Experience Acquired from the Equipment Qualification Process of the Temelin NPP

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ABSTRACT

In this contribution there is shown a practical approach and experience acquired during an equipment qualification process of the Temelin NPP. The equipment qualification process of the Temelin NPP (two VVER-1000 MW units) was initiated several years ago during the construction period of this plant. This process consists of the following main steps: the Qualification screening; the step of requalification, relocation of equipment or use alternative equipment; and as the last step the Equipment preservation phase. During the Qualification screening stage there were done following activities: Definition of design inputs, sorting of equipments, storing of qualification data and evaluation of equipment regarding to its qualification. The goal of this process is to establish the qualification status of selected equipment items - it means the qualification life and qualification specification, which must be performed during the equipment life.

KEY WORDS: Equipment qualification, Qualification screening, Qualification process, NPP safety, safety related equipment, Temelin NPP

INTRODUCTION

First of all, the Equipment Qualification (EQ) is a process, which would begin as the plant is being designed and continues throughout its operating life. This process is prescribed comprehensively in the IAEA Safety Reports Series No. 3 [1]. A plant which is already in operation and which need to adopt EQ process in compliance with IAEA requirements, has to undergo the first stage of EQ process: the Qualification Screening.

QUALIFICATION SCREENING

Phases of the equipment qualification process, which must be run in a plant being in operation-already, are depicted in Figure 1. The first stage - Qualification Screening involves those activities where qualification data are compiled, evaluated, accepted and documented from available sources. This stage covers two phases:

1) The first phase - Design input to equipment qualification. Design input to equipment qualification defines the input data, qualification requirements and criteria. This information includes the safety classification of systems and components, the scope of equipment requiring qualification, equipment performance requirements (seismic and DBA), PIE/DBA under consideration and its normal, abnormal service conditions and accidental environmental conditions.

2) The second phase - Verification phase. Verification phase (see Fig. 2) consists of an available qualification documentation review demonstrating any qualification activities which equipment being subjected, as are the qualification testing, engineering analysis and evaluation of operation experience.

In the first step of the Qualification Screening there has to be developed the methodology that specifies accepted regulations, standards and codes for qualified equipments and set the applicable qualification criteria. The Qualification Screening Methodology makes a concept for the first stage of qualification process in consideration of national legal environment and former qualification practices.

The second stage of EQ process follows if equipment fails a verification phase of the first stage (Fig.2). In general, the deficiencies are classified as a technical or a formal issue. A plan of corrective measures must be taken considering a risk level of the nuclear safety. These actions as a requalification, relocation of equipment or use of alternative equipment must be scheduled and documented in accordance with qualification requirements and criteria defined in the design input phase (Fig.1).

The result of the Qualification Screening is data prepared for next phase of the EQ process – Equipment Preservation.
Fig. 1  Phases of the equipment qualification process in operation already NPP.

Fig. 2  Qualification Screening stage – Verification phase flow chart of a qualification evaluation.
QUALIFICATION SCREENING IN THE TEMELIN NPP

The EQ process first stage the Qualification Screening in the Temelin NPP has been managed in accordance with the Figure 2. Documentation, as sources for verification of equipment qualification are listed in Table 1. The general rule to evaluate and to satisfy the qualification criteria is summarized in the General Check Acceptance Criterion.

Table 1  Check the qualification documentation to demonstrate conformance of equipment with specified requirements

<table>
<thead>
<tr>
<th>Documentation type A</th>
<th>Documentation type B</th>
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</thead>
<tbody>
<tr>
<td>Seismic and environmental (included EMC) requirements documentation</td>
<td>Requirements conformance documentation</td>
</tr>
<tr>
<td>- Design specification (preliminary and final design)</td>
<td>- Equipment passports</td>
</tr>
<tr>
<td>- Special documents prepared by the general designer – EGP</td>
<td>- Quality assurance documents</td>
</tr>
<tr>
<td>- Technical specifications for the equipment supply</td>
<td>- Cogent documentation (strength, seismic resistance, lifetime analysis; manufacturer data and information, material/equipment test results per national standards (ČSN, ASTM, ...)</td>
</tr>
<tr>
<td>- Documents developed by Westinghouse Co.</td>
<td>- Documentation of pre-operational testing</td>
</tr>
<tr>
<td>- Individual quality assurance programs</td>
<td>- Specific qualification documentation (qualification summary reports, qualification reports, test reports, analysis reports, inspection records, operating experience reports etc.)</td>
</tr>
<tr>
<td>- Programs of pre-operational testing</td>
<td></td>
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</tbody>
</table>

The general Check Acceptance Criterion

Equipment item is qualified when the conformance with requirements specified in the documentation A is clearly demonstrated in the documentation B without any deficiencies.

Equipment item is not qualified when the conformance with requirements specified in the documentation A is not demonstrated in the documentation B.

Record of each equipment with its qualification data is stored in the Qualification Database System (QETE System 1.3 [2]), which enabled to mange the qualification screening. The Qualification Screening allows to constitute the base for all qualification programs that established the EQ process throughout the operating life of Temelin NPP according to the scheme in Figure 3.

CONCLUSION

Equipment qualification is a comprehensive process that is an integral and a compact part of configuration management (CM). Good practice for upgrading EQ in nuclear power plants in operation is making review of actual NPP state by approach of the Qualification Screening process. Results of this process provide information for both the NPP management and the regulatory agency, of state-of-the-art NPP. The operating licence is granted on the basis this date that demonstrate an adequate level of plant safety.

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Fig. 3 Summary of the process of establishing and maintaining the qualified status of newly supplied equipment to be qualified into the nuclear power plant.

NOMENCLATURE

ASTM  -  American Society for Testing and Materials
DBA   -  Design Basis Accident
ČSN   -  Czech National Standard
EGP   -  Energoprojekt Praha
EQ    -  Equipment Qualification
IAEA  -  International Atomic Energy Agency
NPP   -  Nuclear Power Plant
PIE   -  Postulated Initiating Event

REFERENCES