A Study on the Software Quality Assurance Plan

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1. Introduction

On 25 August 2006, the CMMI V1.2 (Capability Maturity Model Integration Version 1.2) was released with the new title CMMI-DEV (CMMI for Development) which supersedes the CMMI-SE/SW (CMMI for systems engineering and software engineering) V1.1. This study discusses the application of IEEE Std 730-2002, IEEE Standard for Software Quality Assurance Plans, for the implementation of the Process and Product Quality Assurance (PPQA) process area (PA) of the CMMI-DEV.

2. PPQA PA of CMMI-DEV [1]

The CMMI is a process improvement maturity model for the development of products and services. The three critical dimensions that organizations typically focus on are people, procedures/methods, and tools/equipment. The processes allow us to align these three.

There are 22 CMMI-DEV PAs and these are subdivided into four categories:

- ◦ Process Management
- ◦ Project Management
- ◦ Engineering
- ◦ Support

A PA is a cluster of related practices in an area that, when implemented collectively, satisfies a set of goals considered important for making an improvement in that area.

Since the Engineering PAs of the CMMI-DEV cover systems engineering, software engineering, and hardware engineering consistently, these may be used by the nuclear engineering community.

The activities supporting a product development and maintenance belong to the Support PAs. In the CMMI-DEV, there are five Support PAs:

- ◦ Configuration Management (CM)
- ◦ Process and Product Quality Assurance (PPQA)
- ◦ Measurement and Analysis (MA)
- ◦ Decision Analysis and Resolution (DAR)
- ◦ Causal Analysis and Resolution (CAR)

These Support process areas are further subdivided as Basic Support Process Areas and Advanced Support Process Areas. CM, PPQA, and MA PAs are Basic Support Process Areas. DAR and CAR PAs are Advanced Support Process Areas.

The purpose of the PPQA PA is to provide staff and management with an objective insight into processes and associated work products. The practices in the PPQA PA ensure that planned processes are implemented. The summary of Specific Goals and Practices of PPQA PA are shown in Figure 1.

SG 1	Objectively Evaluate Processes and Work Products	
	SP 1.1	Objectively Evaluate Processes
	SP 1.2	Objectively Evaluate Work Products and Services
SG 2	Provide Objective Insight	
	SP 2.1	Communicate and Ensure Resolution of Noncompliance Issues
	SP 2.2	Establish Records

Figure 1: Specific Goal and Practice Summary (From p.355 of [1])

3. IEEE Std 730-2002 [3]

IEEE Computer Society's Software and Systems Engineering Standards Committee (S2ESC) standards can be used to setup or refine processes that conform to CMMI [4]. S2ESC standards are widely used in the nuclear industry of Korea [5].

IEEE Std 730-2002 assists in determining the content and preparation of Software Quality Assurance Plans (SQAPs) and provides a standard against which such plans can be prepared and assessed. IEEE Std 730-2002 is directed toward the development and maintenance of software.

IEEE Std 730-2002 is consistent with the IEEE/EIA Std 12207.0-1996 (Industry Implementation of International Standard ISO/IEC 12207:1995, Software life cycle processes) and IEEE/EIA Std 12207.1-1997 (Industry Implementation of International Standard ISO/IEC 12207:1995, Software life cycle processes – Life cycle data). IEEE Std 730-2002 provides uniform, minimum acceptable requirements for preparation and content of SQAPs. The term "software" includes firmware, documentation, data, and execution control statements.

4. Application

In the case of PPQA PA, there are changes in format from Version 1.1 to Version 1.2 without major upgrades in content [2].

For IEEE Std 730, there is a main focus change from the nuclear critical software of the 1998 edition to the software of the 2002 edition.

Figure 2 offers a suggested modification with bold-faced letters to the outline proposed by IEEE Std 730-2002 [6][7].

The proposed software quality assurance plan in Figure 2 may be applied to the development and maintenance of the nuclear critical software.

1. Purpose
2. Reference documents
3. Management
    a. Organization
    b. Tasks
    c. Roles and responsibilities
    d. Quality assurance estimated resources
4. Documentation
    a. Purpose
    b. Minimum documentation requirements
        i. Software requirements description
        ii. Software design description
        iii. Verification and validation plans
        iv. Verification results report and validation results report
        v. User documentation
        vi. Software configuration management plan
    c. Other documentation
    d. Feedback mechanisms
5. Standards, practices, conventions, and metrics
    a. Purpose
    b. Content
6. Software reviews
    a. Purpose
    b. Minimum requirements
        i. Software specifications review
        ii. Architecture design review
        iii. Detailed design review
        iv. Verification and validation plan review
        v. Functional audit
        vi. Physical audit
        vii. In-process audits
        viii. Managerial reviews
        ix. Software configuration management plan review
        x. Post-implementation review
    c. Other review and audits
7. Test
8. Problem reporting and corrective action
    a. Problem reporting
    b. Corrective action
    c. Feedback mechanisms
9. **SQA activity review**
    a. Escalation procedures
    b. Metrics and measurement
    c. Tools, techniques, and methodologies
    d. Process
10. Media control
11. Supplier control
12. Records collection, maintenance, and retention
13. Training
14. Risk management
15. Glossary
16. SQAP change procedure and history

Figure 2: Example software quality assurance plan based on IEEE Std 730-2002 (Adapted from Figure 5-4 of [6])

5. Conclusion

There are no major content upgrades from the PPQA PA of the CMMI-SE/SW Version 1.1 to the PPQA PA of the CMMI-DEV Version 1.2.

This study proposed an example software quality assurance plan based on IEEE Std 730-2002 for the implementation of the PPQA PA of the CMMI-DEV Version 1.2 which consistently unified the processes of systems engineering, software engineering, and hardware engineering.

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