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Status of Implementation of the ENIQ Methodology for Qualification of Non-Destructive Testing

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ABSTRACT

The European Network for Inspection Qualification (ENIQ) groups the major part of the nuclear power plant operators in the European Union. The main objective of ENIQ is to co-ordinate and to manage at European level expertise and resources for the qualification of NDE inspection systems, primarily for nuclear components. In this paper the status of implementation of the European methodology is discussed in more detail.

1. INTRODUCTION

The European Network for Inspection Qualification was set up in 1992 recognising the need that the issue of inspection qualification required important resources. Therefore it seemed appropriate to set up a network in which the available resources and expertise available could be managed at European level. It was also recognised that a harmonisation in the field of codes and standards for inspection qualification would represent important advantages for all parties involved. The availability of expertise, technical know-how, hardware and infrastructure from different specialised national institutions, managed in one organisation such as this European network, could indeed bring benefits to the industry in general. An effective management of available resources through ENIQ can stimulate the harmonisation of the national approaches towards a common European attitude on inspection qualification.

2. MAIN ACTIVITIES OF ENIQ

The main objectives of ENIQ can be summarised as follows:

- to co-ordinate and to manage at European level expertise and resources for the assessment and qualification of NDE inspection techniques and procedures primarily for nuclear components
- to develop qualification schemes, both general and specific to components
- to works towards a harmonisation of codes and standards at European level in the field of inspection qualification
- to set up a co-ordinated European union (EU) approach for in-service inspection qualification in view of establishing an industrial co-operation between the EU, and Central and Eastern Europe and Russia

to study risk informed based concepts and possible consequences for inspection qualification.

The core of the network consists of the nuclear plant operators of the EU countries. The plant operators of Switzerland, the Czech Republic, Slovakia and Hungary (these last 3 countries since 1998) are also full members. In addition to the utilities, who provide the voting members on the ENIQ Steering Committee, there is also participation by other organisations with relevant expertise: qualification bodies, plant manufacturers, engineering companies, service vendors and research and development institutions. Furthermore there is also the active participation and support of DG XI (Directorate -General for Environment, Directorate Nuclear safety and Civil Protection, Safety of Nuclear Installations) and DG XVII (Directorate-General for Energy, Directorate Industry and Markets: Non-Fossil Energy, Nuclear Energy). The organisation of the network is very similar to that of the successful programme PISC. A Steering Committee decides on priorities and gives guidance. The Joint Research Centre (JRC) of Petten fulfils the role of Operating Agent (OA) and Reference Laboratory. Interaction of the network with the European regulatory bodies is achieved through the presence of an observer of the European task force of regulators at the Steering Committee meetings. Furthermore, this task force follows very closely the pilot study as observers. The organisation scheme of ENIQ is given in Figure 1.

The ENIQ tasks have been subdivided in 4 groups. The first group of tasks deals with gathering of information, which can be of interest for inspection qualification. Actually following issues are of relevance: the study of the correlation between real and realistic flaws and the setting up of a data bank at European level of assemblies and blocks available for inspection qualification. The correlation from an NDT point of view between real and artificial defects used for qualification test pieces is of course very important for inspection qualification. The availability of a data bank of test pieces for inspection qualification would be an important step in order to set up a management scheme at European level of available resources and expertise.

The second group of tasks deals with the development of general and detailed qualification approaches and is dealt with in more detail in the next section.

Main emphasis in the 3rd group of tasks is put on establishing contacts with Central and Eastern European countries (CEEC), Russia and Ukraine. These contacts are co-ordinated through the European Non-Destructive Evaluation Forum (ENDEF), an expert group managed by DG XVII of the EC with the support of JRC Petten. ENDEF helps in sharing views and experiences of the European industry in order to better co-ordinate and define existing and future bilateral and multilateral co-operation programmes in the CEEC and New Independent States (NIS), respecting thereby the rules for confidentiality.

The general objective of task group 4 to study aspects of ISI or any other surveillance method in view of both a more selective application and optimisation in order to reduce the inspection efforts whilst at the same time increasing the ISI effectiveness. Actions have been decided for gathering and transfer of information on the different aspects of risk based inspection and, possibly at a later stage, writing of a " European methodology" document on RBI.

3. EUROPEAN METHODOLOGY FOR QUALIFICATION OF NON-DESTRUCTIVE TESTS

All ENIQ activities concerning the European methodology are executed within the framework of second group of tasks. It is in the framework of Task Group 2.2 that the European methodology has been written and that the pilot study is conducted in order to explore ways of how to apply it. Task Group 2.3 was set up at the end of 1997 with the specific objective to provide more detailed guidelines on technical justification in the form of recommended practices.

4. STATUS OF THE EUROPEAN METHODOLOGY FOR QUALIFICATIONS OF NON-DESTRUCTIVE TESTS

One of the major achievements of ENIQ has been the approval of the European Methodology for qualification of non-destructive tests.

Along the European methodology qualification of a non-destructive test may require assessment of any inspection system, composed of any combination of inspection procedure, equipment and personnel. This qualification or assessment can be considered as the sum of the following items:

i) Practical assessment (blind or non-blind) conducted on simplified or representative test pieces resembling the component to be inspected.
ii) Technical justification, which involves assembling all evidence on the effectiveness of the test including previous experience of its application, laboratory studies, mathematical modelling, physical reasoning and so on.

The appropriate mix of the above sources of evidence must be judged separately for each particular case, although the use of technical justification is highly recommended.

The first issue of this document was initiated by the PISC III Action 8 Group, dealing with support for codes and standards. It was further developed and finalised by ENIQ. The first issue was approved by the Steering Committee of ENIQ at its meeting of 15 March 1995 in Petten and was published as ENIQ Report 1 [1]. This document was the first to be published in Europe on this issue and contained a number of innovative proposals such as the use of technical justification, the separation between procedure/equipment and personnel qualification and the use of non-blind trials for procedure and equipment qualification.

The European regulators issued in April 1996 a common position document on qualification of NDT systems for pre- and in-service inspection of light water reactor components [2]. This official report of the Nuclear Regulator Working Group (NRWG), sponsored by DG XI, considers also the essential elements of the European Methodology and is, in general, in good agreement with the European Methodology. This means that in Europe there is a remarkable consensus of opinion between the major parties involved on the general principles of inspection qualification.

Since the first issue of the European methodology, the issue of inspection qualification has also been discussed widely both at national and international level and some evolution in thinking has occurred.

The Steering Committee of ENIQ has decided to conduct a pilot study to explore ways of how to apply the European methodology for inspection qualification to a specific component. All this has led the Steering Committee of ENIQ to issue a second version of the European methodology [3]

Many EU countries are already implementing the general principles of the European methodology in their national qualification programmes. France has recently changed it in-service inspection code (RSEM) and inspection qualification along the European methodology is now formally required. Sweden introduced formal requirements for inspection qualification in 1995 and has set up a qualification body. Germany has set up a national ENIQ committee in order to issue German guidelines for inspection qualification. Spain, Finland and Belgium are countries that have to follow by law the ASME code. However, for inspection qualification. Spain has decided to follow the ENIQ approach. Finland and Belgium have an ad hoc approach following basically the ENIQ approach for inspection qualification.

Also the International Atomic Energy Agency has issued guidelines for inspection qualification for VVER operating countries [4]. These IAEA guidelines take into account the European methodology, as proposed by ENIQ. The Czech Republic has for example introduced in its new Atomic Law requirements for inspection qualification taking into consideration the results of two Phare projects on inspection qualification in which ENIQ members were involved.

5. PILOT STUDY

At the beginning of 1996 it was decided by the Steering committee of ENIQ to conduct a pilot study in order to explore ways how to apply the general principles of the European methodology to a specific case and to verify the validity of the principles of the European methodology.

The example chosen for the ENIQ pilot study is the qualification of an inspection of austenitic pipe to pipe and pipe to elbow welds. All aspects of the inspection were qualified. The procedure and equipment qualification involved open trials on test pieces containing defects while that of the personnel was done through blind trials. In addition to practical trials, qualification involved also the production of a technical justification as required by the methodology document.

Once the inspection was qualified, it was applied to a number of "real" components, some containing defects removed from operating reactors and others containing simulated defects but welded using the same materials and procedure as the qualification test pieces. The results obtained were compared in detail to those in the first qualification part of the pilot study. From this comparison, conclusions are drawn about the value of qualification in providing confidence in the inspection. The status of the pilot study at the end of October 1998 is as follows:

- the qualification part of the exercise is finished
- The following pilot study reports were published as official ENIQ reports at the end of 1998: input information, quality assurance scheme followed, qualification procedure, inspection procedure and technical justification pre-trials [5-9].

- The inspection of the ISI simulation specimens is finished. Characterisation of the defects in these ISI specimens requires, however, destructive examination, which is in progress. The final reports on the assessment of the ENIQ pilot study are expected for beginning 1999.

6. RECOMMENDED PRACTICES

The European methodology document is intended to provide a general framework for development of qualifications for the inspection of specific components to ensure they are developed in a coherent and consistent way throughout Europe while still allowing qualification to be tailored in detail to meet different national requirements.

In the European methodology document one will not find a detailed description of how the inspection of a specific component should be qualified. A recommended practice is a document produced by ENIQ to support the production of detailed qualification procedures by individual countries. A recommended practice is the next level of document below the methodology. A recommended practice is applicable in general to any qualification. This general scope means that valuable advice can be given by ENIQ to promote a uniform approach to qualification throughout Europe but the detail of how qualification is to be done is determined at the national level in line with the regulatory and technical requirements in that country. Organisations will be free to make use at national level of the existing recommended practices, as they see fit.

The main objectives of RP 1 [10] on essential/influential parameters are as follows:

- to explain the proposed concept of influential/essential parameters
- to indicate how the concept could be used in inspection qualification according to the European methodology
- to give advice concerning the classification of influential parameters
- to give examples of parameters, which can be influential as a function of the specific inspection to be qualified for 2 cases: an ultrasonic inspection of welds and an eddy current inspection of steam generator tubes.

RP 1 is the result of many discussions within ENIQ task Group 2.2 during the ENIQ pilot study on how to treat this issue.

RP 2 [11] and 3 [12] on technical justification were produced by Task Group 2.3. During the ENIQ pilot study it appeared that it was necessary to provide more detailed guidelines on how to implement in practice the concept of technical justification.

RP2 should assist those producing technical justifications to identify the material which might be included. It should also assist in producing technical justifications in a uniform format throughout Europe. The objectives of RP 3 are:

- to explain the different purposes of technical justification
- to indicate how the specific purpose or application of the technical justification may affect its contents
- to give guidance on the relative weight which has to be given to test piece trials and technical justification taking into account a number of factors such as level, available evidence, specific application, etc.

RP 4 [13] is a recommended practice, which should assist those doing qualifications to identify the material, which might be included in the qualification dossier, which is defined as an assembly of all the information relevant to the definition and execution of the qualification. It should also assist in producing qualification dossiers in a uniform format throughout Europe, an essential element in providing a general framework for a scheme of recognition of qualifications performed in the European Union.

The scope of RP 5 [14] is to provide guidelines on how to conduct test piece trials, once it is has been decided (for example, as a result of the analysis done in the technical justification) that they are required. It refers especially to those test piece trials (open or blind) which are supervised by the qualification body. Guidelines are also given on how to conduct open trials as these require a specific approach.

RP 4 and 5 were published officially as ENIQ reports at the beginning of 1999. The official publication of RP 6 to 8 is expected for the end of 1999. RP 6 will contain guidelines on how to use modelling for inspection qualification. RP 7 will contain general requirements for a body operating qualification of non-destructive tests and RP 8 will contain guidelines on how to define inspection qualification objectives from in-service inspection objectives.

7. CONCLUSIONS

It can be concluded that ENIQ has already contributed significantly to the harmonisation and standardisation of inspection qualification rules in the EU. There is general consensus of opinion on the general principles for inspection qualification not only between the different utilities but also with the regulatory bodies. The publication of ENIQ recommended practices, which contain more detailed guidelines on how to implement the general principles of the European methodology, should contribute to a further harmonisation. Many countries are already using the recommended practices for their national qualification projects.

Future activities will focus on finishing the recommended practices 4 to 8, on studying how test piece trials can be reduced by fully exploiting the concept of technical justification and on validation of artificial defects for use in qualification test pieces.

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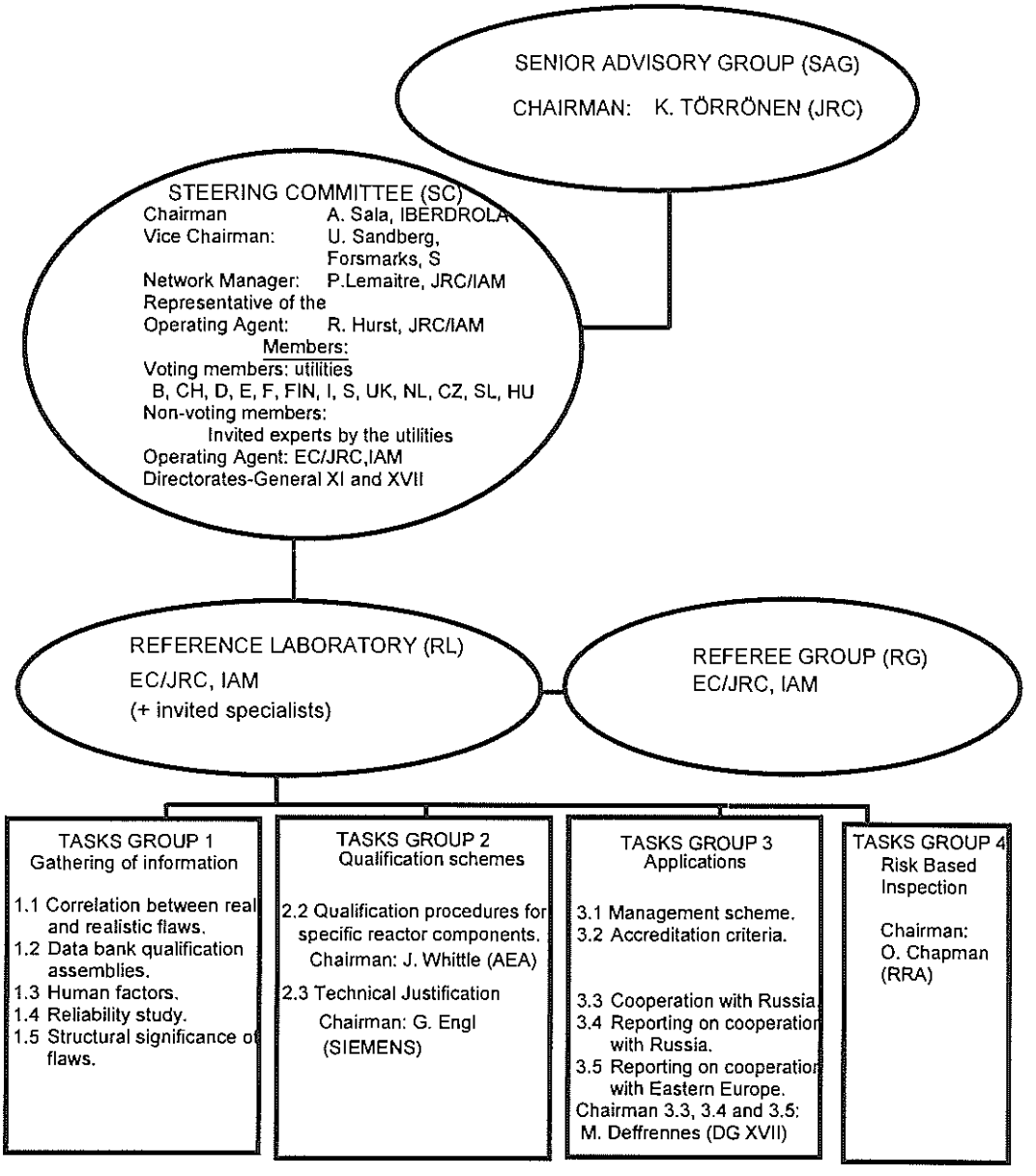

Figure 1: Organisation scheme of ENIQ