

## CONFIGURATION MANAGEMENT

A Support Process Area at Maturity Level 2

### Purpose

The purpose of Configuration Management (CM) is to establish and maintain the integrity of work products using configuration identification, configuration control, configuration status accounting, and configuration audits.

### Introductory Notes

The Configuration Management process area involves the following activities:

- Identifying the configuration of selected work products that compose baselines at given points in time
- Controlling changes to configuration items
- Building or providing specifications to build work products from the configuration management system
- Maintaining the integrity of baselines
- Providing accurate status and current configuration data to developers, end users, and customers

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The work products placed under configuration management include the products that are delivered to the customer, designated internal work products, acquired products, tools, and other items used in creating and describing these work products. (See the definition of “configuration management” in the glossary.)

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Acquired products may need to be placed under configuration management by both the supplier and the acquirer. Provisions for conducting configuration management should be established in supplier agreements. Methods to ensure that data are complete and consistent should be established and maintained.

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The configuration management approach depends on acquisition factors such as acquisition approach, number of suppliers, design responsibility, support concept, and associated costs and risks. In any case, configuration management involves interaction between the acquirer and supplier.

Deleted: Refer to the Supplier Agreement Management process area for more information about establishing and maintaining agreements with suppliers.¶

Planning for managing configuration items, including during the transition to operations and support, is addressed as part of project planning and supplier agreement development to avoid unexpected costs for both the acquirer and supplier. Project plans and supplier agreements should make provisions for managing configuration items within and across project teams and the infrastructure required to manage configuration items among the acquirer, supplier, operational users, and other relevant stakeholders.

For example, there are shared responsibilities between the acquirer and supplier for the technical solution. The acquirer maintains configuration control of the contractual requirements and the supplier performs configuration management for the technical solution (e.g., establish and maintain the product baseline).

In this example, the acquirer retains the authority and responsibility for approving design changes that impact the product's ability to meet contractual requirements. The supplier manages other design changes. The acquirer maintains the right to access configuration data at any level required to implement planned or potential design changes and support options. Configuration management of legacy systems should be addressed on a case-by-case basis as design changes are contemplated.

Examples of work products that may be placed under configuration management include the following:

- Plans
- Process descriptions
- Requirements
- Acquisition strategies
- Solicitation packages
- Supplier agreements
- Supplier deliverables

Deleted: <#>Design data¶  
<#>Drawings¶  
<#>Product specifications¶  
<#>Code¶  
<#>Compilers¶  
<#>Product data files¶  
<#>Product technical publications¶  
¶

Configuration management of work products may be performed at several levels of granularity. Configuration items can be decomposed into configuration components and configuration units. Only the term configuration item is used in this process area. Therefore, in these practices, configuration item may be interpreted as configuration component or configuration unit, as appropriate. (See the definition of "configuration item" in the glossary.)

Baselines provide a stable basis for the continuing evolution of configuration items.

An example of an acquirer's baseline is a collection of acquirer work products such as contractual requirements and acceptance criteria that are related to the product baseline managed by the supplier.

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Deleted: An example of a baseline is an approved description of a product that includes internally consistent versions of requirements, requirement traceability matrices, design, discipline-specific items, and end-user documentation.¶

Baselines are added to the configuration management system as they are developed. Changes to baselines and the release of work products built from the configuration management system are systematically controlled and monitored via the configuration control, change management, and configuration auditing functions of configuration management.

This process area applies not only to configuration management on projects but also to configuration management on organizational work products such as standards, procedures, and reuse libraries.

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Configuration management is focused on the rigorous control of the managerial and technical aspects of work products, including the delivered system.

This process area covers the practices for performing the configuration management function and is applicable to all work products that are placed under configuration management.

### Related Process Areas

*Refer to the Agreement Management process area for more information about formal acceptance of supplier deliverables.*

*Refer to the Project Planning process area for more information about developing plans and work breakdown structures, which may be useful for determining configuration items.*

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*Refer to the Project Monitoring and Control process area for more information about performance analyses and corrective actions.*

#### Specific Goal and Practice Summary

##### SG 1 Establish Baselines

- SP 1.1 Identify Configuration Items
- SP 1.2 Establish a Configuration Management System
- SP 1.3 Create or Release Baselines

##### SG 2 Track and Control Changes

- SP 2.1 Track Change Requests
- SP 2.2 Control Configuration Items

##### SG 3 Establish Integrity

- SP 3.1 Establish Configuration Management Records
- SP 3.2 Perform Configuration Audits

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### Specific Practices by Goal

#### SG 1 Establish Baselines

***Baselines of identified work products are established.***

Specific practices to establish baselines are covered by this specific goal. The specific practices under the Track and Control Changes specific goal serve to maintain the baselines. The specific practices of the Establish Integrity specific goal document and audit the integrity of the baselines.

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### SP 1.1 Identify Configuration Items

#### **Identify configuration items, components, and related work products to be placed under configuration management.**

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Configuration identification is the selection, creation, and specification of the following:

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- Products delivered to the customer
- Designated internal work products
- Acquired products
- Tools and other capital assets of the project's work environment
- Other items used in creating and describing these work products

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Items under configuration management include specifications and interface documents that define requirements for the product. Other documents, such as test results, may also be included, depending on their importance to defining the product.

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A configuration item is an entity designated for configuration management, which may consist of multiple related work products that form a baseline. This logical grouping provides ease of identification and controlled access. The selection of work products for configuration management should be based on criteria established during planning.

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Configuration items may vary widely in complexity, size, and type, from an aircraft to commercial-of-the-shelf software to a test meter or a project plan. Any item required for product support and designated for separate procurement is a configuration item. Acquirer work products provided to suppliers such as solicitation packages and technical standards are typically designated as configuration items.

#### Typical Work Products

1. Identified configuration items

#### Subpractices

1. Select configuration items and work products that compose them based on documented criteria.

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Example criteria for selecting configuration items at the appropriate work product level include the following:

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- Work products that may be used by two or more groups
- Work products that are expected to change over time either because of errors or changes in requirements
- Work products that are dependent on each other (i.e., a change in one mandates a change in the others)
- Work products critical to project success

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Examples of acquirer work products and supplier deliverables that may be part of a configuration item include the following:

- Process descriptions
- Requirements
- Acceptance criteria
- Supplier project progress and performance reports
- Supplier test results

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<#>Test plans and procedures¶  
Test

2. Assign unique identifiers to configuration items.
3. Specify the important characteristics of each configuration item.
4. Specify when each configuration item is placed under configuration management.

Deleted: <#>Interface descriptions¶  
<#>Drawings¶  
<#>Source code¶  
<#>Tools (e.g., compilers)¶

Example criteria for determining when to place work products under configuration management include the following:

- Stage of the project lifecycle
- When the acquirer work product is ready for review and approval
- Degree of control desired on the work product
- Cost and schedule limitations
- Customer requirements

Deleted: Example characteristics of configuration items include author, document or file type, and programming language for software code files.¶

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5. Identify the owner responsible for each configuration item.

**SP 1.2 Establish a Configuration Management System**

***Establish and maintain a configuration management and change management system for controlling work products.***

A configuration management system includes the storage media, procedures, and tools for accessing the system.

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A change management system includes the storage media, procedures, and tools for recording and accessing change requests.

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The acquirer considers how configuration items are shared between the acquirer and supplier as well as among relevant stakeholders. If the use of an acquirer's configuration management system is extended to a supplier, the acquirer must exercise security and access control procedures. In many cases, leaving acquired configuration items in the physical possession of the supplier and having access to supplier deliverables is an alternative solution. The supplier agreement specifies appropriate acquirer rights to supplier deliverables, in addition to requirements for delivery or access. Supplier work products, whenever they are delivered to the acquirer, are presented in accordance with accepted standards to ensure usability by the acquirer.

**Typical Work Products**

1. Configuration management system with controlled work products
2. Configuration management system access control procedures

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### 3. Change request database

#### Subpractices

#### 1. Establish a mechanism to manage multiple levels of control.

The level of control is typically selected based on project objectives, risk, and resources. Levels of control can range from informal control that simply tracks changes made when configuration items are being developed by the acquirer or when supplier work products are delivered or made accessible to the acquirer, to formal configuration control using baselines that can only be changed as part of a formal configuration management process.

#### 2. Store and retrieve configuration items in a configuration management system.

#### 3. Share and transfer configuration items between control levels in the configuration management system.

#### 4. Store and recover archived versions of configuration items.

#### 5. Store, update, and retrieve configuration management records.

#### 6. Create configuration management reports from the configuration management system.

#### 7. Preserve the contents of the configuration management system.

Examples of preservation functions of the configuration management system include the following:

- Backup and restoration of configuration management files
- Archive of configuration management files
- Recovery from configuration management errors

#### 8. Revise the configuration management structure as necessary.

### SP 1.3 Create or Release Baselines

#### Create or release baselines for internal use and for delivery to the customer.

A baseline is a set of specifications or work products that has been formally reviewed and agreed on, that thereafter serves as the basis for further development or delivery, and that can be changed only through change control procedures. A baseline represents the assignment of an identifier to a configuration item or a collection of configuration items and associated entities. As a product evolves, several baselines may be used to control its development and testing.

The acquirer reviews and approves the release of product baselines created by the supplier. The acquirer creates baselines for acquirer work products that describe the project, requirements, funding, schedule, and performance measures and makes a commitment to manage the project to those baselines.

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Deleted: Control levels may vary in relation to the project lifecycle, type of system under development, and specific project requirements.

Example levels of control include the following:

<#>Create – controlled by author

<#>Engineering – notification to relevant stakeholders when changes are made

<#>Development – lower level CCB control

<#>Formal – higher level CCB control with customer involvement

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Deleted: Examples of configuration management systems include the following:

<#>Dynamic (or author's) systems contain components currently being created or revised. They are in the author's workspace and are controlled by the author. Configuration items in a dynamic system are under version control.

<#>Master (or controlled) systems contain current baselines and changes to them. Configuration items in a master system are under full configuration management as described in this process area.

<#>Static systems contain archives of various baselines released for use. Static systems are under full configuration management as described in this process area.

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For Systems Engineering  
One common set of baselines includes the system-level requirements, system-element-level design requirements, and the product definition at the end of development/beginning of production. These are typically referred to as the "functional baseline," "allocated baseline," and "product baseline."

For Software Engineering  
A software baseline can be a set of requirements, design, source code files and the associated executable code, build files, and user documentation (associated ent...

**Typical Work Products**

1. Baselines
2. Description of baselines

**Typical Supplier Deliverables**

1. Product baselines
2. Description of product baselines

**Subpractices**

1. Obtain authorization from the configuration control board (CCB) before creating or releasing baselines of configuration items.
2. Create or release baselines only from configuration items in the configuration management system.
3. Document the set of configuration items that are contained in a baseline.
4. Make the current set of baselines readily available.

**SG 2 Track and Control Changes**

***Changes to the work products under configuration management are tracked and controlled.***

The specific practices under this specific goal serve to maintain baselines after they are established by specific practices under the Establish Baselines specific goal.

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**SP 2.1 Track Change Requests**

***Track change requests for configuration items.***

Change requests address not only new or changed requirements but also failures and defects in work products.

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Change requests can be initiated either by the acquirer or supplier. Changes that impact acquirer work products and supplier deliverables as defined in the supplier agreement are handled through the acquirer's configuration management process.

Change requests are analyzed to determine the impact that the change will have on the work product, related work products, the budget, and the schedule.

**Typical Work Products**

1. Change requests

**Typical Supplier Deliverables**

1. Change requests

**Subpractices**

1. Initiate and record change requests in the change request database.

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- 2. Analyze the impact of changes and fixes proposed in change requests.

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The acquirer analyzes the impact that submitted change requests may have on supplier agreements.

Deleted: Changes are evaluated through activities that ensure that they are consistent with all technical and project requirements. Changes are evaluated for their impact beyond immediate project or contract requirements. Changes to an item used in multiple products can resolve an immediate issue while causing a problem in other applications.

Refer to the Solicitation and Supplier Agreement Development process area for more information about changing the supplier agreement.

- 3. Review change requests to be addressed in the next baseline with relevant stakeholders and get their agreement.

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Conduct the change request review with appropriate participants. Record the disposition of each change request and the rationale for the decision, including success criteria, a brief action plan if appropriate, and needs met or unmet by the change. Perform the actions required in the disposition, and report results to relevant stakeholders.

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- 4. Track the status of change requests to closure.

**SP 2.2 Control Configuration Items**

**Control changes to configuration items.**

Deleted: Change requests brought into the system need to be handled in an efficient and timely manner. Once a change request has been processed, it is critical to close the request with the appropriate approved action as soon as it is practical. Actions left open result in larger than necessary status lists, which in turn result in added costs and confusion.

Control is maintained over the configuration of the work product baseline. This control includes tracking the configuration of each configuration item, approving a new configuration if necessary, and updating the baseline.

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The acquirer decides which configuration items require version control, or more stringent levels of configuration control, and establishes mechanisms to ensure configuration items are controlled. Although the supplier may manage configuration items on the acquirer's behalf, the acquirer is responsible for approval and control of changes to these configuration items.

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**Typical Work Products**

- 1. Revision history of configuration items
- 2. Archives of baselines

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**Subpractices**

- 1. Control changes to configuration items throughout the life of the product.
- 2. Obtain appropriate authorization before changed configuration items are entered into the configuration management system.

For example, authorization may come from the CCB, the project manager, or the customer.

- 3. Check in and check out configuration items in the configuration management system for incorporation of changes in a manner that maintains the correctness and integrity of configuration items.

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- 4. Perform reviews to ensure that changes have not caused unintended effects on the baselines (e.g., ensure that changes have not compromised the safety and/or security of the system).
- 5. Record changes to configuration items and reasons for changes, as appropriate.

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**Deleted:** Examples of check-in and check-out steps include the following:¶  
 <#>Confirming that the revisions are authorized¶  
 <#>Updating the configuration items¶  
 <#>Archiving the replaced baseline and retrieving the new baseline¶  
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**SG 3 Establish Integrity**

**Integrity of baselines is established and maintained.**

The integrity of baselines, established by processes associated with the Establish Baselines specific goal, and maintained by processes associated with the Track and Control Changes specific goal, is addressed by the specific practices under this specific goal.

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 If a proposed change to the work product is accepted, a schedule is identified for incorporating the change into the work product and other affected areas.¶  
 Configuration control mechanisms can be tailored to categories of changes. For example, the approval considerations could be less stringent for component changes that do not affect other components.¶  
 Changed configuration items are released after review and approval of configuration changes. Changes are not official until they are released.

**SP 3.1 Establish Configuration Management Records**

**Establish and maintain records describing configuration items.**

**Typical Work Products**

- 1. Revision history of configuration items
- 2. Change log
- 3. Change request records
- 4. Status of configuration items
- 5. Differences between baselines

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**Typical Supplier Deliverables**

- 1. Revision history of product and supplier deliverables defined in the supplier agreement

**Subpractices**

- 1. Record configuration management actions in sufficient detail so the content and status of each configuration item is known and previous versions can be recovered.
- 2. Ensure that relevant stakeholders have access to and knowledge of the configuration status of configuration items.
- 3. Specify the latest version of baselines.
- 4. Identify the version of configuration items that constitute a particular baseline.
- 5. Describe differences between successive baselines.
- 6. Revise the status and history (i.e., changes and other actions) of each configuration item as necessary.

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**Deleted:** Examples of activities for communicating configuration status include the following:¶  
 <#>Providing access permissions to authorized end users¶  
 <#>Making baseline copies readily available to authorized end users¶  
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**SP 3.2 Perform Configuration Audits**

**Perform configuration audits to maintain the integrity of configuration baselines.**

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Configuration audits confirm that the resulting baselines and documentation conform to a specified standard or requirement. Audit results should be recorded, as appropriate. (See the glossary for a definition of “configuration audit.”)

**Typical Work Products**

1. Configuration audit results
2. Action items

**Typical Supplier Deliverables**

1. Supplier configuration audit results

**Subpractices**

1. Assess the integrity of baselines.
2. Confirm that configuration management records correctly identify configuration items.
3. Review the structure and integrity of items in the configuration management system.
4. Confirm the completeness and correctness of items in the configuration management system.  
Completeness and correctness of the configuration management system's content is based on requirements as stated in the plan and the disposition of approved change requests.
5. Confirm compliance with applicable configuration management standards and procedures.
6. Track action items from the audit to closure.

**Deleted:** Examples of audit types include the following.¶

<#>Functional Configuration Audits (FCA) – Audits conducted to verify that the as-tested functional characteristics of a configuration item have achieved the requirements specified in its functional baseline documentation and that the operational and support documentation is complete and satisfactory.¶

<#>Physical Configuration Audit (PCA) – Audits conducted to verify that the as-built configuration item conforms to the technical documentation that defines it.¶

<#>Configuration management audits – Audits conducted to confirm that configuration management records and configuration items are complete, consistent, and accurate.¶

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**Continuous Only** [2]



*For Systems Engineering*

*One common set of baselines includes the system-level requirements, system-element-level design requirements, and the product definition at the end of development/beginning of production. These are typically referred to as the “functional baseline,” “allocated baseline,” and “product baseline.”*

*For Software Engineering*

*A software baseline can be a set of requirements, design, source code files and the associated executable code, build files, and user documentation (associated entities) that have been assigned a unique identifier.*

Generic Practices by Goal

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**Continuous Only****GG 1      Achieve Specific Goals**

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*The process supports and enables achievement of the specific goals of the process area by transforming identifiable input work products to produce identifiable output work products.*

**GP 1.1      Perform Specific Practices**

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*Perform the specific practices of the configuration management process to develop work products and provide services to achieve the specific goals of the process area.*

**GG 2      Institutionalize a Managed Process**

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*The process is institutionalized as a managed process.*

**GP 2.1      Establish an Organizational Policy**

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*Establish and maintain an organizational policy for planning and performing the configuration management process.*

## Elaboration:

This policy establishes organizational expectations for establishing and maintaining baselines, tracking and controlling changes to the

work products (under configuration management), and establishing and maintaining integrity of the baselines.

**GP 2.2 Plan the Process**

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***Establish and maintain the plan for performing the configuration management process.***

Elaboration:

This plan for performing the configuration management process can be included in (or referenced by) the project plan, which is described in the Project Planning process area.

**GP 2.3 Provide Resources**

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***Provide adequate resources for performing the configuration management process, developing the work products, and providing the services of the process.***

Elaboration:

Examples of resources provided include the following tools:

- Configuration management tools
- Data management tools
- Archiving and reproduction tools
- Database programs

**GP 2.4 Assign Responsibility**

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***Assign responsibility and authority for performing the process, developing the work products, and providing the services of the configuration management process.***

**GP 2.5 Train People**

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***Train the people performing or supporting the configuration management process as needed.***

Elaboration:

Examples of training topics include the following:

- Roles, responsibilities, and authority of the configuration management staff
- Configuration management standards, procedures, and methods
- Configuration library system

## **GP 2.6      Manage Configurations**

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***Place designated work products of the configuration management process under appropriate levels of control.***

Elaboration:

Refer to Table 6.2 on page 95 in Generic Goals and Generic Practices for more information about the relationship between generic practice 2.6 and the Configuration Management process area.

Examples of work products placed under control include the following:

- Access lists
- Change status reports
- Change request database
- CCB meeting minutes
- Archived baselines

## **GP 2.7      Identify and Involve Relevant Stakeholders**

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***Identify and involve the relevant stakeholders of the configuration management process as planned.***

Elaboration:

Examples of activities for stakeholder involvement include the following:

- Establishing baselines
- Reviewing configuration management system reports and resolving issues
- Assessing the impact of changes for the configuration items
- Performing configuration audits
- Reviewing the results of configuration management audits

## **GP 2.8      Monitor and Control the Process**

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***Monitor and control the configuration management process against the plan for performing the process and take appropriate corrective action.***

Elaboration:

Examples of measures and work products used in monitoring and controlling include the following:

- Number of changes to configuration items
- Number of configuration audits conducted
- Schedule of CCB or audit activities

**GP 2.9 Objectively Evaluate Adherence**

***Objectively evaluate adherence of the configuration management process against its process description, standards, and procedures, and address noncompliance.***

Elaboration:

Examples of activities reviewed include the following:

- Establishing baselines
- Tracking and controlling changes
- Establishing and maintaining integrity of baselines

Examples of work products reviewed include the following:

- Archives of the baselines
- Change request database

**GP 2.10 Review Status with Higher Level Management**

***Review the activities, status, and results of the configuration management process with higher level management and resolve issues.***

**Staged Only**

GG3 and its practices do not apply for a maturity level 2 rating, but do apply for a maturity level 3 rating and above.

**Continuous/Maturity Levels 3 - 5 Only**

**GG 3 Institutionalize a Defined Process**

***The process is institutionalized as a defined process.***

**GP 3.1 Establish a Defined Process**

***Establish and maintain the description of a defined configuration management process.***

## Continuous/Maturity Levels 3 - 5 Only

### **GP 3.2      Collect Improvement Information**

***Collect work products, measures, measurement results, and improvement information derived from planning and performing the configuration management process to support the future use and improvement of the organization's processes and process assets.***

Elaboration:

Examples of work products, measures, measurement results, and improvement information include the following:

- Trends in the status of configuration items
- Configuration audit results
- Change request aging reports

## Continuous Only

### **GG 4      Institutionalize a Quantitatively Managed Process**

***The process is institutionalized as a quantitatively managed process.***

#### **GP 4.1      Establish Quantitative Objectives for the Process**

***Establish and maintain quantitative objectives for the configuration management process, which address quality and process performance, based on customer needs and business objectives.***

#### **GP 4.2      Stabilize Subprocess Performance**

***Stabilize the performance of one or more subprocesses to determine the ability of the configuration management process to achieve the established quantitative quality and process-performance objectives.***

### **GG 5      Institutionalize an Optimizing Process**

***The process is institutionalized as an optimizing process.***

#### **GP 5.1      Ensure Continuous Process Improvement**

***Ensure continuous improvement of the configuration management process in fulfilling the relevant business objectives of the organization.***

**Continuous Only**

**GP 5.2      Correct Root Causes of Problems**

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***Identify and correct the root causes of defects and other problems in the configuration management process.***