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The development of quality assurance plan for the maintenance and use of the PSA

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1. Introduction

Probabilistic safety assessment (PSA) has had a growing amount of use in the electric power industry. It has always been the position of most of the Nuclear Power Industry, including nuclear power plants in Korea, that PSA is to be used as a source of information for prudent decision-making. It was never intended to be used as the sole source of information for decision making, which is often related to safety related items. As such, it has never been clear as to what quality assurance (QA) aspects of 10 CFR 50 Appendix B should apply to PSA and how to apply them, since PSA has never clearly been identified as safety related. As the utilities began to use their PSAs to justify changes to their licensing basis such as technical specification, it has become more difficult to argue that they are not safety related and many utilities have begun to look at including their PSAs under their Appendix B QA plans. To have the better understanding of QA for PSA, I would like to introduce the quality assurance guideline that has been used for PSAs in utilities.

2. Guideline for PSA QP

The original PSAs such as the Reactor Safety Study (Wash-1400) were primarily academic exercises. As such, they went through extensive peer reviews, but the requirements of 10CFR50, Appendix B were not applied. The initial large scale use of PSA by the operating utilities was primarily in response to Generic Letter (GL) 88-20 which requested that all U.S. commercial nuclear power plants perform an individual plant evaluation to identify risk outliers. At that time, PSAs were not considered to be safety related and were not included in the Appendix B Quality Assurance (QA) plans. About 10 to 12 years ago, the utilities began to use their PSAs to justify changes to their technical specification allowed outage times (AOTs) and surveillance test intervals (STIs) and other changes to their licensing basis. Given these applications of the PSAs, it has become more difficult to argue that they are not safety related and many utilities have begun to look at including their PSAs under their Appendix B QA plans. Typically, the utilities have all of the documents related to their PSA independently reviewed and signed off. The documents are stored in their document tracking systems and are subject to audit. They also maintain the software they use to prepare and quantify the PSA under software control. The generic guidelines for developing quality assurance plans for PSAs are as follows:

2.1 A quality pedigree of the PSA is desirable to install confidence and acceptance in the PSA results on the part of outside organizations (e.g., operations, maintenance, NRC).

2.2 There is a need to develop a quality plan specific to PSA within the constraints of the utility QA program.

2.3 There is a need to limit the scope of the quality elements of the PSA so as not to overburden the PSA to the point of precluding it as a useful living source, or to reduce its ability to perform "best estimates" assessments.

2.4 Relegating much of the QA control details to guidance documents rather than quality procedures simplifies the process of modifying and maintaining such guidelines. The use of guidelines provides the utility PSA project leader with flexibility in meeting the quality control.

2.5 Having elements of the PSA reviewed in a structured manner against specific and by appropriate organizations in the company promotes acceptance of PSA

2.6 Quality and Living PSA guidelines are inexorably linked. The development of quality guidelines for the maintenance and use of the PSA is done to support a living PSA program, such that future applications of the PSA can be performed with confidence and to assure technical accuracy.

2.7 The quality level and scope of the PSA must be commensurate with the proposed application.

2.8 Finally, it is important not to hinder the usefulness of the PSA by imposing superfluous, rigid quality controls.

3. What quality assurance (QA) aspects of 10 CFR 50 Appendix B could apply to PSA

The preceding paragraphs basically describe how individual utilities deal with QA for PSAs. The paragraph immediately above describes what should be considered at an industry level to address PSA Quality.

This does not address the questions of what we should do. The following presents some of my thoughts item by item.

I. Organization: You are required to establish a QA organization. You should already have one in place. What you probably should do is to convey to that organization the special aspects of PSA with respect to the typical interpretation of what is required for QA. You do not need to have a separate QA organization for PSA.

II. Quality Assurance Program: You should already have a QA program in place. As with the QA organization above, you should address the special aspects of PSA in an adjunct document to your QA program plan.

III. Design Control: This is typically the area that we consider to cover our PSA analyses. Again, when invoking these requirements, you need to consider the special aspects of PSA with respect to documentation and traceability. You may want to have a PSA-specific analysis QA procedure for this.

IV. Procurement Document Control: You should consider this applicable to the extent when you have outside organizations perform PSA analyses for you should explicitly state the extent to which your QA procedures for PSA are applicable to the analyses being procured.

V. Instructions Procedures & Drawings: This is considered to be applicable to the extent that you should have some level of procedures in place for performing PSA and for performing the reviews associated with your calculations.

VI. Document Control: This is definitely included. Your existing document control system should be used to track you PSA documents.

VII. Control of Purchased Services: Again, this is applicable to the extent that you hire external organizations to perform analyses for you. This may also be applicable if you purchase outside software.

XVI. Corrective Actions: This is applicable within bounds. The Corrective Actions Program should address identification and correction of errors in the PSA models and data, but you need to recognize that PSAs are in a constant state of flux. Initiating event frequencies and component failure rates are constantly changing as we gain operating experience.

XVII. Quality Assurance Records: This is applicable. All of the PSA analyses should be treated as Quality Records keeping in mind the traceability of certain inputs and nature of certain analyses such as HRA and severe accident analyses which involve significant phenomenological uncertainties. The ASME Standard provides excellent guidance on what should be documented. You may also want to consider documenting the qualifications of you analysts.

XVIII. Audits: This is applicable. All of the PSA records should be subject to audits. Note however that the auditors should be qualified in PSA. This is one of the functions of the peer reviews specified in all of the PSA standards.

The following elements of 10CFR50 Appendix B do not appear to be applicable.

- Identification and Control of Materials, Parts and Components:
- Control of Special Processes
- Inspection
- Test Control
- Control of Measuring and Test Equipment
- Handling Storage and Shipping
- Inspection, Test and Operating Status
- Nonconforming Materials, Parts, or Components

4. Conclusions

Applying QA aspects to PSAs is desirable to have confidence and acceptance in PSA results. As the utilities began to use their PSAs to justify changes to their licensing basis, it has become more difficult to argue that they are not safety related and many utilities have begun to look at including their PSAs under their Appendix B QA plans. However, it is important not to hinder the usefulness of the PSA by imposing superfluous, rigid quality controls.

REFERENCES

[1] 10CFR50 Appendix B, “The Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants
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