ❑ Analyzes the organization's standard software process to determine areas where new technologies would be most helpful. ❑ Identifies helpful technology changes and determines the economics of those changes. ❑ Defines the relationship of the identified technology to the organization's standard software process. ❑ Defines the expected outcomes of the technology change qualitatively and quantitatively, as appropriate. ❑ Determines the need for piloting each potential technology change. ❑ Determines the priority of the candidate new technologies. ❑ Documents results of the analysis activities.	
	Technologies are selected and acquired for the organization and software projects according to a documented procedure. (L5-26, A5) [Refer to Level 5 Procedure Checklists for additional information.]	

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TCM Process - Activities, Continued

Activities, continued

The table below lists the recommended activities for the technology change management process, continued from the previous page.

√	Activities	References
	Pilot efforts for improving technology are conducted, where appropriate, before a new technology is introduced into normal practice. (L5-27, A6) ❑ These pilot efforts are conducted to determine the feasibility and economics of untried or advanced technologies. ❑ The plans for the pilot effort are documented. ❑ The plan for conducting the pilot effort is reviewed and approved by the **managers of the affected groups**. ❑ The **group responsible for technology change management activities** provides consultation and assistance to the project implementing the pilot effort. ❑ The pilot effort is performed in an environment that is relevant to the development or maintenance environment. ❑ The results of the pilot effort are collected, analyzed, and documented. ❑ Lessons learned and problems encountered during the effort are documented. ❑ The benefits and impacts of broader use in the organization are estimated. The uncertainty in these estimates is assessed. ❑ A decision is made whether to terminate the effort, proceed with broad-scale implementation of the technology, or replan and continue the pilot effort.	
	Appropriate new technologies are incorporated into the organization's standard software process according to a documented procedure. (L5-28, A7)	
	Appropriate new technologies are incorporated into the projects' defined software processes according to a documented procedure. (L5-28, A8)	
	Measurements are made and used to determine the status of the organization's activities for technology change management. (L5-28, M1)	

	The organization's activities for technology change management are reviewed with **senior management** on a periodic basis. (L5-29, V1) [Refer to TCM Process Reviews and Audits for additional information.]	

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TCM Process - Activities, Continued

Activities, continued

The table below lists the recommended activities for the technology change management process, continued from the previous page.

√	Activities	References
	The **software quality assurance group** reviews and/or audits the activities and work products for technology change management and reports the results. (L5-29, V2) [Refer to TCM Process Reviews and Audits for additional information.]	

TCM Process - Outputs

Outputs

The table below lists the recommended outputs produced by the technology change management process.

√	Output	Org. Output	References
	Approach for introducing new technologies to address specific needs of the organization and projects. (L5-24, A1, 4)		
	Approaches for accomplishing the organization's strategy. (L5-19, C2, 3)		
	Approaches for assessing unproven candidate technologies. (L5-24, A1, 4.6)		
	Approaches for identifying opportunities for technology changes. (L5-24, A1, 4.2)		
	Areas of technology change. (L5-24, A2)		
	Areas that need or could benefit from new technology. (L5-25, A4)		
	Areas where new technologies have been used successfully. (L5-25, A2, 2.4)		
	Areas where new technologies would be most helpful. (L5-25, A4, 1)		
	Available new technologies that may be appropriate to the organization's and projects' needs. (L5-24, A2, 2)		
	Benefits of (a new technology's) broader use in the organization (based on the results of the pilot efforts for improving technology). (L5-28, A6, 6.2)		
	Candidate technologies. (L5-24, A1, 4.3)		
	Commercially available technologies that meet identified and anticipated needs. (L5-24, A2, 2.1)		
	Commitment to the effort for technology change management. (L5-19, C2, 4)		
	Commitments for funding, staffing, and other resources (for technology change management activities). (L5-19, C2, 5)		
	Data needed to evaluate technology changes. (L5-21, Ab3)		
	Data of experience (with using new technologies in areas where they have been used successfully). (L5-25, A2, 2.4)		

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TCM Process - Outputs, Continued

Outputs, continued

The table below lists the recommended outputs produced by the technology change management process, continued from the previous page.

√	Output	Org. Output	References
	Decision whether to terminate the effort (pilot effort for improving technology), proceed with broad-scale implementation of the technology, or replan and continue the pilot effort. (L5-28, A6, 6.3)		
	Documentation of experience (with using new technologies in areas where they have been used successfully). (L5-25, A2, 2.4)		
	Enhancements (to technology). (L5-21, Ab1, 2.5)		
	Evaluation criteria for the pilot effort. (L5-27, A6, 2.1)		
	Expected life span for replacement/ upgrade. (L5-26, A5, 4.1)		
	Expected outcomes of the technology change. (L5-26, A4, 4)		
	Goals for accomplishing the organization's strategy. (L5-19, C2, 3)		
	Impacts of (a new technology's) broader use in the organization (based on the results of the pilot efforts for improving technology). (L5-28, A6, 6.2)		
	Information on advanced technologies already in use in parts of the organization. (L5-25, A3, 2)		
	Information on new technologies. (L5-25, A3, 1)		
	Information on the status of technologies being transferred into the organization. (L5-25, A3, 3)		
	Lessons learned encountered during the (pilot) effort. (L5-27, A6, 6.1)		
	Life span for the planned technologies (from introduction to replacement). (L5-24, A1, 4.4)		
	Long-term plans for funding, staffing, and other resources. (L5-19, C2, 5)		

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TCM Process - Outputs, Continued

Outputs, continued

The table below lists the recommended outputs produced by the technology change management process, continued from the previous page.

√	Output	Org. Output	References
	Long-term technical strategy (for automating and improving the organization's standard software process and enhancing the organization's market position). (L5-23, A1, 2)		
	Make/buy tradeoff studies (for introducing new technology). (L5-24, A1, 4.5)		
	Measurements to determine the status of the organization's activities for technology change management. (L5-28, M1)		
	Need for piloting each potential technology change. (L5-26, A4, 5)		
	Needed strategy changes. (L5-29, V1, 2)		
	New technologies. (L5-21, Ab1, 2.2)		
	Objectives for technology change management. (L5-18, C1, 1)		
	Objectives for the pilot effort. (L5-27, A6, 2.1)		
	Organization's standard software process. (L5-28, A7)		
	Organizational objectives. (L5-20, C3, 3)		
	Organizational strategies. (L5-20, C3, 3)		
	Plan for conducting the pilot effort. (L5-27, A6, 2) [Refer to Level 5 Standards for additional information regarding this plan.]		
	Plan for technology change management. (L5-19, C1, 2) [Refer to Level 5 Standards for additional information regarding this plan.]		
	Planned technologies. (L5-24, A1, 4.3)		
	Plans for the selected technology changes. (L5-26, A5, 4)		
	Potential areas for applying new technology. (L5-20, Ab1, 2.1)		
	Priority of the candidate new technologies. (L5-26, A4, 6)		

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TCM Process - Outputs, Continued

Outputs, continued

The table below lists the recommended outputs produced by the technology change management process, continued from the previous page.

√	Output	Org. Output	References
	Problems encountered during the (pilot) effort. (L5-27, A6, 6.1)		
	Problems (with technology). (L5-21, Ab1, 2.5)		
	Process areas that are potential areas for technology changes. (L5-24, A1, 4.1)		
	Process data (selected). (L5-22, Ab3, 1)		
	Product data (selected). (L5-22, Ab3, 1)		
	Projects' defined software processes. (L5-28, A8)		
	Relationship of the identified technology to the organization's standard software process. (L5-25, A4, 3)		
	Requests for the acquisition of new technologies. (L5-26, A5, 1)		
	Requirements for the selected technology changes. (L5-26, A5, 4)		
	Results (of the **software quality assurance group** reviews and/or audits of the activities and work products for technology change management). (L5-29, V2)		
	Results of the analysis activities (for performing systematic analysis of the organization's standard software process to identify areas that need or could benefit from new technology). (L5-26, A4, 7)		
	Results of the pilot effort (for improving technology). (L5-27, A6, 6)		
	Strategies for technology change management. (L5-20, C3, 3)		
	Strategy that addresses the customer's and end users' needs and desires. (L5-19, C2, 2)		
	Strategy that addresses the organization's goals for product quality, productivity, and cycle time for product development. (L5-19, C2, 1)		

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TCM Process - Outputs, Continued

Outputs, continued

The table below lists the recommended outputs produced by the technology change management process, continued from the previous page.

√	Output	Org. Output	References
	Technologies with projected expenses above a predefined level. (L5-26, A5, 1.1)		
	Technologies. (L5-26, A5)		
	Technology changes. (L5-22, Ab4)		
	Tradeoff studies (to determine whether the technology should be developed internally or procured externally). (L5-26, A5, 4.2)		
	Uncertainty in the estimates of benefits of (a new technology's) broader use in the organization (based on the results of the pilot efforts for improving technology). (L5-28, A6, 6.2)		
	Uncertainty in the estimates of impacts of (a new technology's) broader use in the organization (based on the results of the pilot efforts for improving technology). (L5-28, A6, 6.2)		

TCM Process - Exit Criteria

Output-based exit criteria

The CMM recommends that outputs satisfy the states described in the table below to exit the technology change management process.

√	Output	State	References
	Approaches for accomplishing the organization's strategy	are defined by coordination between the **organization's managers** and **senior management**. (L5-19, C2, 3)	
	Areas of technology change	are identified by the **group responsible for the organization's technology change management activities** working with the software projects. (L5-24, A2)	
	Areas that need or could benefit from new technology	are identified by the **group responsible for the organization's technology change management** by systematically analyzing the organization's standard software process. (L5-25, A4)	
	Areas where new technologies have been used successfully	are identified by the **group responsible for the organization's technology change management activities**. (L5-25, A2, 2.4)	
	Areas where new technologies would be most helpful	are determined by the **group responsible for the organization's technology change management** by analyzing the organization's standard software process. (L5-25, A4, 1)	
	Available new technologies that may be appropriate to the organization's and projects' needs	are identified by the **group responsible for the organization's technology change management activities**. (L5-24, A2, 2)	
	Benefits of (a new technology's) broader use in the organization (based on the results of the pilot efforts for improving technology)	are estimated. (L5-28, A6, 6.2)	

	Commercially available technologies that meet identified and anticipated needs	are identified by a periodic search by the **group responsible for the organization's technology change management activities**. (L5-24, A2, 2.1)	

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TCM Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the technology change management process, continued from the previous page.

√	Output	State	References
	Commitment to the effort for technology change management	❑ is made by **senior management**. (L5-19, C2, 4) ❑ is visible throughout the organization. (L5-19, C2, 4)	
	Commitments for funding, staffing, and other resources	are established by **senior management**. (L5-19, C2, 5)	
	Data of experience (in areas where new technologies have been used successfully)	❑ are collected by the **group responsible for the organization's technology change management activities**. (L5-25, A2, 2.4) ❑ are reviewed by the **group responsible for the organization's technology change management activities**. (L5-25, A2, 2.4)	
	Decision whether to terminate the effort (pilot effort for improving technology), proceed with broad-scale implementation of the technology, or replan and continue the pilot effort	is made. (L5-28, A6, 6.3)	
	Documentation of experience (in areas where new technologies have been used successfully)	❑ is collected by the **group responsible for the organization's technology change management activities**. (L5-25, A2, 2.4) ❑ is reviewed by the **group responsible for the organization's technology change management activities**. (L5-25, A2, 2.4)	

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TCM Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the technology change management process, continued from the previous page.

√	Output	State	References
	Enhancements (to technology)	are communicated to the **technology suppliers** (with coordination and help from the **group responsible for the organization's technology change management activities**). (L5-21, Ab1, 2.5)	
	Expected life span for replacement/ upgrade	is estimated, where practical. (L5-26, A5, 4.1)	
	Expected outcomes of the technology change	❑ are defined qualitatively by the **group responsible for the organization's technology change management**, as appropriate. (L5-26, A4, 4) ❑ are defined quantitatively by the **group responsible for the organization's technology change management**, as appropriate. (L5-26, A4, 4)	
	Goals for accomplishing the organization's strategy	are defined by **senior management** coordinating with the **organization's managers**. (L5-19, C2, 3)	
	Impacts of (a new technology's) broader use in the organization (based on the results of the pilot efforts for improving technology)	are estimated. (L5-28, A6, 6.2)	
	Information on advanced technologies already in use in parts of the organization	is disseminated as appropriate. (L5-25, A3, 2)	
	Information on new technologies	is disseminated as appropriate. (L5-25, A3, 1)	

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Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the technology change management process, continued from the previous page.

√	Output	State	References
	Information on the status of technologies being transferred into the organization	is disseminated as appropriate. (L5-25, A3, 3)	
	Lessons learned that are encountered during the (pilot) effort	are documented. (L5-27, A6, 6.1)	
	Life span for the planned technologies (from introduction to replacement)	is estimated, where appropriate. (L5-24, A1, 4.4)	
	Long-term plans for funding, staffing, and other resources (for technology change management activities)	are established by **senior management**. (L5-19, C2, 5)	
	Long-term technical strategy (for automating and improving the organization's standard software process and enhancing the organization's market position)	is defined in the plan for technology change management. (L5-23, A1, 2)	
	Make/buy tradeoff studies (for introducing new technology)	are documented. (L5-24, A1, 4.5)	
	Measurements (to determine the status of the organization's activities for technology change management)	❑ are made. (L5-28, M1) ❑ are used. (L5-28, M1)	

	Need for piloting each potential technology change	is determined by the **group responsible for the organization's technology change management**. (L5-26, A4, 5)	

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TCM Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the technology change management process, continued from the previous page.

√	Output	State	References
	Needed strategy changes	are identified in periodic reviews with **senior management**. (L5-29, V1, 2)	
	New technologies	❑ are selected (with coordination and help from the **group responsible for the organization's technology change management activities**). (L5-21, Ab1, 2.2) ❑ are planned (with coordination and help from the **group responsible for the organization's technology change management activities**). (L5-21, Ab1, 2.2) ❑ are acquired (with coordination and help from the **group responsible for the organization's technology change management activities**). (L5-21, Ab1, 2.3) ❑ are installed (with coordination and help from the **group responsible for the organization's technology change management activities**). (L5-21, Ab1, 2.3) ❑ are customized (with coordination and help from the **group responsible for the organization's technology change management activities**). (L5-21, Ab1, 2.3)	
	Objectives for technology change management	❑ are established. (L5-18, C1, 1) ❑ are documented. (L5-18, C1, 1)	
	Organization's standard software process	has incorporated appropriate new technologies according to a documented procedure. (L5-28, A7)	

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TCM Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the technology change management process, continued from the previous page.

√	Output	State	References
	Organizational objectives	are related to strategies for technology change management (with **senior management's** help). (L5-20, C3, 3)	
	Organizational strategies	are related to strategies for technology change management (with **senior management's** help). (L5-20, C3, 3)	
	Plan for conducting the pilot effort (for improving technology)	❑ is documented. (L5-27, A6, 2) ❑ is reviewed by the **managers of the affected groups**. (L5-27, A6, 3) ❑ is approved by the **managers of the affected groups**. (L5-27, A6, 3)	
	Plan for technology change management	❑ is documented. (L5-19, C1, 2) ❑ addresses the objectives for technology change management. (L5-19, C1, 2) ❑ is established (with **senior management** participation). (L5-20, C3, 4) ❑ is developed by the organization. (L5-23, A1) ❑ is maintained by the organization. (L5-23, A1) ❑ undergoes peer review. (L5-24, A1, 5) ❑ is reviewed by the **affected managers**. (L5-24, A1, 6)	

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TCM Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the technology change management process, continued from the previous page.

√	Output	State	References
	Plans for the selected technology changes	❑ are defined. (L5-26, A5, 4) ❑ are documented. (L5-26, A5, 4) ❑ are estimated. (L5-26, A5, 4.1) ❑ provide for installing the new technology on a pilot basis to determine its effectiveness and economic benefits. (L5-26, A5, 4.3) ❑ are reviewed by the **managers of the affected groups** and the **group responsible for technology change management activities**. (L5-26, A5, 4.4)	
	Potential areas for applying new technology	are explored (with coordination and help from the **group responsible for the organization's technology change management activities**). (L5-20, Ab1, 2.1)	
	Priority of the candidate new technologies	is determined by the **group responsible for the organization's technology change management**. (L5-26, A4, 6)	
	Problems (with technology)	are communicated to the **technology suppliers** (with coordination and help from the **group responsible for the organization's technology change management activities**). (L5-21, Ab1, 2.5)	
	Problems encountered during the (pilot) effort	are documented. (L5-27, A6, 6.1)	
	Projects' defined software processes	have incorporated appropriate new technologies according to a documented procedure. (L5-28, A8)	

	Relationship of the identified technology to the organization's standard software process	is defined by the **group responsible for the organization's technology change management**. (L5-25, A4, 3)	

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TCM Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the technology change management process, continued from the previous page.

√	Output	State	References
	Requests for the acquisition of new technologies	are documented. (L5-26, A5, 1)	
	Requirements for the selected technology changes	❑ are defined. (L5-26, A5, 4) ❑ are documented. (L5-26, A5, 4) ❑ are reviewed by the **managers of the affected groups** and the **group responsible for technology change management activities**. (L5-26, A5, 4.4)	
	Results (of the **software quality assurance group** reviews and/or audits of the activities and work products for technology change management)	are reported. (L5-29, V2)	
	Results of the analysis activities (from the systematic analysis of the organization's standard software process to identify areas that need or could benefit from new technology)	are documented by the **group responsible for the organization's technology change management**. (L5-26, A4, 7)	
	Results of the pilot effort (for improving technology)	❑ are collected. (L5-27, A6, 6) ❑ are analyzed. (L5-27, A6, 6) ❑ are documented. (L5-27, A6, 6)	
	Strategies for technology change management	are related to organizational strategies and objectives (with **senior management's** help). (L5-20, C3, 3)	

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TCM Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the technology change management process, continued from the previous page.

√	Output	State	References
	Strategy that addresses the customer's and end users' needs and desires	is defined (with **senior management's** help), as appropriate. (L5-19, C2, 2)	
	Strategy that addresses the organization's goals for product quality, productivity, and cycle time for product development	is defined (with **senior management's** help). (L5-19, C2, 1)	
	Technologies	❑ are selected for the organization and software projects according to a documented procedure. (L5-26, A5) ❑ are acquired for the organization and software projects according to a documented procedure. (L5-26, A5)	
	Technologies with projected expenses above a predefined level	have management approval. (L5-26, A5, 1.1)	
	Technology changes	are identified by the **group responsible for the organization's technology change management**. (L5-25, A4, 2)	
	Tradeoff studies (to determine whether the technology should be developed internally or procured externally)	❑ are documented, where appropriate. (L5-26, A5, 4.2) ❑ are performed, where appropriate. (L5-26, A5, 4.2) ❑ are reviewed, where appropriate. (L5-26, A5, 4.2)	

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TCM Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the technology change management process, continued from the previous page.

√	Output	State	References
	Uncertainty in the estimates of benefits of (a new technology's) broader use in the organization (based on the results of the pilot efforts for improving technology)	is assessed. (L5-28, A6, 6.2)	
	Uncertainty in the estimates of impacts of (a new technology's) broader use in the organization (based on the results of the pilot efforts for improving technology)	is assessed. (L5-28, A6, 6.2)	

General exit criteria

The CMM recommends that the conditions described in the table below be satisfied to exit the technology change management process.

√	Condition	References
	Senior management allocates resources for technology change management activities. (L5-19, C3, 2)	
	Senior management coordinates requirements and issues for technology change management at all appropriate levels of the organization. (L5-20, C3, 4.1)	
	Senior management coordinates with the **organization's managers** to secure the **managers'** and **staff's** support and participation. (L5-20, C3, 4.2)	

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TCM Process - Exit Criteria, Continued

General exit criteria, continued

The CMM recommends that the conditions described in the table below be satisfied to exit the technology change management process, continued from the previous page.

√	Condition	References
	The **group responsible for the organization's technology change management activities** coordinates and helps to (L5-20, Ab1, 2): ❑ explore potential areas for applying new technology; ❑ select and plan for new technologies; ❑ acquire, install, and customize new technologies; ❑ communicate and coordinate with related research and development activities within the organization; and ❑ communicate with the **technology suppliers** on problems and enhancements.	
	The group responsible for the organization's technology change management activities solicits suggestions for technology changes. (L5-24, A2, 1)	
	Systematic efforts are made to maintain awareness of leading relevant technical work and trends of new technologies. (L5-25, A2, 2.2)	
	Systematic efforts are made to review the technologies used externally and to compare these technologies to those used within the organization. (L5-25, A2, 2.3)	
	The group responsible for the organization's technology change management activities evaluates new technologies to determine their applicability to the organization's and projects' current and future needs. (L5-25, A2, 3)	
	Software managers and technical **staff** are kept informed of new technologies. (L5-25, A3)	
	The **group responsible for the organization's technology change management** systematically analyzes the organization's standard software process to identify areas that need or could benefit from new technology. (L5-25, A4) ❑ This **group** identifies helpful technology changes and determines the economics of those changes. (L5-25, A4, 2)	
	Preliminary cost/benefit analyses are performed for the potential technology changes. (L5-26, A5, 2)	

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TCM Process - Exit Criteria, Continued

General exit criteria, continued

The CMM recommends that the conditions described in the table below be satisfied to exit the technology change management process, continued from the previous page.

√	Condition	References
	Predefined and approved selection criteria are used to identify the highest potential benefits (when selecting and acquiring technologies). (L5-26, A5, 3)	
	Pilot efforts for improving technology are conducted, where appropriate, before a new technology is introduced into normal practice. (L5-27, A6) ❑ These pilot efforts are conducted to determine the feasibility and economics of untried or advanced technologies. (L5-27, A6, 1) ❑ The **group responsible for technology change management activities** provides consultation and assistance to the project implementing the pilot effort. (L5-27, A6, 4) ❑ The pilot effort is performed in an environment that is relevant to the development or maintenance environment. (L5-27, A6, 5)	
	The organization's activities for technology change management are reviewed with **senior management** on a periodic basis. (L5-29, V1)	
	The **software quality assurance group** reviews and/or audits the activities and work products for technology change management and reports the results. (L5-29, V2)	

TCM Process - Reviews and Audits

Reviews and audits

The table below lists the recommended reviews and audits for the technology change management process.

√	Review or Audit	Review Participants	References
	Senior management helps to establish policies for technology change management and reviews and approves these policies. (L5-19, C3, 1)	**Senior management**	
	The organizational plan for technology change management undergoes peer review. (L5-24, A1, 5)	**Not specified in CMM**	
	The organizational plan for technology change management is reviewed by the **affected managers**. (L5-24, A1, 6)	**Affected managers**	
	Systematic efforts are made to review the technologies used externally and to compare these technologies to those used within the organization. (L5-25, A2, 2.3)	**Group responsible for the organization's technology change management activities**	
	Areas where new technologies have been used successfully are identified, and data and documentation of experience with using them are collected and reviewed. (L5-25, A2, 2.4)	**Group responsible for the organization's technology change management activities**	
	Where appropriate, tradeoff studies are performed, reviewed, and documented to determine whether the technology should be developed internally or procured externally. (L5-26, A5, 4.2)	**Not specified in CMM**	
	The requirements and plans (for selected technology changes) are reviewed by the **managers of the affected groups** and the **group responsible for technology change management activities**. (L5-26, A5, 4.4)	**Managers of the affected groups** **Group responsible for technology change management activities**	

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TCM Process - Reviews and Audits, Continued

Reviews and audits, continued

The table below lists the recommended reviews and audits for the technology change management process, continued from the previous page.

√	Review or Audit	Review Participants	References
	The plan for conducting the pilot effort is reviewed and approved by the **managers of the affected groups**. (L5-27, A6, 3)	**Managers of the affected groups**	
	The organization's activities for technology change management are reviewed with **senior management** on a periodic basis. (L5-29, V1) These reviews: ❑ Summarize the activities for technology change management. ❑ Identify needed strategy changes. ❑ Result in the resolution of issues. ❑ Result in the approval of revisions to the plans for technology change management, as appropriate.	**Senior management**	
	The **software quality assurance group** reviews and/or audits the activities and work products for technology change management and reports the results. (L5-29, V2) At a minimum, the reviews and/or audits verify: ❑ The plans for technology change management. ❑ The process for selecting, procuring, and installing new technologies.	**Software quality assurance group**	

TCM Process - Work Products Managed and Controlled

Work products managed and controlled	There are no work products that are recommended to be managed and controlled during the technology change management process.

TCM Process - Measurements

Measurements

The table below lists the measurements recommended for the technology change management process.

√	Measurements	References
	Data of experience with using (new technologies that have been used successfully). (L5-25, A2, 2.4)	
	Measurements to determine the status of the organization's activities for technology change management. (L5-28, M1) Examples of measurements include: ❑ The overall technology change activity, including number, type, and size of changes. ❑ The effect of implementing the technology change, compared to the goals.	

TCM Process - Documented Procedures

Documented procedures

The table below lists the activities in the technology change management process recommended to be performed according to a documented procedure.

√	Documented Procedure(s)	References
	Technologies are selected and acquired for the organization and software projects according to a documented procedure. (L5-26, A5) [Refer to Level 5 Procedure Checklists for additional information.]	
	Appropriate new technologies are incorporated into the organization's standard software process according to a documented procedure. (L5-28, A7)	
	Appropriate new technologies are incorporated into the projects' defined software processes according to a documented procedure. (L5-28, A8)	

TCM Process - Training

Training

The table below lists the training recommended for the technology change management process.

√	Training	References
	Members of the **group responsible for the organization's technology change management activities** receive required training to perform these activities. (L5-23, Ab5)	

TCM Process - Tools

Tools

The table below lists the tools recommended for the technology change management process.

√	Tools	References
	Tools to support technology change management are made available. (L5-21, Ab2, 2) Examples of support tools include: ❑ workstations, ❑ database programs, and ❑ subscriptions to on-line technology databases.	

Process Change Management (PCM) Process

PCM Process - Overview

PCM process purpose

The purpose of Process Change Management is to continually improve the software processes used in the organization with the intent of improving software quality, increasing productivity, and decreasing the cycle time for product development. (L5-31)

PCM process description

Process Change Management involves defining process improvement goals and, with senior management sponsorship, proactively and systematically identifying, evaluating, and implementing improvements to the organization's standard software process and the projects' defined software processes on a continuous basis.

Training and incentive programs are established to enable and encourage everyone in the organization to participate in process improvement activities. Improvement opportunities are identified and evaluated for potential payback to the organization. Pilot efforts are performed to assess process changes before they are incorporated into normal practice.

When software process improvements are approved for normal practice, the organization's standard software process and the projects' defined software processes are revised as appropriate. The practices for revising the organization's standard software process are found in the Organization Process Definition key process area, and the practices for revising the projects' defined software processes are found in the Integrated Software Management key process area. (L5-31)

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Section overview

The table below contains a description and the location of each checklist for this key process area.

Checklist	Description	Page
Roles	List of roles participating in process activities.	L5-Process-79
Entry Criteria	Description of when the process can start.	L5-Process-85
Inputs	Description of the work products used by the process.	L5-Process-87
Activities	Description of the activities of the process.	L5-Process-88
Outputs	Description of the work products produced by the process.	L5-Process-91
Exit Criteria	Description of when the process is complete.	L5-Process-95
Reviews and Audits	List of reviews and audits.	L5-Process-104
Work Products Managed and Controlled	List of work products to be managed and controlled.	L5-Process-107
Measurements	Description of process measurements.	L5-Process-108
Documented Procedures	List of the activities to be completed according to a documented procedure.	L5-Process-109
Training	List of training.	L5-Process-110
Tools	List of tools.	L5-Process-111

PCM Process - Roles

Roles

The table below lists the roles and the activities in which they participate in the process change management process.

√	Role	Activities Participated in...	Reference
	Administrative personnel	**Administrative personnel** are included in oversight and review of the software process improvement activities. (L5-38, A4, 6.2)	
	Experienced individuals who have expertise in defining and analyzing software processes	**Experienced individuals who have expertise in defining and analyzing software processes** are available to help the organization in its process improvement activities. (L5-34, Ab1, 2)	

Continued on next page

PCM Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the process change management process, continued from the previous page.

√	Role	Activities Participated in...	Reference

	Group responsible for the organization's software process activities (e.g., software engineering process group)	❑ The **group responsible for the organization's software process activities (e.g., software engineering process group)** coordinates the software process improvement activities. (L5-36, A2) ❑ The **group responsible for the organization's software process activities (e.g., software engineering process group)**: ❑ Defines organizational goals and measurement plans for software process performance. ❑ Reviews the organizational goals for process performance with senior management for their endorsement. ❑ Participates in the effort to define the organization's training needs for process improvement and supports the development and presentation of training course materials. ❑ Defines and maintains the procedures for handling process improvement proposals. ❑ Reviews software process improvement proposals and coordinates the actions for these proposals. ❑ Tracks status, accomplishments, and participation in the process improvement activities and periodically reports the results to senior management. ❑ Coordinates and tracks changes to the organization's standard software process. ❑ Defines, establishes, and maintains the process improvement records.	

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PCM Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the process change management process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Group that defines and maintains the affected process descriptions	The plans (for process improvement team activities) are approved by the managers of the affected groups and the **group that defines and maintains the affected process descriptions**. (L5-41, A6, 3)	
	Individuals responsible for implementing the software processes	The strategy for collecting data to measure and track the change in software process performance is agreed to by the **individuals responsible for implementing the software processes affected by the change**. (L5-43, A8, 2.1)	
	Management	Software process changes that are judged to have a major impact on product quality or productivity or that will significantly alter satisfaction of the customer and end users are reviewed and approved by appropriate **management** before they are implemented. (L5-41, A5, 9)	
	Managers	❑ All of the organization's staff and **managers** are expected to participate in improving the software processes. (L5-32, C1, 3) ❑ The software process improvement plan is reviewed by the affected **managers**. (L5-37, A3, 3) ❑ The plans (for process improvement team activities) are approved by the **managers** of the affected groups and the group that defines and maintains the affected process descriptions. (L5-41, A6, 3)	
	Managers of software-related groups	The **managers** and technical staff of the software engineering group and other **software-related groups** receive required training in software process improvement. (L5-34, Ab3)	

	Managers of the software engineering group	The **managers** and technical staff of the **software engineering group** and other software-related groups receive required training in software process improvement. (L5-34, Ab3)	

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PCM Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the process change management process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Members of the organization	❑ A software process improvement program is established which empowers the **members of the organization** to improve the processes of the organization. (L5-35, A1) ❑ **Members of the organization** actively participate in teams to develop software process improvements for assigned process areas. (L5-41, A6)	
	Senior management	❑ **Senior management** sponsors the organization's activities for software process improvement. (L5-32, C2) ❑ **Senior management**: ❑ Establishes the organization's long-term goals and plans for process improvement. ❑ Allocates resources for process improvement activities. ❑ Coordinates with the software managers to ensure they have reasonable, yet aggressive, process improvement goals and effective process improvement plans to meet these goals. ❑ Monitors process improvement performance against goals. ❑ Maintains a consistent priority focus on process improvement in the face of product crises. ❑ Ensures that process improvement issues are promptly resolved. ❑ Rewards employee participation in the process improvement activities. ❑ **Senior management** receives required training in software process improvement. (L5-35, Ab4)	
	Role continued on next page		

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PCM Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the process change management process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Senior management, continued	❑ The group responsible for the organization's software process activities (e.g., software engineering process group) reviews the organizational goals for process performance with **senior management** for their endorsement. (L5-36, A2, 2) ❑ The group responsible for the organization's software process activities (e.g., software engineering process group) tracks status, accomplishments, and participation in the process improvement activities and periodically reports the results to **senior management**. (L5-36, A2, 6) ❑ The activities for software process improvement are reviewed with **senior management** on a periodic basis. (L5-46, V1)	
	Software managers	❑ Senior management coordinates with the **software managers** to ensure they have reasonable, yet aggressive, process improvement goals and effective process improvement plans to meet these goals. (L5-33, C2, 3) ❑ **Software managers** receive required training in software process improvement. (L5-34, Ab2) ❑ **Software managers** and technical staff receive feedback on the status and results of the software process improvement activities on an event-driven basis. (L5-44, A10)	
	Software quality assurance (SQA) group	The **software quality assurance group** reviews and/or audits the activities and work products for software process improvement and reports the results. (L5-46, V2)	

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PCM Process - Roles, Continued

Roles, continued

The table below lists the roles and the activities in which they participate in the process change management process, continued from the previous page.

√	Role	Activities Participated in...	Reference
	Staff	❑ All of the organization's **staff** and managers are expected to participate in improving the software processes. (L5-32, C1, 3) ❑ Software managers and technical **staff** receive feedback on the status and results of the software process improvement activities on an event-driven basis. (L5-44, A10)	
	Submitters of the software process improvement proposals	**Submitters of the software process improvement proposals** receive: (L5-41, A5, 11) ❑ Prompt acknowledgment of their proposals. ❑ Notification of the disposition of their proposals.	
	Team responsible for implementation (of software process improvement actions)	Software process improvement actions that require a substantial effort are assigned to a **team responsible for implementation**. (L5-40, A5, 6)	
	Technical staff of software-related groups	The managers and **technical staff** of the software engineering group and other **software-related groups** receive required training in software process improvement. (L5-34, Ab3)	
	Technical staff of the software engineering group	The managers and **technical staff of the software engineering group** and other software-related groups receive required training in software process improvement. (L5-34, Ab3)	

PCM Process - Entry Criteria

Input-based entry criteria

The CMM recommends that inputs satisfy the states described in the table below before entering the process change management process.

√	Input	State	References
	Organizational goals for software process improvement	❑ are quantitative. (L5-32, C1, 1) ❑ are measurable. (L5-32, C1, 1)	
	Software process improvement proposal	is submitted. (L5-39, A5, 1)	

General entry criteria

The CMM recommends that the conditions described in the table below be satisfied before entering the process change management process.

√	Condition	References
	The organization follows a written policy for implementing software process improvements. (L5-32, C1) [Refer to Level 5 Policies for additional information regarding PCM policy.]	
	Senior management sponsors the organization's activities for software process improvement. (L5-32, C2)	
	Adequate resources and funding are provided for software process improvement activities. (L5-33, Ab1)	
	Resources are allocated to: (L5-33, Ab1, 1) ❑ Lead, guide, and support the process improvement activities. ❑ Maintain the process improvement records. ❑ Develop, control, and disseminate process changes. ❑ Establish and operate the administrative and human resources functions to conduct the communications, motivation, and recognition activities needed to maintain a high level of employee participation.	
	Experienced individuals who have expertise in defining and analyzing software processes are available to help the organization in its process improvement activities. (L5-34, Ab1, 2)	
	Tools to support process improvement are made available. (L5-34, Ab1, 3)	
	Software managers receive required training in software process improvement. (L5-34, Ab2)	

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PCM Process - Entry Criteria, Continued

General entry criteria, continued

The CMM recommends that the conditions described in the table below be satisfied before entering the process change management process, continued from the previous page.

√	Condition	References
	The **managers** and **technical staff of the software engineering group** and other **software-related groups** receive required training in software process improvement. (L5-34, Ab3)	
	Senior management receives required training in software process improvement. (L5-35, Ab4)	

PCM Process - Inputs

Inputs

The table below lists the inputs to the process change management process.

√	Input	Org. Input	References
	Customer satisfaction indicators. (L5-37, A3, 1.2)		
	Expected needs. (L5-43, A8, 4)		
	Long-term goals for software process improvement. (L5-38, A4, 3)		
	Long-term goals for software process performance. (L5-38, A4, 3)		
	Organization's business plans. (L5-37, A3, 1.1)		
	Organization's strategic operating plans. (L5-37, A3, 1.1)		
	Organizational goals for software process improvement. (L5-32, C1, 1)		
	Plan for software process improvement. (L5-37, A3) [Refer to Level 5 Standards for additional information regarding this plan.]		
	Process improvement goals. (L5-33, C2, 4)		
	Process improvement records. (L5, 33, Ab1, 1.2)		
	Short-term goals for software process improvement. (L5-38, A4, 3)		
	Short-term goals for software process performance. (L5-38, A4, 3)		
	Software process improvement issues. (L5-33, C2, 6)		
	Software process improvement proposal. (L5-36, A2, 4)		

PCM Process - Activities

Activities

The table below lists the recommended activities for the process change management process.

√	Activities	References
	A software process improvement program is established which empowers the members of the organization to improve the processes of the organization. (L5-35, A1)	
	The **group responsible for the organization's software process activities (e.g., software engineering process group)** coordinates the software process improvement activities. (L5-36, A2)	
	The organization develops and maintains a plan for software process improvement according to a documented procedure. (L5-37, A3) [Refer to Level 5 Procedure Checklists for additional information.]	
	The software process improvement activities are performed in accordance with the software process improvement plan. (L5-38, A4)	
	Software process improvement proposals are handled according to a documented procedure. (L5-39, A5) [Refer to Level 5 Procedure Checklists for additional information.]	
	Members of the organization actively participate in teams to develop software process improvements for assigned process areas. (L5-41, A6) ❑ Each of these process improvement teams is funded and the activities are planned and scheduled. ❑ Goals are established for each process improvement effort; where possible, these goals are defined quantitatively. ❑ The plans are approved by the **managers of the affected groups** and the **group that defines and maintains the affected process descriptions**.	

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Activities, continued

The table below lists the recommended activities for the process change management process, continued from the previous page.

√	Activities	References
	Where appropriate, the software process improvements are installed on a pilot basis to determine their benefits and effectiveness before they are introduced into normal practice. (L5-42, A7) ❑ Adjustments to the proposed process improvement are made and documented during the pilot effort to optimize its implementation. ❑ Lessons learned and problems encountered are documented. ❑ The benefits, risks, and impacts of the process improvement's broader use in the organization are estimated, and the uncertainty in these estimates is assessed. ❑ A decision is made whether to terminate the effort, proceed with broad-scale implementation of the improvement, or replan and continue the pilot effort.	
	When the decision is made to transfer a software process improvement into normal practice, the improvement is implemented according to a documented procedure. (L5-42, A8) [Refer to Level 5 Procedure Checklists for additional information.]	
	Records of software process improvement activities are maintained. (L5-43, A9) ❑ Information about the initiation, status, and implementation of software process improvement proposals is maintained. ❑ Ready access is provided to the software process improvement records. ❑ Historical data are maintained and reports are produced on software process improvements.	
	Software managers and **technical staff** receive feedback on the status and results of the software process improvement activities on an event-driven basis. (L5-44, A10)	
	Measurements are made and used to determine the status of the software process improvement activities. (L5-45, M1)	

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PCM Process - Activities, Continued

Activities, continued

The table below lists the recommended activities for the process change management process, continued from the previous page.

√	Activities	References
	The activities for software process improvement are reviewed with **senior management** on a periodic basis. (L5-46, V1) [Refer to PCM Process Reviews and Audits for additional information.]	
	The software quality assurance group reviews and/or audits the activities and work products for software process improvement and reports the results. (L5-46, V2) [Refer to PCM Process Reviews and Audits for additional information.]	

PCM Process - Outputs

Outputs

The table below lists the recommended outputs produced by the process change management process.

√	Output	Org. Output	References
	Accomplishments of the process improvement activities. (L5-36, A2, 6)		
	Adjustments to the proposed process improvement. (L5-42, A7, 1)		
	Benefits of each software process improvement. (L5-40, A5, 3)		
	Change in software process performance. (L5-43, A8, 2)		
	Changes to the organization's standard software process. (L5-36, A2, 7)		
	Changes to the projects' defined software processes. (L5-47, V2, 4)		
	Decision rationale (for deciding whether to implement the software process improvement proposal). (L5-39, A5, 2)		
	Decision to transfer a software process improvement into normal practice. (L5-42, A8)		
	Decision whether to implement each software process improvement proposal. (L5-39, A5, 2)		
	Decision whether to terminate the (pilot) effort, proceed with broad-scale implementation of the improvement, or replan and continue the pilot effort. (L5-42, A7, 4)		
	Expected benefits of each software process improvement proposal. (L5-40, A5, 3)		
	Feedback on the status and results of the software process improvement activities. (L5-44, A10)		
	Focus on high-priority software process improvement proposals. (L5-40, A5, 4.1)		
	Goals for each process improvement effort. (L5-41, A6, 2)		
	Highest priority process areas for improvement. (L5-38, A4, 2)		

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PCM Process - Outputs, Continued

Outputs, continued

The table below lists the recommended outputs produced by the process change management process, continued from the previous page.

√	Output	Org. Output	References
	Historical data on software process improvements. (L5-44, A9, 3)		
	Impacts of each software process improvement. (L5-42, A7, 3)		
	Information about the implementation of software process improvement proposals. (L5-44, A9, 1)		
	Information about the initiation of software process improvement proposals. (L5-44, A9, 1)		
	Information about the status of software process improvement proposals. (L5-44, A9, 1)		
	Lessons learned (from piloting software process improvements). (L5-42, A7, 2)		
	Measurement plans for software process performance. (L5-36, A2, 1)		
	Measurements (to determine the status of the software process improvement activities). (L5-45, M1)		
	Needed goal changes. (L5-46, V1, 3)		
	Notification of the disposition of software process improvement proposals. (L5-41, A5, 11.2)		
	Organization's long-term goals for process improvement. (L5-33, C2, 1)		
	Organization's long-term plans for process improvement. (L5-33, C2, 1)		
	Organization's training needs for process improvement. (L5-36, A2, 3)		
	Organizational goals for software process performance. (L5-36, A2, 1)		
	Organizational plan for software process improvement. (L5-37, A3)		
	Plans for process improvement team activities. (L5-41, A6, 1)		

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PCM Process - Outputs, Continued

Outputs, continued

The table below lists the recommended outputs produced by the process change management process, continued from the previous page.

√	Output	Org. Output	References
	Priority of software process improvement proposals selected for implementation. (L5-40, A5, 4)		
	Problems encountered (when pilot testing software process improvements). (L5-42, A7, 2)		
	Process changes. (L5-33, Ab1, 1.3)		
	Process improvement goals. (L5-33, C2, 3)		
	Process improvement plans to meet these (process improvement) goals. (L5-33, C2, 3)		
	Process measurements. (L5-47, V2, 3)		
	Prompt acknowledgment of submitted software process improvement proposals. (L5-41, A5, 11.1)		
	Records of software process improvement. (L5-36, A2, 8)		
	Reports on software process improvements. (L5-44, A9, 3)		
	Results (of **software quality assurance group** reviews and/or audits of the activities and work products for software process improvement). (L5-46, V2)		
	Results of tracking status, accomplishments, and participation in the process improvement activities (from the **group responsible for the organization's software process activities, e.g., software engineering process group)**. (L5-36, A2, 6)		
	Revisions to the plan for software process improvement. (L5-46, V1, 5)		
	Risks of each software process improvement. (L5-42, A7, 3)		
	Software process improvement. (L5-42, A8)		

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PCM Process - Outputs, Continued

Outputs, continued

The table below lists the recommended outputs produced by the process change management process, continued from the previous page.

√	Output	Org. Output	References
	Status of each software process improvement proposal. (L5-41, A5, 7)		
	Status of the process improvement activities. (L5-36, A2, 6)		
	Strategy for collecting data to measure and track the change in software process performance. (L5-43, A8, 2)		
	Summary of the major software process improvement activities. (L5-44, A10, 1)		
	Summary status of the software process improvement proposals that are submitted, open, and completed. (L5-44, A10, 3)		
	Training course materials. (L5-36, A2, 3)		
	Training courses. (L5-43, A8, 3)		
	Uncertainty in the estimate of the benefits of each software process improvement proposal. (L5-42, A7, 3)		
	Uncertainty in the estimate of the impacts of each software process improvement proposal. (L5-42, A7, 3)		
	Uncertainty in the estimate of the risks of each software process improvement proposal. (L5-42, A7, 3)		

PCM Process - Exit Criteria

Output-based exit criteria

The CMM recommends that outputs satisfy the states described in the table below to exit the process change management process.

√	Output	State	References
	Accomplishments of the process improvement activities	are tracked by **the group responsible for the organization's software process activities, e.g., software engineering process group**. (L5-36, A2, 6)	
	Adjustments to the proposed process improvement	❑ are made during the pilot effort to optimize its implementation. (L5-42, A7, 1) ❑ are documented during the pilot effort to optimize its implementation. (L5-42, A7, 1)	
	Benefits of each software process improvement	❑ are determined, where appropriate, (by installing the improvements) on a pilot basis before they are introduced into normal practice. (L5-42, A7) ❑ are estimated (for broader use in the organization based on pilot testing). (L5-42, A7, 3)	

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PCM Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the process change management process, continued from the previous page.

√	Output	State	References
	Changes to the organization's standard software process or software process changes	❑ are coordinated by the **group responsible for the organization's software process activities, e.g., software engineering process group**. (L5-36, A2, 7) ❑ are tracked by **the group responsible for the organization's software process activities, e.g., software engineering process group**. L5-36, A2, 7) ❑ that are judged to have a major impact on product quality or productivity or that will significantly alter satisfaction of the customer and end users are reviewed and approved by appropriate **management** before they are implemented. (L5-41, A5, 9) ❑ are incorporated into the organization's standard software process. (L5-43, A8, 5) ❑ are incorporated into the projects' defined software processes. (L5-43, A8, 6)	
	Decision rationale (for deciding whether to implement the software process improvement proposal)	is documented. (L5-39, A5, 2)	
	Decision whether to implement each software process improvement proposal	is made. (L5-39, A5, 2)	

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PCM Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the process change management process, continued from the previous page.

√	Output	State	References
	Decision whether to terminate the (pilot) effort, proceed with broad-scale implementation of the improvement, or replan and continue the pilot effort	is made. (L5-42, A7, 4)	
	Expected benefits of each software process improvement proposal	are determined. (L5-40, A5, 3)	
	Feedback on the status and results of the software process improvement activities	❑ is received by **software managers** and **technical staff** on an event-driven basis. (L5-44, A10) ❑ provides a summary of the major software process improvement activities. (L5-44, A10, 1) ❑ provides significant innovations and actions taken to address software process improvement. (L5-44, A10, 2) ❑ provides a summary status of the software process improvement proposals that are submitted, open, and completed. (L5-44, A10, 3)	
	Focus on high-priority software process improvement proposals	is maintained. (L5-40, A5, 4.1)	
	Goals for each process improvement effort	❑ are established. (L5-41, A6, 2) ❑ are defined quantitatively, where possible. (L5-41, A6, 2)	
	Historical data on software process improvements	are maintained. (L5-44, A9, 3)	

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PCM Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the process change management process, continued from the previous page.

√	Output	State	References
	Impacts of each software process improvement	are estimated (for broader use in the organization based on pilot testing). (L5-42, A7, 3).	
	Information about the implementation of software process improvement proposals	is maintained. (L5-44, A9, 1)	
	Information about the initiation of software process improvement proposals	is maintained. (L5-44, A9, 1)	
	Information about the status of software process improvement proposals	is maintained. (L5-44, A9, 1)	
	Lessons learned (from piloting software process improvements)	are documented. (L5-42, A7, 2)	
	Measurement plans for software process performance	are defined by the **group responsible for the organization's software process activities (e.g., software engineering process group)**. (L5-36, A2, 1)	
	Measurements (to determine the status of the software process improvement activities)	are made. (L5-45, M1) are used. (L5-45, M1)	
	Needed goal changes	are identified (during periodic **senior management** reviews of the activities for software process improvement). (L5-46, V1, 3)	

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PCM Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the process change management process, continued from the previous page.

√	Output	State	References
	Notification of the disposition of software process improvement proposals	is received by **submitters of the software process improvement proposals**. (L5-41, A5, 11.2)	
	Organization's long-term goals for process improvement	are established by **senior management**. (L5-33, C2, 1)	
	Organization's long-term plans for process improvement	are established by **senior management**. (L5-33, C2, 1)	
	Organization's training needs for process improvement	are defined with the participation of the **group responsible for the organization's software process activities (e.g., software engineering process group)**. (L5-36, A2, 3)	
	Organizational goals for software process performance	❑ are defined by the **group responsible for the organization's software process activities (e.g., software engineering process group)**. (L5-36, A2, 1) ❑ are reviewed with **senior management** for their endorsement. (L5-36, A2, 2)	
	Organizational plan for software process improvement	❑ is developed according to a documented procedure. (L5-37, A3) ❑ is maintained according to a documented procedure. (L5-37, A3) ❑ undergoes peer review. (L5-37, A3, 2) ❑ is reviewed by the affected **managers**. (L5-37, A3, 3) ❑ is managed and controlled. (L5-37, A3, 4)	

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PCM Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the process change management process, continued from the previous page.

√	Output	State	References
	Plans for process improvement team activities	are approved by the **managers of the affected groups** and the **group that defines and maintains the affected process descriptions**. (L5-41, A6, 3)	
	Priority of software process improvement proposals selected for implementation	is determined. (L5-40, A5, 4)	
	Problems encountered (when pilot testing software process improvements)	are documented. (L5-42, A7, 2)	
	Process improvement goals	are reasonable, yet aggressive. (L5-33, C2, 3)	
	Process improvement plans to meet these (process improvement) goals	are effective. (L5-33, C2, 3)	
	Prompt acknowledgment of submitted software process improvement proposals	is received by **submitters of the software process improvement proposals**. (L5-41, A5, 11.1)	
	Records of software process improvement	❑ are defined, ❑ are established, and ❑ are maintained by the **group responsible for the organization's software process activities**, e.g., **software engineering process group**. (L5-36, A2, 8) ❑ are readily accessible. (L5-44, A9, 2)	
	Reports on software process improvements	are produced. (L5-44, A9, 3)	

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PCM Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the process change management process, continued from the previous page.

√	Output	State	References
	Results (of **software quality assurance group** reviews and/or audits of the activities and work products for software process improvement)	are reported. (L5-46, V2)	
	Results of tracking status, accomplishments, and participation in the process improvement activities	are periodically reported to **senior management** (by the **group responsible for the organization's software process activities e.g., software engineering process group)**. (L5-36, A2, 6)	
	Revisions to the plan for software process improvement	are approved (during periodic **senior management** reviews of the activities for software process improvement), as appropriate. (L5-46, V1, 5)	
	Risks of each software process improvement	are estimated (for broader use in the organization based on pilot testing). (L5-42, A7, 3)	
	Software process improvement	is implemented according to a documented procedure. (L5-42, A8)	
	Status of each software process improvement proposal	is tracked. (L5-41, A5, 7)	
	Status of the process improvement activities	is tracked by **the group responsible for the organization's software process activities, e.g., software engineering process group**. (L5-36, A2, 6)	

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PCM Process - Exit Criteria, Continued

Output-based exit criteria, continued

The CMM recommends that outputs satisfy the states described in the table below to exit the process change management process, continued from the previous page.

√	Output	State	References
	Strategy for collecting data to measure and track the change in software process performance (from transferring a software process improvement into normal practice)	❑ is documented. (L5-43, A8, 2) ❑ is reviewed. (L5-43, A8, 2) ❑ is agreed to by the **individuals responsible for implementing the software processes affected by the change**. (L5-43, A8, 2.1)	
	Training course materials	❑ development is supported by the **group responsible for the organization's software process activities (e.g., software engineering process group)**. (L5-36, A2, 3) ❑ presentation is supported by the **group responsible for the organization's software process activities (e.g., software engineering process group)**. (L5-36, A2, 3)	
	Training courses	are updated to reflect the current software process. (L5-43, A8, 3)	
	Uncertainty in the estimate of the benefits of each software process improvement proposal	is assessed. (L5-42, A7, 3)	
	Uncertainty in the estimate of the impacts of each software process improvement proposal	is assessed. (L5-42, A7, 3)	
	Uncertainty in the estimate of the risks of each software process improvement proposal	is assessed. (L5-42, A7, 3)	

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PCM Process - Exit Criteria, Continued

General exit criteria

The CMM recommends that the conditions described in the table below be satisfied to exit the process change management process.

√	Condition	References
	The organization has quantitative, measurable goals for software process improvement and tracks performance against these goals. (L5-32, C1, 1)	
	A software process improvement program is established which empowers the members of the organization to improve the processes of the organization. (L5-35, A1)	
	The **group responsible for the organization's software process activities (e.g., software engineering process group)** coordinates the software process improvement activities. (L5-36, A2)	
	The software process improvement activities are performed in accordance with the software process improvement plan. (L5-38, A4)	
	Software process improvement proposals are handled according to a documented procedure. (L5-39, A5)	
	Each software process improvement proposal is evaluated; a decision is made whether to implement the proposal, and the decision rationale is documented. (L5-39, A5, 2)	
	Software process improvement proposals for which the response has been unusually long are identified and acted upon. (L5-41, A5, 8)	
	Each of the process improvement teams is funded and the activities are planned and scheduled. (L5-41, A6, 1)	
	Training courses are updated to reflect the current software process, and training is provided before installing the process change for general use. (L5-43, A8, 3)	
	Consultation support, appropriate to the expected needs, is established before installing the process change for broad-scale use and is continued as needed. (L5-43, A8, 4)	

PCM Process - Reviews and Audits

Reviews and audits

The table below lists the recommended reviews and audits for the process change management process.

√	Review or Audit	Review Participants	References
	The **group responsible for the organization's software process activities (e.g., software engineering process group)** reviews the organizational goals for process performance with **senior management** for their endorsement. (L5-36, A2, 2)	**Group responsible for the organization's software process activities (e.g., software engineering process group)** **Senior management**	
	The **group responsible for the organization's software process activities (e.g., software engineering process group)** reviews software process improvement proposals and coordinates the actions for these proposals. (L5-36, A2, 5)	**Group responsible for the organization's software process activities (e.g., software engineering process group)**	
	The software process improvement plan undergoes peer review. (L5-37, A3, 2)	**Not specified in the CMM**	
	The software process improvement plan is reviewed by the **affected managers**. (L5-37, A3, 3)	**Affected managers**	
	Software process changes that are judged to have a major impact on product quality or productivity or that will significantly alter satisfaction of the customer and end users are reviewed and approved by appropriate **management** before they are implemented. (L5-41, A5, 9)	**Management**	
	Completed software process improvement actions are reviewed, verified, and approved before they are closed. (L5-41, A5, 10)	**Not specified in the CMM**	

	The strategy for collecting data to measure and track the change in software process performance is documented, reviewed, and agreed to. (L5-43, A8, 2)	**Not specified in the CMM**	

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PCM Process - Reviews and Audits, Continued

Reviews and audits, continued

The table below lists the recommended reviews and audits for the process change management process, continued from the previous page.

√	Review or Audit	Review Participants	References
	The activities for software process improvement are reviewed with **senior management** on a periodic basis. (L5-46, V1) These reviews are held to: ❑ Summarize participation in the process improvement activities. ❑ Assess process performance. ❑ Identify needed goal changes. ❑ Resolve issues. ❑ Approve revisions to the software process improvement plan as appropriate.	**Senior management**	

Continued on next page

PCM Process - Reviews and Audits, Continued

Reviews and audits, continued

The table below lists the recommended reviews and audits for the process change management process, continued from the previous page.

√	Review or Audit	Review Participants	References
	The **software quality assurance group** reviews and/or audits the activities and work products for software process improvement and reports the results. (L5-46, V2) At a minimum, the reviews and/or audits verify: ❑ The preparation of the organization's software process improvement plan. ❑ The process of initiating, submitting, reviewing, approving, and planning implementation of software process improvement proposals. ❑ The degree to which the process measurements conform to the software process descriptions and reflect actual performance. ❑ The process for documenting, reviewing, approving, controlling, and disseminating changes to the organization's standard software process and projects' defined software processes. ❑ The degree to which software process improvement activities are consistently measured and tracked. ❑ The degree to which actual software process improvement performance achieves the plans and goals.	**Software quality assurance group**	

PCM Process - Work Products Managed and Controlled

Work products managed and controlled

The table below lists the work products recommended to be managed and controlled during the process change management process.

√	Work Products Managed and Controlled	References
	Software process improvement plan. (L5-37, A3, 4)	

PCM Process - Measurements

Measurements The table below lists the measurements recommended for the process change management process.

√	Measurements	References
	Measurements to determine the status of the software process improvement activities. (L5-45, M1) Examples of measurements include: ❑ The number of software process improvement proposals submitted and implemented for each process area. ❑ The number of software process improvement proposals submitted by each of the projects, groups, and departments. ❑ The number and types of awards and recognitions received by each of the projects, groups, and departments. ❑ The response time for handling software process improvement proposals. ❑ The percentage of software process improvement proposals accepted per reporting period. ❑ The overall change activity, including number, type, and size of changes. ❑ The effect of implementing each process improvement compared to its defined goals. ❑ Overall performance of the organization's and project's processes, including effectiveness, quality, and productivity compared to their defined goals. ❑ Overall productivity and software quality trends for each project. ❑ Process measurements that relate to the indicators of the customer's satisfaction.	

PCM Process - Documented Procedures

Documented procedures

The table below lists activities in the process change management process recommended to be performed according to a documented procedure.

√	Documented Procedure(s)	References
	The organization develops and maintains a plan for software process improvement according to a documented procedure. (L5-37, A3) [Refer to Level 5 Procedure Checklists for additional information.]	
	Software process improvement proposals are handled according to a documented procedure. (L5-39, A5) [Refer to Level 5 Procedure Checklists for additional information.]	
	When the decision is made to transfer a software process improvement into normal practice, the improvement is implemented according to a documented procedure. (L5-42, A8) [Refer to Level 5 Procedure Checklists for additional information.]	

PCM Process - Training

Training

The table below lists the training recommended for the process change management process.

√	Training	References
	Software managers receive required training in software process improvement. (L5-34, Ab2)	
	The **managers** and **technical staff of the software engineering group** and other **software-related groups** receive required training in software process improvement. (L5-34, Ab3)	
	Senior management receives required training in software process improvement. (L5-35, Ab4)	
	Training courses are updated to reflect the current software process, and training is provided before installing the process change for general use. (L5-43, A8, 3)	

PCM Process - Tools

Tools

The table below lists the tools recommended for the process change management process.

√	Tools	References
	Tools to support process improvement. (L5-34, Ab1, 3) Examples of support tools include: ❑ statistical analysis tools, ❑ database systems, ❑ process automation tools, and ❑ process modeling tools.	
	Support tools to record the desired data (to measure and track the change in software process performance). (L5-43, A8, 2.2)	

Appendices

Overview

Appendix contents

The appendices and their descriptions are provided in the table below.

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Appendix A: List of Acronyms

List of acronyms

The table below lists the acronyms in the software process framework and their meaning.

Acronym	Meaning
CMM	Capability maturity model
DP	Defect prevention
IC	Intergroup coordination
ISM	Integrated software management
KPA	Key process area
OPD	Organization process definition
OPF	Organization process focus
PAT	Process action team
PCM	Process change management
PR	Peer reviews
QPM	Quantitative process management
RM	Requirements management
SCM	Software configuration management
SEI	Software Engineering Institute
SEPG	Software engineering process group
SPE	Software product engineering
SPF	Software process framework
SPP	Software project planning
SPTO	Software project tracking and oversight
SQA	Software quality assurance
SQM	Software quality management
SSM	Software subcontract management
TCM	Technology change management
TP	Training program

Appendix B: Glossary of Terms[1]

A

ability to perform	(See *common features*.)
acceptance criteria	The criteria that a system or component must satisfy in order to be accepted by a user, customer, or other authorized entity. [IEEE-STD-610]
acceptance testing	Formal testing conducted to determine whether or not a system satisfies its acceptance criteria and to enable the customer to determine whether or not to accept the system. [IEEE-STD-610]
activity	Any step taken or function performed, both mental and physical, toward achieving some objective. Activities include all the work the managers and technical staff do to perform the tasks of the project and organization. (See *task* for contrast.)
activities performed	(See *common features*.)
action item	(1) A unit in a list that has been assigned to an individual or group for disposition. (2) An action proposal that has been accepted.
action proposal	A documented suggestion for change to a process or process-related item that will prevent the future occurrence of defects identified as a result of defect prevention activities. (See also *software process improvement proposal*.)
agent*	(See *role.*)
allocated requirements	(See *system requirements allocated to software*.)
application domain	A bounded set of related systems (i.e., systems that address a particular type of problem). Development and maintenance in an application domain usually requires special skills and/or resources. Examples include payroll and personnel systems, command and control systems, compilers, and expert systems.
assessment	(See *software process assessment*.)
audit	An independent examination of a work product or set of work products to assess compliance with specifications, standards, contractual agreements, or other criteria. [IEEE-STD-610]

B

baseline	A specification or product that has been formally reviewed and agreed upon, that thereafter serves as the basis for further development, and that can be changed only through formal change control procedures. [IEEE-STD-610]
baseline configuration management	The establishment of baselines that are formally reviewed and agreed on and serve as the basis for further development. Some software work products, e.g., the software design and the code, should have baselines established at predetermined points, and a rigorous change control process should be applied to these items. These baselines provide control and stability when interacting with the customer. (See also *baseline management*.)

[1] Unless denoted by an asterisk, all terms are as defined in [Paulk93b].

baseline management	In configuration management, the application of technical and administrative direction to designate the documents and changes to those documents that formally identify and establish baselines at specific times during the life cycle of a configuration item. [IEEE-STD-610]
benchmark	A standard against which measurements or comparisons can be made. [IEEE-STD-610]
bidder	An individual, partnership, corporation, or association that has submitted a proposal and is a candidate to be awarded a contract to design, develop, and/or manufacture one or more products.

C

capability maturity model	A description of the stages through which software organizations evolve as they define, implement, measure, control, and improve their software processes. This model provides a guide for selecting process improvement strategies by facilitating the determination of current process capabilities and the identification of the issues most critical to software quality and process improvement.
causal analysis	The analysis of defects to determine their underlying root cause.
causal analysis meeting	A meeting, conducted after completing a specific task, to analyze defects uncovered during the performance of that task.
commitment	A pact that is freely assumed, visible, and expected to be kept by all parties.
commitment to perform	(See *common features*.)
common cause (of a defect)	A cause of a defect that is inherently part of a process or system. Common causes affect every outcome of the process and everyone working in the process. (See *special cause* for contrast.)
common features	The subdivision categories of the CMM key process areas. The common features are attributes that indicate whether the implementation and institutionalization of a key process area is effective, repeatable, and lasting. The CMM common features are the following: ❑ *commitment to perform*: The actions the organization must take to ensure that the process is established and will endure. Commitment to Perform typically involves establishing organizational policies and senior management sponsorship. ❑ *ability to perform*: The preconditions that must exist in the project or organization to implement the software process competently. Ability to Perform typically involves resources, organizational structures, and training. ❑ *activities performed*: A description of the roles and procedures necessary to implement a key process area. Activities Performed typically involve establishing plans and procedures, performing the work, tracking it, and taking corrective actions as necessary.

Definition continued on next page

common features, continued	❑ *measurement and analysis* : A description of the need to measure the process and analyze the measurements. Measurement and Analysis typically includes examples of the measurements that could be taken to determine the status and effectiveness of the Activities Performed. ❑ *verifying implementation*: The steps to ensure that the activities are performed in compliance with the process that has been established. Verification typically encompasses reviews and audits by management and software quality assurance.
configuration	In configuration management, the functional and physical characteristics of hardware or software as set forth in technical documentation or achieved in a product. [IEEE-STD-610]
configuration control	An element of configuration management, consisting of the evaluation, coordination, approval or disapproval, and implementation of changes to configuration items after formal establishment of their configuration identification. [IEEE-STD-610]
configuration identification	An element of configuration management, consisting of selecting the configuration items for a system and recording their functional and physical characteristics in technical documentation. [IEEE-STD-610]
configuration item	An aggregation of hardware, software, or both, that is designated for configuration management and treated as a single entity in the configuration management process. [IEEE-STD-610]
configuration management	A discipline applying technical and administrative direction and surveillance to identify and document the functional and physical characteristics of a configuration item, control changes to those characteristics, record and report change processing and implementation status, and verify compliance with specified requirements. [IEEE-STD-610]
configuration management library system	The tools and procedures to access the contents of the software baseline library.
configuration unit	The lowest level entity of a configuration item or component that can be placed into, and retrieved from, a configuration management library system.
consistency	The degree of uniformity, standardization, and freedom from contradiction among the documents or parts of system or component. [IEEE-STD-610]
contingency factor	An adjustment (increase) of a size, cost, or schedule plan to account for likely underestimates of these parameters due to incomplete specification, inexperience in estimating the application domain, etc.
contract terms and conditions	The stated legal, financial, and administrative aspects of a contract.
critical computer resource	The parameters of the computing resources deemed to be a source of risk to the project because the potential need for those resources may exceed the amount that is available. Examples include target computer memory and host computer disk space.
critical path	A series of dependent tasks for a project that must be completed as planned to keep the entire project on schedule.

customer	The individual or organization that is responsible for accepting the product and authorizing payment to the developing organization.

D

defect	A flaw in a system or system component that causes the system or component to fail to perform its required function. A defect, if encountered during execution, may cause a failure of the system.
defect density	The number of defects identified in a product divided by the size of the product component (expressed in standard measurement terms for that product).
defect prevention	The activities involved in identifying defects or potential defects and preventing them from being introduced into a product.
defect root cause	The underlying reason (e.g., process deficiency) that allowed a defect to be introduced.
defined level	(See *maturity level.*)
defined software process	(See *project's defined software process.*)
dependency item	A product, action, piece of information, etc., that must be provided by one individual or group to a second individual or group so that the second individual or group can perform a planned task.
developmental configuration management	The application of technical and administrative direction to designate and control software and associated technical documentation that define the evolving configuration of a software work product during development. Developmental configuration management is under the direct control of the developer. Items under developmental configuration management are not baselines, although they may be baselined and placed under baseline configuration management at some point in their development.
deviation	A noticeable or marked departure from the appropriate norm, plan, standard, procedure, or variable being reviewed.
documented procedure	(See *procedure*.)

E

effective process	A process that can be characterized as practiced, documented, enforced, trained, measured, and able to improve. (See also *well-defined process*.)
end user	The individual or group who will use the system for its intended operational use when it is deployed in its environment.
end user representatives	A selected sample of end users who represent the total population of end users.
engineering group	A collection of individuals (both managers and technical staff) representing an engineering discipline. Examples of engineering disciplines include systems engineering, hardware engineering, system test, software engineering, software configuration management, and software quality assurance.
entry criteria*	The conditions under which an activity can be started. Entry criteria often take the form of a simple or compound predicate about the state of a work product, role, or activity.
exit criteria*	The conditions under which an activity can be declared complete. Exit criteria often take the form of a simple or compound predicate about the state of an artifact, role, or activity.

evaluation	(See *software capability evaluation.*)
event-driven review/activity	A review or activity that is performed based on the occurrence of an event within the project (e.g., a formal review or the completion of a life cycle stage). (See *periodic review/activity* for contrast.)

F

findings	The conclusions of an assessment, evaluation, audit, or review that identify the most important issues, problems, or opportunities within the area of investigation.
first-line software manager	A manager who has direct management responsibility (including providing technical direction and administering the personnel and salary functions) for the staffing and activities of a single organizational unit (e.g., a department or project team) of software engineers and other related staff.
formal review	A formal meeting at which a product is presented to the end user, customer, or other interested parties for comment and approval. It can also be a review of the management and technical activities and of the progress of the project.
function	A set of related actions, undertaken by individuals or tools that are specifically assigned or fitted for their roles, to accomplish a set purpose or end.

G

goals	A summary of the key practices of a key process area that can be used to determine whether an organization or project has effectively implemented the key process area. The goals signify the scope, boundaries, and intent of each key process area.
group	The collection of departments, managers, and individuals who have responsibility for a set of tasks or activities. A group could vary from a single individual assigned part time, to several part-time individuals assigned from different departments, to several individuals dedicated full time.

H

host computer	A computer used to develop software. (See *target computer* for contrast.)

I

initial level	(See *maturity level.*)
input*	The relationship or link between an activity and a work product. Inputs are the results produced by a prior activity and used by the current activity and may be qualified by the state of a work product.
institutionalization	The building of infrastructure and corporate culture that support methods, practices, and procedures so that they are the ongoing way of doing business, even after those who originally defined them are gone.

integrated software management	The unification and integration of the software engineering and management activities into a coherent defined software process based on the organization's standard software process and related process assets.
integration	(See *software integration.*)

K

key practices	The infrastructures and activities that contribute most to the effective implementation and institutionalization of a key process area.
key process area	A cluster of related activities that, when performed collectively, achieve a set of goals considered important for establishing process capability. The key process areas have been defined to reside at a single maturity level. They are the areas identified by the SEI to be the principal building blocks to help determine the software process capability of an organization and understand the improvements needed to advance to higher maturity levels. The level 2 key process areas in the CMM are Requirements Management, Software Project Planning, Software Project Tracking and Oversight, Software Subcontract Management, Software Quality Assurance, and Software Configuration Management. The level 3 key process areas in the CMM are Organization Process Focus, Organization Process Definition, Training Program, Integrated Software Management, Software Product Engineering, Intergroup Coordination, and Peer Reviews. The level 4 key process areas are Quantitative Process Management and Software Quality Management. The level 5 key process areas are Defect Prevention, Technology Change Management, and Process Change Management.

L

life cycle	(See *software life cycle*.)

M

maintenance	The process of modifying a software system or component after delivery to correct faults, improve performance or other attributes, or adapt to a changed environment. [IEEE-STD-610]
managed and controlled	The process of identifying and defining software work products that are not part of a baseline and, therefore, are not placed under configuration management but that must be controlled for the project to proceed in a disciplined manner. "Managed and controlled" implies that the version of the work product in use at a given time (past or present) is known (i.e., version control), and changes are incorporated in a controlled manner (i.e., change control).
managed level	(See *maturity level.*)
manager	A role that encompasses providing technical and administrative direction and control to individuals performing tasks or activities within the manager's area of responsibility. The traditional functions of a manager include planning, resourcing, organizing, directing, and controlling work within an area of responsibility.

maturity level

A well-defined evolutionary plateau toward achieving a mature software process. The five maturity levels in the SEI's Capability Maturity Model are:

- *initial*: The software process is characterized as ad hoc, and occasionally even chaotic. Few processes are defined, and success depends on individual effort.

Definition continued on next page

maturity level, continued

- *repeatable*: Basic project management processes are established to track cost, schedule, and functionality. The necessary process discipline is in place to repeat earlier successes on projects with similar applications.
- *defined*: The software process for both management and engineering activities is documented, standardized, and integrated into a standard software process for the organization. All projects use an approved, tailored version of the organization's standard software process for developing and maintaining software.
- *managed*: Detailed measures of the software process and product quality are collected. Both the software process and products are quantitatively understood and controlled.
- *optimizing*: Continuous process improvement is enabled by quantitative feedback from the process and from piloting innovative ideas and technologies.

maturity questionnaire

A set of questions about the software process that sample the key practices in each key process area of the CMM. The maturity questionnaire is used as a springboard to appraise the capability of an organization or project to execute a software process reliably.

measure

A unit of measurement (such as source lines of code or document pages of design).

measurement

The dimension, capacity, quantity, or amount of something (e.g., 300 source lines of code or 7 document pages of design).

method

A reasonably complete set of rules and criteria that establish a precise and repeatable way of performing a task and arriving at a desired result.

methodology

A collection of methods, procedures, and standards that defines an integrated synthesis of engineering approaches to the development of a product.

milestone

A scheduled event for which some individual is accountable and that is used to measure progress.

N

nontechnical requirements

Agreements, conditions, and/or contractual terms that affect and determine the management activities of a software project.

O

operational software

The software that is intended to be used and operated in a system when it is delivered to its customer and deployed in its intended environment.

optimizing level	(See *maturity level.*)
organization	A unit within a company or other entity (e.g., government agency or branch of service) within which many projects are managed as a whole. All projects within an organization share a common top-level manager and common policies.
organization's measurement program	The set of related elements for addressing an organization's measurement needs. It includes the definition of organization-wide measurements, methods and practices for collecting organizational measurement data, methods and practices for analyzing organizational measurement data, and measurement goals for the organization.
organization's software process assets	A collection of entities, maintained by an organization, for use by projects in developing, tailoring, maintaining, and implementing their software processes. These software process assets typically include: ❑ the organization's standard software process, ❑ descriptions of the software life cycles approved for use, ❑ the guidelines and criteria for tailoring the organization's standard software process, ❑ the organization's software process database, and ❑ a library of software process-related documentation. Any entity that the organization considers useful in performing the activities of process definition and maintenance could be included as a process asset.
organization's software process database	A database established to collect and make available data on the software processes and resulting software work products, particularly as they relate to the organization's standard software process. The database contains or references both the actual measurement data and the related information needed to understand the measurement data and assess it for reasonableness and applicability. Examples of process and work product data include estimates of software size, effort, and cost; actual data on software size, effort, and cost; productivity data; peer review coverage and efficiency; and number and severity of defects found in the software code.
organization's standard software process	The operational definition of the basic process that guides the establishment of a common software process across the software projects in an organization. It describes the fundamental software process elements that each software project is expected to incorporate into its defined software process. It also describes the relationships (e.g., ordering and interfaces) between these software process elements.
orientation	An overview or introduction to a topic for those overseeing or interfacing with the individuals responsible for performing in the topic area. (See *train* for contrast.)

output*	The relationship or link between an activity and a work product. Outputs are the results produced by the current activity and used by a subsequent activity and may be qualified by the state of a work product.

P

Pareto analysis	The analysis of defects by ranking causes from most significant to least significant. Pareto analysis is based on the principle, named after the 19th-century economist Vilfredo Pareto, that most effects come from relatively few causes, i.e., 80% of the effects come from 20% of the possible causes.
peer review	A review of a software work product, following defined procedures, by peers of the producers of the product for the purpose of identifying defects and improvements.
peer review leader	An individual specifically trained and qualified to plan, organize, and lead a peer review.
periodic review/activity	A review or activity that occurs at specified regular time intervals. (See *event-driven review/activity* for contrast.)
policy	A guiding principle, typically established by senior management, which is adopted by an organization or project to influence and determine decisions.
prime contractor	An individual, partnership, corporation, or association that administers a subcontract to design, develop, and/or manufacture one or more products.
procedure	A written description of a course of action to be taken to perform a given task. [IEEE-STD-610]
process	A sequence of steps performed for a given purpose; for example, the software development process. [IEEE-STD-610]
process capability	The range of expected results that can be achieved by following a process. (See *process performance* for contrast.)
process capability baseline	A documented characterization of the range of expected results that would normally be achieved by following a specific process under typical circumstances. A process capability baseline is typically established at an organizational level. (See *process performance baseline* for contrast.)
process database	(See *organization's software process database*.)
process description	The operational definition of the major components of a process. Documentation that specifies, in a complete, precise, verifiable manner, the requirements, design, behavior, or other characteristics of a process. It may also include the procedures for determining whether these provisions have been satisfied. Process descriptions may be found at the task, project, or organizational level.
process development	The act of defining and describing a process. It may include planning, architecture, design, implementation, and validation.
process measurement	The set of definitions, methods, and activities used to take measurements of a process and its resulting products for the purpose of characterizing and understanding the process.

process performance	A measure of the actual results achieved by following a process. (See *process capability* for contrast.)
process performance baseline	A documented characterization of the actual results achieved by following a process, which is used as a benchmark for comparing actual process performance against expected process performance. A process performance baseline is typically established at the project level, although the initial process performance baseline will usually be derived from the process capability baseline. (See *process capability baseline* for contrast.)
process tailoring	The activity of creating a process description by elaborating, adapting, and/or completing the details of process elements or other incomplete specifications of a process. Specific business needs for a project will usually be addressed during process tailoring.
product	(See *software product* and *software work product*.)
profile	A comparison, usually in graphical form, of plans or projections versus actuals, typically over time.
project	An undertaking requiring concerted effort, which is focused on developing and/or maintaining a specific product. The product may include hardware, software, and other components. Typically a project has its own funding, cost accounting, and delivery schedule.
project's defined software process	The operational definition of the software process used by a project. The project's defined software process is a well-characterized and understood software process, described in terms of software standards, procedures, tools, and methods. It is developed by tailoring the organization's standard software process to fit the specific characteristics of the project. (See also *organization's standard software process, effective process,* and *well-defined process*.)
project manager	The role with total business responsibility for an entire project; the individual who directs, controls, administers, and regulates a project building a software or hardware/software system. The project manager is the individual ultimately responsible to the customer.
project software manager	The role with total responsibility for all the software activities for a project. The project software manager is the individual the project manager deals with in terms of software commitments and who controls all the software resources for a project.

Q

quality	(1) The degree to which a system, component, or process meets specified requirements. (2) The degree to which a system, component, or process meets customer or user needs or expectations. [IEEE-STD-610]
quality assurance	(See *software quality assurance*.)
quantitative control	Any quantitative or statistically-based technique appropriate to analyze a software process, identify special causes of variations in the performance of the software process, and bring the performance of the software process within well-defined limits.

R

repeatable level	(See *maturity level.*)
required training	Training designated by an organization to be required to perform a specific role.
risk	Possibility of suffering loss.
risk management	An approach to problem analysis which weighs risk in a situation by using risk probabilities to give a more accurate understanding of the risks involved. Risk management includes risk identification, analysis, prioritization, and control.
risk management plan	The collection of plans that describe the risk management activities to be performed on a project.
role	A unit of defined responsibilities that may be assumed by one or more individuals.

S

senior manager	A management role at a high enough level in an organization that the primary focus is the long-term vitality of the organization, rather than short-term project and contractual concerns and pressures. In general, a senior manager for engineering would have responsibility for multiple projects.
software architecture	The organizational structure of the software or module. [IEEE-STD-610]
software baseline audit	An examination of the structure, contents, and facilities of the software baseline library to verify that baselines conform to the documentation that describes the baselines.
software baseline library	The contents of a repository for storing configuration items and the associated records.
software build	An operational version of a software system or component that incorporates a specified subset of the capabilities the final software system or component will provide. [IEEE-STD-610]
software capability evaluation	An appraisal by a trained team of professionals to identify contractors who are qualified to perform the software work or to monitor the state of the software process used on an existing software effort.
software configuration control board	A group responsible for evaluating and approving or disapproving proposed changes to configuration items, and for ensuring implementation of approved changes.
software development plan	The collection of plans that describe the activities to be performed for the software project. It governs the management of the activities performed by the software engineering group for a software project. It is not limited to the scope of any particular planning standard, such as DOD-STD-2167A and IEEE-STD-1058, which may use similar terminology.

software engineering group	The collection of individuals (both managers and technical staff) who have responsibility for software development and maintenance activities (i.e., requirements analysis, design, code, and test) for a project. Groups performing software-related work, such as the software quality assurance group, the software configuration management group, and the software engineering process group, are not included in the software engineering group.
software engineering process group	A group of specialists who facilitate the definition, maintenance, and improvement of the software process used by the organization. In the key practices, this group is generically referred to as "the group responsible for the organization's software process activities."
software engineering staff	The software technical people (e.g., analysts, programmers, and engineers), including software task leaders, who perform the software development and maintenance activities for the project, but who are not managers.
software integration	A process of putting together selected software components to provide the set or specified subset of the capabilities the final software system will provide.
software life cycle	The period of time that begins when a software product is conceived and ends when the software is no longer available for use. The software life cycle typically includes a concept phase, requirements phase, design phase, implementation phase, test phase, installation and checkout phase, operation and maintenance phase, and, sometimes, retirement phase. [IEEE-STD-610]
software manager	Any manager, at a project or organizational level, who has direct responsibility for software development and/or maintenance.
software plans	The collection of plans, both formal and informal, used to express how software development and/or maintenance activities will be performed. Examples of plans that could be included: software development plan, software quality assurance plan, software configuration management plan, software test plan, risk management plan, and process improvement plan.
software process	A set of activities, methods, practices, and transformations that people use to develop and maintain software and the associated products (e.g., project plans, design documents, code, test cases, and user manuals).
software process assessment	An appraisal by a trained team of software professionals to determine the state of an organization's current software process, to determine the high-priority software process-related issues facing an organization, and to obtain the organizational support for software process improvement.
software process assets	(See *organization's software process assets.*)
software process capability	(See *process capability.)*
software process description	The operational definition of a major software process component identified in the project's defined software process or the organization's standard software process. It documents, in a complete, precise, verifiable manner, the requirements, design, behavior, or other characteristics of a software process. (See also *process description*.)

software process element	A constituent element of a software process description. Each process element covers a well-defined, bounded, closely related set of tasks (e.g., software estimating element, software design element, coding element, and peer review element). The descriptions of the process elements may be templates to be filled in, fragments to be completed, abstractions to be refined, or complete descriptions to be modified or used unmodified.
software process improvement plan	A plan, derived from the recommendations of a software process assessment, that identifies the specific actions that will be taken to improve the software process and outlines the plans for implementing those actions. Sometimes referred to as an action plan.
software process improvement proposal	A documented suggestion for change to a process or process-related item that will improve software process capability and performance. (See also *action proposal*.)
software process maturity	The extent to which a specific process is explicitly defined, managed, measured, controlled, and effective. Maturity implies a potential for growth in capability and indicates both the richness of an organization's software process and the consistency with which it is applied in projects throughout the organization.
software process performance	(See *process performance*.)
software process-related documentation	Example documents and document fragments, which are expected to be of use to future projects when they are tailoring the organization's standard software process. The examples may cover subjects such as a project's defined software process, standards, procedures, software development plans, measurement plans, and process training materials.
software product	The complete set, or any of the individual items of the set, of computer programs, procedures, and associated documentation and data designated for delivery to a customer or end user. [IEEE-STD-610] (See *software work product* for contrast.)
software project	An undertaking requiring concerted effort, which is focused on analyzing, specifying, designing, developing, testing, and/or maintaining the software components and associated documentation of a system. A software project may be part of a project building a hardware/software system.
software quality assurance	(1) A planned and systematic pattern of all actions necessary to provide adequate confidence that a software work product conforms to established technical requirements. (2) A set of activities designed to evaluate the process by which software work products are developed and/or maintained.
software quality goal	Quantitative quality objectives defined for a software work product.
software quality management	The process of defining quality goals for a software product, establishing plans to achieve these goals, and monitoring and adjusting the software plans, software work products, activities, and quality goals to satisfy the needs and desires of the customer and end users.

software-related group	A collection of individuals (both managers and technical staff) representing a software engineering discipline that supports, but is not directly responsible for, software development and/or maintenance. Examples of software engineering disciplines include software quality assurance and software configuration management.
software requirement	A condition or capability that must be met by software needed by a user to solve a problem or achieve an objective. [IEEE-STD-610]
software work product	Any artifact created as part of defining, maintaining, or using a software process, including process descriptions, plans, procedures, computer programs, and associated documentation, which may or may not be intended for delivery to a customer or end user. (See *software product* for contrast.)
special cause (of a defect)	A cause of a defect that is specific to some transient circumstance and not an inherent part of a process. Special causes provide random variation (noise) in process performance. (See *common cause* for contrast.)
staff	The individuals, including task leaders, who are responsible for accomplishing an assigned function, such as software development or software configuration management, but who are not managers.
stage	A partition of the software effort that is of a manageable size and that represents a meaningful and measurable set of related tasks which are performed by the project. A stage is usually considered a subdivision of a software life cycle and is often ended with a formal review prior to the onset of the following stage.
standard	Mandatory requirements employed and enforced to prescribe a disciplined uniform approach to software development.
standard software process	(See *organization's standard software process*.)
statement of work	A description of all the work required to complete a project, which is provided by the customer.
subcontract manager	A manager in the prime contractor's organization who has direct responsibility for administering and managing one or more subcontracts.
subcontractor	An individual, partnership, corporation, or association that contracts with an organization (i.e., the prime contractor) to design, develop, and/or manufacture one or more products.
system	A collection of components organized to accomplish a specific function or set of functions. [IEEE-STD-610]
system engineering group	The collection of individuals (both managers and technical staff) who have responsibility for specifying the system requirements; allocating the system requirements to the hardware, software, and other components; specifying the interfaces between the hardware, software, and other components; and monitoring the design and development of these components to ensure conformance with their specifications.
system requirement	A condition or capability that must be met or possessed by a system or system component to satisfy a condition or capability needed by a user to solve a problem. [IEEE-STD-610]

system requirements allocated to software	The subset of the system requirements that are to be implemented in the software components of the system. The allocated requirements are a primary input to the software development plan. Software requirements analysis elaborates and refines the allocated requirements and results in software requirements which are documented.

T

tailor	To modify a process, standard, or procedure to better match process or product requirements.
target computer	The computer on which delivered software is intended to operate. (See *host computer* for contrast.)
task	(1) A sequence of instructions treated as a basic unit of work. [IEEE-STD-610] (2) A well-defined unit of work in the software process that provides management with a visible checkpoint into the status of the project. Tasks have readiness criteria (preconditions) and completion criteria (postconditions). (See *activity* for contrast.)
task kick-off meeting	A meeting held at the beginning of a task of a project for the purpose of preparing the individuals involved to perform the activities of that task effectively.
task leader	The leader of a technical team for a specific task, who has technical responsibility and provides technical direction to the staff working on the task.
team	A collection of people, often drawn from diverse but related groups, assigned to perform a well-defined function for an organization or a project. Team members may be part-time participants of the team and have other primary responsibilities.
testability	(1) The degree to which a system or component facilitates the establishment of test criteria and the performance of tests to determine whether those criteria have been met. (2) The degree to which a requirement is stated in terms that permit establishment of test criteria and performance of tests to determine whether those criteria have been met. [IEEE-STD-610]
technical requirements	Those requirements that describe what the software must do and its operational constraints. Examples of technical requirements include functional, performance, interface, and quality requirements.
technology	The application of science and/or engineering in accomplishing some particular result.
tool*	A mechanism that provides the needed support for organizational policies, standards, processes, procedures, and training in order to build software products.
traceability	The degree to which a relationship can be established between two or more products of the development process, especially products having a predecessor-successor or master-subordinate relationship to one another. [IEEE-STD-610]
train	To make proficient with specialized instruction and practice. (See also *orientation*.)

training group	The collection of individuals (both managers and staff) who are responsible for coordinating and arranging the training activities for an organization. This group typically prepares and conducts most of the training courses and coordinates use of other training vehicles.
training program	The set of related elements that focus on addressing an organization's training needs. It includes an organization's training plan, training materials, development of training, conduct of training, training facilities, evaluation of training, and maintenance of training records.
training waiver	A written approval exempting an individual from training that has been designated as required for a specific role. The exemption is granted because it has been objectively determined that the individual already possesses the needed skills to perform the role.

U

unit	(1) A separately testable element specified in the design of a computer software component. (2) A logically separable part of a computer program. (3) A software component that is not subdivided into other components. [IEEE-STD-610]
user	(See *end user.)*

V

validation	The process of evaluating software during or at the end of the development process to determine whether it satisfies specified requirements. [IEEE-STD-610]
verification	The process of evaluating software to determine whether the products of a given development phase satisfy the conditions imposed at the start of that phase. [IEEE-STD-610]
verifying implementation	(See *common features*.)

W

waiver	(See *training waiver)*.
well-defined process	A process that includes readiness criteria, inputs, standards and procedures for performing the work, verification mechanisms (such as peer reviews), outputs, and completion criteria. (See also *effective process*.)
work product*	Any final or intermediate product, service, or result of a process or activity.

Appendix C: Role Translation Table

Introduction

This section provides definitions of the major roles that occur in the CMM and blank role translation tables.

Reference

Refer to Chapter 2, “Features of the Software Process Framework” for additional information regarding role translation tables.

In this appendix

This appendix contains the following sections:

Section	Page
Definitions of frequently used roles	Appendix-22
Role/KPA matrix	Appendix-26
Role translation table	Appendix-33

Definitions of Frequently Used Roles

Definitions: Major roles

The following describes roles that are frequently referenced in the key practices:

Manager	A manager fulfills a role that encompasses providing technical and administrative direction and control to individuals performing tasks or activities within the manager's area of responsibility. The traditional functions of a manager include planning, resourcing, organizing, directing, and controlling work within an area of responsibility.
Senior manager	A senior manager fulfills a management role at a high enough level in an organization that the primary focus is the long-term vitality of the organization, rather than short-term project and contractual concerns and pressures. In general, a senior manager for engineering would have responsibility for multiple projects. A senior manager also provides and protects resources for long-term improvement of the software process (e.g., a software engineering process group). Senior management, as used in the CMM, can denote any manager who satisfies the above description, up to and including the head of the whole organization. As used in the key practices, the term senior management should be interpreted in the context of the key process area and the projects and organization under consideration. The intent is to include specifically those senior managers who are needed to fulfill the leadership and oversight roles essential to achieving the goals of the key process area.
Project manager	A project manager fulfills the role with total business responsibility for an entire project; the project manager is the individual who directs, controls, administers, and regulates a project building a software or hardware/software system. The project manager is the individual ultimately responsible to the customer. In a project-oriented organizational structure, most of the people working on a project would report to the project manager, although some disciplines might have a matrixed reporting relationship. In a matrixed organizational structure, it may be only the business staff who reports to the project manager. The engineering groups would then have a matrixed reporting relationship.

Project software manager	A project software manager fulfills the role with total responsibility for all the software activities for a project. The project software manager is the individual the project manager deals with in terms of software commitments and who controls all the software resources for a project. The software engineering groups on a project would report to the project software manager, although some activities such as tools development might have a matrixed reporting relationship. *Definition continued on next page*

Continued on next page

Definitions of Frequently Used Roles, Continued

Definitions: Major roles, continued

The following describes roles that are frequently referenced in the key practices, continued from the previous page:

Project software manager, continued	In a large project, the project software manager is likely to be a second-, third-, or fourth-line manager. In a small project or department with a single project, the project software manager might be the first-line software manager or might be at a higher level.
First-line software manager	A first-line software manager fulfills the role with direct management responsibility (including providing technical direction and administering the personnel and salary functions) for the staffing and activities of a single organizational unit (e.g., a department or project team) of software engineers and other related staff.
Software task leader	A software task leader fulfills the role of leader of a technical team for a specific task. A software task leader has technical responsibility and provides technical direction to the staff working on the task. The software task leader usually reports to the same first-line software manager as the other people who are working on the task.
Staff, software engineering staff, individuals	Several terms are used in the CMM to denote the individuals who perform the various technical roles described in various key practices of the CMM. The staff are the individuals, including task leaders, who are responsible for accomplishing an assigned function, such as software development or software configuration management, but who are not managers. The software engineering staff are the software technical people (e.g., analysts, programmers, and engineers), including software task leaders, who perform the software development and maintenance activities for the project, but who are not managers. The term "individuals" as used in the key practices is qualified and bounded by the context in which the term appears (e.g., "the individual involved in managing the software subcontract").

Definitions of Frequently Used Roles, Continued

Definition: Concepts

The fundamental concepts of organization, project, and group must be understood to interpret the key practices of the Capability Maturity Model properly. The following paragraphs define the use of these concepts in the CMM:

Organization	An organization is a unit within a company or other entity (e.g., government agency or branch of service) within which many projects are managed as a whole. All projects within an organization share a common top-level manager and common policies.
Project	A project is an undertaking requiring concerted effort, which is focused on developing and/or maintaining a specific product. The product may include hardware, software, and other components. Typically a project has its own funding, cost accounting, and delivery schedule.
Group	A group is the collection of departments, managers, and individuals who have responsibility for a set of tasks or activities. A group could vary from a single individual assigned part time, to several part-time individuals assigned from different departments, to several individuals dedicated full time.

Definitions: Groups

Groups commonly referred to in the CMM are described below:

Software engineering group	The software engineering group is the collection of individuals (both managers and technical staff) who have responsibility for software development and maintenance activities (i.e., requirements analysis, design, code, and test) for a project. Groups performing software-related work, such as the software quality assurance group, the software configuration management group, and the software engineering process group, are not included in the software engineering group. These groups are considered to be one of the "other software-related groups."
Software-related groups	A software-related group is the collection of individuals (both managers and technical staff) representing a software engineering discipline that supports, but is not directly responsible for, software development and/or maintenance. Examples of software engineering disciplines include software quality assurance and software configuration management.
Software engineering process group	The software engineering process group is the group of specialists who facilitate the definition, maintenance, and improvement of the software process used by the organization. In the key practices, this group is generically referred to as "the group responsible for the organization's software process activities."

Continued on next page

Definitions of Frequently Used Roles, Continued

Definitions: Groups, continued

Groups commonly referred to in the CMM are described below, continued from the previous page:

System engineering group	The system engineering group is the collection of individuals (both managers and technical staff) who have responsibility for specifying the system requirements; allocating the system requirements to the hardware, software, and other components; specifying the interfaces between the hardware, software, and other components; and monitoring the design and development of these components to ensure conformance with their specifications.
System test group	The system test group is the collection of individuals (both managers and technical staff) who have responsibility for planning and performing the independent system testing of the software to determine whether the software product satisfies its requirements.
Software quality assurance group	The software quality assurance group is the collection of individuals (both managers and technical staff) who plan and implement the project's quality assurance activities to ensure the software process steps and standards are followed.
Software configuration management group	The software configuration management group is the collection of individuals (both managers and technical staff) who have responsibility for planning, coordinating, and implementing the formal configuration management activities for the software project.
Training group	The training group is the collection of individuals (both managers and staff) who are responsible for coordinating and arranging the training activities for an organization. This group typically prepares and conducts most of the training courses and coordinates use of other training vehicles.

Role/KPA Matrix

Purpose

The purpose of the role/KPA matrix is to allow users to find the roles referenced in a KPA rapidly. A secondary purpose is to allow users to quickly identify the KPAs in which a role is referenced.

Expected use

There will be cases in which an organization is focused on only a portion of the CMM, and thus interested in a few KPAs. In this case, the role/KPA matrix will allow the user to make only the neccessary translations.

Role/KPA matrix

The following matrix shows each CMM role and the KPA in which it appears.

	Level 2						*Level 3*							*Level 4*		*Level 5*		
	RM	**SPP**	**SPTO**	**SSM**	**SQA**	**SCM**	**OPF**	**OPD**	**TP**	**ISM**	**SPE**	**IC**	**PR**	**QPM**	**SQM**	**DP**	**TCM**	**PCM**
Administrative personnel																		X
Affected groups	X	X	X	X	X	X	X		X	X	X	X			X			
Affected individuals		X							X	X					X			
Affected managers																	X	
Customer			X	X	X					X	X	X			X			
Customer SQA personnel					X													
Documentation specialist											X							
End user			X	X						X	X	X			X			
Engineering group		X										X						
Experienced individuals who have expertise in defining and analyzing software processes																		X
Experts independent of the SQA group					X													
First-line software managers			X															
Group responsible for analyzing and allocating system requirements	X																	
Group responsible for coordinating the organization's software process activities (e.g., SEPG)										X								

Continued on next page

Role/KPA matrix, continued

The following matrix shows each CMM role and the KPA in which it appears, continued from the previous page.

	Level 2						*Level 3*							*Level 4*		*Level 5*		
	RM	**SPP**	**SPTO**	**SSM**	**SQA**	**SCM**	**OPF**	**OPD**	**TP**	**ISM**	**SPE**	**IC**	**PR**	**QPM**	**SQM**	**DP**	**TCM**	**PCM**
Group responsible for coordinating the quantitative process management activities for the organization														X				
Group responsible for providing the critical dependency item												X						
Group responsible for system and acceptance testing											X							
Group responsible for the organization's technology change management activities																	X	
Group responsible for the organization's software process activities							X	X						X				X
Group responsible for the system requirements											X							
Group that defines and maintains the affected process descriptions																		X
Groups involved in implementing the software processes							X											
Group that is independent of the software engineering group										X								
Individuals				X	X	X	X			X	X				X			
Individuals and groups external to the organization	X	X	X															

Individuals implementing and supporting software quality management														x			

Continued on next page

Role/KPA matrix, continued

The following matrix shows each CMM role and the KPA in which it appears, continued from the previous page.

	Level 2						*Level 3*							*Level 4*		*Level 5*		
	RM	**SPP**	**SPTO**	**SSM**	**SQA**	**SCM**	**OPF**	**OPD**	**TP**	**ISM**	**SPE**	**IC**	**PR**	**QPM**	**SQM**	**DP**	**TCM**	**PCM**
Individuals implementing or supporting quantitative process management														X				
Individuals (involved in coding)											X							
Individuals (involved in developing the software requirements)											X							
Individuals (involved in software design)											X							
Individuals (responsible for the software design)											X							
Individuals (responsible for the software requirements)											X							
Individuals responsible for developing the project's defined software process										X								
Individuals responsible for implementing the software processes																		X
Individuals who develop and maintain the organization's standard software process and related process assets								X										
Management													X					X
Manager					X	X	X		X			X	X					X
Managers of the affected groups																	X	
Managers of the software engineering groups														X				X
Managers of software-related groups														X				X

Members of the organization																	X

Continued on next page

Role/KPA matrix, continued

The following matrix shows each CMM role and the KPA in which it appears, continued from the previous page.

	Level 2						*Level 3*							*Level 4*		*Level 5*		
	RM	**SPP**	**SPTO**	**SSM**	**SQA**	**SCM**	**OPF**	**OPD**	**TP**	**ISM**	**SPE**	**IC**	**PR**	**QPM**	**SQM**	**DP**	**TCM**	**PCM**
Organization's managers																	X	
Peer review checklist developers' peers													X					
Peer review leader													X					
Peer review checklist potential users													X					
Person responsible for each configuration item/unit						X												
Person trained in conducting casusal analysis meetings																X		
Prime contractor				X														
Prime contractor's management				X														
Prime contractor's SCM group				X														
Prime contractor's SQA group				X														
Producer													X					
Project																		
Project manager	X	X	X	X	X	X				X	X	X		X	X	X		
Project software manger		X	X			X												
Receiving group of a critical dependency item												X						
Representatives of the project's software engineering group												X						
Representatives of the other engineering groups												X						
Representatives of the project engineering groups												X						

Continued on next page

Role/KPA matrix, continued

The following matrix shows each CMM role and the KPA in which it appears, continued from the previous page.

	Level 2						*Level 3*							*Level 4*		*Level 5*		
	RM	**SPP**	**SPTO**	**SSM**	**SQA**	**SCM**	**OPF**	**OPD**	**TP**	**ISM**	**SPE**	**IC**	**PR**	**QPM**	**SQM**	**DP**	**TCM**	**PCM**
Representatives of the receiving group of a critical dependency item												X						
Reviewer													X					
Senior management	X	X	X	X	X	X	X		X	X	X	X		X	X	X	X	X
Senior manager					X		X							X				
SCCB						X												
SCM group						X												
Software engineering group	X	X	X		X	X	X			X		X		X	X	X		
Software engineering managers																X		
Software engineering technical staff											X							
Software engineer		X																
Software maintainer											X							
Software manager	X	X	X	X	X		X		X	X	X			X			X	X
Software-related groups	X	X	X			X	X							X	X	X		
Software subcontractor				X														
Software subcontractor groups				X														
Software subcontractor's management				X														
Software subcontractor's software engineering group				X														
Software task leader			X		X									X				
Specialty engineers in areas such as safety and reliabilty															X			
SQA group	X	X	X		X	X		X		X	X	X	X	X	X	X	X	X
Staff							X											X
Subcontract bidder				X														

Continued on next page

Role/KPA matrix, continued

The following matrix shows each CMM role and the KPA in which it appears, continued from the previous page.

	Level 2						*Level 3*							*Level 4*		*Level 5*		
	RM	**SPP**	**SPTO**	**SSM**	**SQA**	**SCM**	**OPF**	**OPD**	**TP**	**ISM**	**SPE**	**IC**	**PR**	**QPM**	**SQM**	**DP**	**TCM**	**PCM**
Subcontract manager				X														
Subcontractor															X			
Submitters of the action proposals																X		
Submitters of the software process improvement proposals																		X
System engineering group																		
Task leaders												X						
Task leaders of other software-related groups														X				
Task leaders of the software engineering groups														X				
Team of peers and experts										X								
Team performing the software task															X	X		
Team responsible for implementation of software process improvement actions																		X
Teams assigned to coordinate defect prevention activities																X		
Teams at another level in the organization																X		
Technical staff																X	X	
Technical staff of the software-related groups																		X
Technical staff of the software engineering group																		X

Continued on next page

Role/KPA matrix, continued

The following matrix shows each CMM role and the KPA in which it appears, continued from the previous page.

	Level 2						*Level 3*							*Level 4*		*Level 5*		
	RM	**SPP**	**SPTO**	**SSM**	**SQA**	**SCM**	**OPF**	**OPD**	**TP**	**ISM**	**SPE**	**IC**	**PR**	**QPM**	**SQM**	**DP**	**TCM**	**PCM**
Technology suppliers																	X	
Test group											X							
Training group	`						X		X									

Role Translation Table

Role translation table

Fill in the equivalent role for your organization in the table below.

CMM Roles/Groups	Your Organization's Roles/Groups
Administrative personnel	
Affected groups	
Affected individuals	
Affected managers	
Customer	
Customer SQA personnel	
Documentation specialist	
End user	
Engineering group	
Experienced individuals who have expertise in defining and analyzing software processes	
Experts independent of the SQA group	
First-line software managers	
Group responsible for analyzing and allocating system requirements	
Group responsible for coordinating the organization's software process activities (e.g., SEPG)	
Group responsible for coordinating the quantitative process management activities for the organization	
Group responsible for providing the critical dependency item	
Group responsible for system and acceptance testing	
Group responsible for the organization's technology change management activities	
Group responsible for the organization's software process activities	
Group responsible for the system requirements	
Group that defines and maintains the affected process descriptions	

Continued on next page

Role Translation Table, Continued

Role translation table, continued

Fill in the equivalent role for your organization in the table below, continued from the previous page.

CMM Role	Your Organization's Role(s)
Groups involved in implementing the software processes	
Group that is independent of the software engineering group	
Individuals	
Individuals and groups external to the organization	
Individuals implementing and supporting software quality management	
Individuals implementing or supporting quantitative process management	
Individuals (involved in coding)	
Individuals (involved in developing the software requirements)	
Individuals (involved in software design)	
Individuals (responsible for the software design)	
Individuals (responsible for the software requirements)	
Individuals responsible for developing the project's defined software process	
Individuals responsible for implementing the software processes	
Individuals who develop and maintain the organization's standard software process and related process assets	
Management	
Manager	
Managers of the affected groups	
Managers of the software engineering groups	

Continued on next page

Role Translation Table, Continued

Role translation table, continued

Fill in the equivalent role for your organization in the table below, continued from the previous page.

CMM Role	Your Organization's Role(s)
Managers of software-related groups	
Members of the organization	
Organization's managers	
Peer review checklist developers' peers	
Peer review leader	
Peer review checklist potential users	
Person responsible for each configuration item/unit	
Person trained in conducting casusal analysis meetings	
Prime contractor	
Prime contractor's management	
Prime contractor's SCM group	
Prime contractor's SQA group	
Producer	
Project	
Project manager	
Project software manger	
Receiving group of a critical dependency item	
Representatives of the project's software engineering group	
Representatives of the other engineering groups	
Representatives of the project engineering groups	
Representatives of the receiving group of a critical dependency item	
Reviewer	
Senior management	
Senior manager	
SCCB	

SCM group	
Software engineering group	

Continued on next page

Role Translation Table, Continued

Role translation table, continued

Fill in the equivalent role for your organization in the table below, continued from the previous page.

CMM Role	Your Organization's Role(s)
Software engineering managers	
Software engineering technical staff	
Software engineer	
Software maintainer	
Software manager	
Software-related groups	
Software subcontractor	
Software subcontractor groups	
Software subcontractor's management	
Software subcontractor's software engineering group	
Software task leader	
Specialty engineers in areas such as safety and reliabilty	
SQA group	
Staff	
Subcontract bidder	
Subcontract manager	
Subcontractor	
Submitters of the action proposals	
Submitters of the software process improvement proposals	
System engineering group	
Task leaders	
Task leaders of other software-related groups	
Task leaders of the software engineering groups	
Team of peers and experts	
Team performing the software task	
Team responsible for implementation of software process improvement actions	

Continued on next page

Role Translation Table, Continued

Role translation table, continued

Fill in the equivalent role for your organization in the table below, continued from the previous page. Blank entries are provide for your use.

CMM Role	Your Organization's Role(s)
Teams assigned to coordinate defect prevention activities	
Teams at another level in the organization	
Technical staff	
Technical staff of the software-related groups	
Technical staff of the software engineering group	
Technology suppliers	
Test group	
Training group	

Appendix D: General Term Translation Table

Reference

Refer to Chapter 2, "Features of the Software Process Framework" for additional information regarding general term translation tables.

General term translation table

Fill in the equivalent term for your organization in the table below. Blank rows are provided for additional terms.

CMM General Terms	Your Organization's Term
Organization	
Product	
Project	
Software product	
Software project	
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