REQUALIFICATION OF TRANSPORT AND HANDLING EQUIPMENT IN ACCORDANCE WITH GERMAN ATOMIC LAW

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SUMMARY

In the now valid standards of the (German) Nuclear Safety Commission (KTA) there are new, other and/or stronger requirements for design (analytical and mechanical) and tests (Construction and Acceptance Tests and In-service Inspections) of transport- and handling equipment. At the time of erecting the first nuclear power plants (NPP) in Germany there have only been the German DIN- Standards. Since that time, the KTA has created drafts and standards with some higher requirements. This is the reason why the above described equipment has design deviations. On base of the „as-built" documentation in safety analysis, we are carrying out comparisions with the requirements of current standards and are analysing the deviations. Important missing assessments have to be added. After finishing this step there has to follow the evaluation of the possible deviations, their acceptance and/or change in assessment and hardware.

INTRODUCTION

At the time when the first nuclear power plants in Germany were erected there existed only the DIN-Standards for transport- and handling systems. In the 1970`s and 1980`s the early KTA standards were developed. In the 1990`s the Nuclear Safety Standards Commission (KTA) modified the existing standards for „Lifting Equipment in Nuclear Power Plants" (KTA 3902, 1992) and „Testing of Lifting Equipment in Nulear Power Plants" (KTA 3903, 1993) and created a new standard for „Load Attaching Points on Loads in Nuclear Power Plants" (KTA 3905, 1994). The now valid standards take into account the experiences and the knowledge gained from safety investigations in previous years.

The Bavarian Ministry of Country Development and Environment Protection commissioned the TÜV Bavaria to re-evaluate the important transport and handling systems in Bavarian NPP with respect to the new above mentioned regulations.

LOADCHAINS

A so called „Load-chain" is the sum of all transport and handling systems needed to move or handle a load. Usually these components in a „Load-chain" are the crane, the lifting equipment and the load attaching point.

IMPORTANT MODIFICATIONS IN THE KTA

The most important modifications in the KTA standards lead to a higher safety standard of the components. There are higher load-factors and higher safety-factors, mainly for stress and fatigue analysis. Greater requirements on the material, e. g., more material tests and additional non-destructive tests are necessary.

INITAL POSITION

For the above mentioned investigations, we had to check all important „Load-chains" in a NPP. Importance was given for those which are classified in components with „additional requirements" (class 4.2) and with „more stringent requirements" (class 4.3) of the above mentioned standards. In these „Load-chains", it is possible to have equipment which fulfills the requirements of the now valid safety standards of the KTA, or to have equipment which fulfills the requirements of the earlier safety standards of the KTA or even to have equipment which fulfills only the requirements of the former DIN-standards.

COMPARISION

For the requalification one first needs the documentation of the „Load-chains" or if this is not available, one needs to have „as-built" documents (drawings, likely material certifications, etc.). The parts of the documentation are drawings, calculations, inspection documents for the materials, construction and acceptance test reports, and of course the traceability of the documents to the components of the load-chains.

The next step is to analyse the deviations from current safety standards of the KTA. The most effective way to do it is to follow the structure of the above mentioned safety standards step by step. At first, one has to look at the classification of the equipment and the construction and check to see, if it fulfills the requirements of the fixed classification for all equipments in the load-chain. Then one has to verify the calculation required in the above mentioned standards. At this point one has to decide if a general stress analysis is sufficient or a fatigue analysis is necessary. This depends on the number of load cycles. Up to now it is not necessary to have the original documentation. The reason for this is that it was possible to make „as-built"-drawings and perform new calculations.

For missing inspection documents of material testings, construction tests, acceptance and in-service inspection tests, it is not possible to revise these documents. For such revisions one has to list all the unfulfilled requirements of the today KTA standards.

Afterwards, one has to decide if these gaps are deviations. If these are only formal deviations, one can easily tolerate them. If, however, there are essential technical deviations one has to make additional tests or even hardware changes. During this work we made sure that the essential requirements of the now valid safety standards of the KTA are fulfilled. Unimportant minor points were neglected. Otherwise there will be substitutional steps necessary which will be the subject of the following sections.

TOLERATION OF DEVIATIONS

If there are only formal deviations, e. g., a part of the acceptance test was done during the construction tests, it will be no problem to tolerate these deviations. If the used material is not listed in the safety standards, but the same material testings for similar materials is documented, it is only a formal point. One can prepare a material test sheet, where these requirements could be verified afterwards.

COMPLEMENTARY TESTS AND MEASURES

If there are essential deviations to the necessary requirements, one has to perform additional tests, in order to close these deviations. These substitutional steps could be additional tests for material requalification, an additional overload test, nondestructive tests, an additional detailed calculation, or even hardware changes.

Some possibilities for the material requalification are spectroscopic inspections to get the chemical composition of the material, hardness testings to get an information about the heat-treating or perhaps an ultrasonic detection of possible imperfections in the used materials. Missing parts of construction and acceptance testings could be completely repeated. Good design information can be derived from a load test with specific measurements. If it is not possible to requalify by complementary tests, a serious deviation in the construction will result.

In case of other important serious deviations, e. g. in the analytical design, there is the possibility to remove single components which do not fulfill the requirements and make developones either with another geometry or with a stronger material. The ultimate measure is to design and construct new handling equipment.

EXPERIENCES AND EXAMPLES

In our work, we already performed some comparisions for all kinds of transport and handling equipment in the so called „Load-chains". We made investigations at the „Reactor Building Crane" in the German nuclear power plant ISAR 1 (KKI 1), at lifting equipments in the German nuclear power plants Biblis (KWB-A/B), ISAR 1 and Grafenrheinfeld (KKG), and at load attaching points of flasks for transport and for storage. For these points, we compared the trunnions of the flasks NTL 11-01 to -03 and TN 17/2-701 to -703.

During this investigation, there was aproblem, insolving application of different national standards (e. g. DIN vs. British Standard). There were slight but somewhat important deviations to be evaluated. Because we have material which is not listed in the KTA, we created a new material test sheet in which the German requirements of material testing were applied to a British steel.

The stronger requirements of the todays KTA standards could cause many components to be removed. With additional detailed calculations, realistic loading zones make approval possible. These calculations often show that the component is often in accordance with the requirements of the KTA standards after additional measures and assessment.

CONCLUSION

There are stronger requirements in the current KTA standards. Now it is possible to use qualified serial components, instead of prototypes. Increased safety is one of the objectives of the new standards. Another point is that one needs less destructive tests and can use non-destructive tests instead.

In the future, one can imagine that there will be periodic safety analysis with design comparisions for transport and handling equipment not only at German plants but at other European or International plants. The possibility for such periodic safety analyses concerns European or International regulations as well.

REFERENCES

German Nuclear Safety Commisssion (KTA), Safety Standard 3902, Lifting Equipment in Nuclear Power Plants, June 1992
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