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SUBJECT: REPORT ON OFFICIAL TRAVEL TO PETTEN, THE NETHERLANDS -- MARCH 11-13, 1997

From Tuesday, March 11 to Thursday, March 13, 1997, staff members from the Offices of Nuclear Regulatory Research (RES) and Nuclear Reactor Regulation (NRR) attended a Joint Specialists Meeting on non destructive examination (NDE) Techniques Capability Demonstration and Inspection Qualification in Petten, The Netherlands. On Thursday, March 13, 1997, the RES staff member attended a meeting of the International Cooperative Group on Piping Performance.

This memorandum summarizes the major observations and information acquired from the Joint Specialists meeting, the International Cooperative Group on Piping Performance and from the ensuing discussions. Proceedings of the conference will be published and available for staff review .

SPECIALISTS MEETING ON NDE TECHNIQUES CAPABILITY DEMONSTRATION AND INSPECTION QUALIFICATION

The purpose of the meeting was to provide an international forum for the discussion of recent developments, results and of utility experience with NDE techniques capability demonstration and inspection qualification methods. The meeting provided an opportunity to compare and assess the qualification principles from the US Performance Demonstration Initiative (PDI), the European Network for Inspection Qualification (ENIQ) and the International Atomic Energy Agency (IAEA) guidelines). Special emphasis was placed on NDE qualification techniques to detect and size flaws in order to assure structural integrity during plant design life or into the period of license extension. Presentations by an NRC staff member on Regulatory Perspective

of Performance Demonstration (PD) of US Examination Systems and Electric Power Research Institute (EPRI) member on PDI Experience were the focal points of several discussions.

The order of the topics is from the order of the sessions. The first session was an opening and introduction by K. Torroenen (European Council (EC)), P. Trampus (IAEA), A. Miller (Organization for Economic Cooperation and Development (OECD)), and S. Crutzen, EC, Petten. The remaining four sessions are summarized below.

General Approaches

General Approaches was the most informative session with eighteen presentations related to inspection qualification and performance demonstrations. The various countries, (US, UK, Germany, France, Belgium, Spain, Sweden, Norway, Hungary) represented in the presentations at this session are presently involved in or planning performance demonstration and inspection qualification activities. The global movement toward performance demonstration activities has many countries considering their approach to inspection qualification and assessing their experience to date.

L. Becker of EPRI discussed the background of ASME Section XI Appendices VII/VIII and the basic approach to PDI. He identified technical basis/justification, industry guidance, realistic samples, documentation and the balance of cost and benefit as the key elements required for the basic approach to PDI. He also identified the following shortcomings: 1) personnel demonstrations are too long; 2) personnel test requirements overly complicated; 3) definition of flaw characteristics is lacking; 4) responsibility for implementation is not defined, roles of authorized inspectors, and 5) an independent administrator is not defined.

P. Lemaitre of JRC Petten presented the European Methodology for qualification of non destructive testing (NDT) developed by ENIQ. A second issue of the European methodology was recently completed in February 1997. It was revised to incorporate some evolution in thinking which occurred after national and international discussions on the issue of inspection qualification. The revised document sets out the requirements that a qualification body carrying out qualification of NDE should follow in providing certification that a given test is fit for its objective.

F. Cazorla of IAEA discussed the IAEA guideline's preparation for the qualification of VVER reactor components inservice inspection (ISI). The Russian design plants have insufficient defense in depth that required interim measures and corrective actions. Guidance on NDE qualification was requested from operators of VVER designed plants. The resulting publication VVER-SC-123 states guidelines for qualification of ISI systems for VVER nuclear power plants.

R. Hermann of NRC presented the Regulatory Perspective on Performance Demonstration of US Examination Systems. It is evident from a variety of experiences, including the PISC program, IGSCC inspections in BWR piping, the PDI, and Appendix VIII type reactor vessel inspection, that using only existing U.S. regulatory requirements on UT might not be adequate to ensure that flaws in reactor vessels and piping can be reliably detected and sized. However, significant improvement in the ability to reliably detect and size flaws in reactor vessels and

piping can be achieved using performance demonstration methods. R. Hermann's paper is attachment one to this memorandum.

C. Waites of the U reiterated a concern from other presenters that the cost of preparing a program is a disadvantage of the qualification process but the costs are offset by the economic benefit. The economic benefits are: 1) avoidance of inadequate inspections, 2) use of simple techniques, 3) objective determination of inspection intervals, 4) improved decisions on repairs/replacements, 5) earlier repair decisions. Qualification improves inspections, increases confidence and quantifies performance.

The remaining presenters discussed the qualification process and experiences/lessons learned in their individual countries. The German process of qualification has hardware qualification and three specific categories for component qualification. In France, the participants in the inspection qualification process are the plant operator, qualifying body and the vendor. In all European Union countries (and Switzerland), the plant operator (licensee) is responsible for ISI assigned to vendors of inspection services. There were consensus statements regarding a qualification requirement for dissimilar metal welds, austenitic stainless steel and nickel alloys.

During the discussion session questions related to cost and benefit of PDI and how the benefits of PDI are evaluated. The distinction between ENIQ and IAEA requirements were presented to the speakers. L. Becker summarized the concerns with the statement that the main benefit is the result of a higher level of confidence that the job is done correctly the first time. He also provided information on the request at the last ASME Section XI meeting to expedite the process of incorporating Appendix VIII into the code. The distinction between IAEA and ENIQ was explained by P. Lemaitre who stated that IAEA's focus is only nuclear facilities while ENIQ focuses on nuclear and non-nuclear facilities.

Applications and Experience Gained

M. Lepiece discussed the Belgian Response to ASME Section XI requirements. Significant experience existed at Belgian utilities in the area of qualification of procedures and operators prior to the introduction of the requirements of the 92 edition of the ASME Sec. XI code. A technical committee was formed to assess the new requirements of ASME Sec XI and concluded that some requirements are overly expensive to implement and not necessary. Proven industry techniques are chosen on a case by case basis. The choices do improve in-service inspection and are not costly. Both the European approach and the American PDI initiative have been considered.

Lessons learned from the ENIQ pilot study was presented by P. Lemaitre of JRC, Petten. The purpose of the pilot study is to try to implement the European methodology for qualification of NDT and explore ways to apply it. Phase 1 is intended to show the feasibility of the methodology. Phase 2 includes involvement of industrial vendors. The test specimens are austenitic 300 to 700 mm diameter pipes with 12-30 mm wall thickness. Cracks are present in the heat affected zone and 50% through wall. The blind trials will be conducted in March 1997.

The Inspection of the first set of ISI assemblies will be done in April 1997 with the 2nd set being done in the May/June timeframe in 1997. Lessons learned from the ENIQ pilot study are: 1) the importance of providing all information in advance; 2) importance of essential parameters; 3) importance of defining the valid range of the essential parameters.

B. Jacobs of Southwest Research Institute (SwRI) presented a paper that discussed the preparations and technical approach which resulted in the successful completion of a very challenging PDI program. Two training mockups (BWR, PWR) were designed by SwRI to the same standards as Appendix VIII test blocks. A training program was implemented and proved that procedures and equipment performed as expected and examiners became proficient. During the initial procedure qualification phase, a large data base was developed on BWR and PWR thickness samples to assure enough data sets would be available to qualify a large group of examiners. A new multichannel high performance state-of-the-art UT imaging system, the EDAS-II, was developed during this period. Conclusions were the qualification process is valid and achievable.

R. Booler of the U.K. presented a case study of qualification of remote automated UT inspection of austenitic pipe welds. A technique referred to as graphical UT imaging for display and evaluation (GUIDE) was used to detect a defect in the heat affected zone of SS 316 material. This defect was in a gas cooled reactor. Conclusion in the blind trials demonstrated that the human element of the procedure was satisfactory.

T. Sjo of Sweden discussed recent experiences of qualification performed by TRC. The qualification experiences to date are: UT(detection and sizing), ET(detection-length sizing), and VT (detection-length sizing). Audits of suppliers and internal audits are performed. Three qualifications were performed in 1996, pump house, weld box, and core box. The planned qualifications for 1997 are the core shroud, pump housing (HCP at 2 plants), head recirc, and the nozzle. Each qualification was performed in conjunction with a project manager who established internal qualification procedures and training. Extensive work was completed to identify essential variables. Technical justification (TJ) will be a useful tool to manage qualifications in the future. Technical justifications have not been used much. The normal time to qualify at a plant is 1.5 years compared to the laboratory time of 6 months.

Validating ET Array probes for inspecting steam generator tubes was discussed by S. Sullivan of Canada. This method of inspection focuses on cracking in the U bend of the steam generator tubes. The problem resulted from the presence of ID deposits. Layers of deposits causes magnetic shielding effects and background noise. Copper also adds to the noise. It is possible to detect small cracks with transmit receive code that with UT. Extensive information was gained from pull tube which is an expensive operation. This procedure can simulate field condition which is promising.

Qualification of Radiographic Techniques was discussed by L. Hammer of Sweden. A combination of materials sometimes makes it impossible to use UT. The new digital technique discussed looks like real time but has a delay. An extra tube is present in the x-ray camera. The camera is manipulated by a manipulator which positions camera and a tube. The tube and camera are manipulated independently but will align tube and camera. A Swedish nuclear

power plant is sponsoring this work. To optimize the equipment, it needs to be tilted parallel to line of crack. Camera can tilt to a plus or minus 30 degrees.

Technical justification programme of tecnatom to qualify ISI procedures and systems was discussed by G. Bollini representing Spain. Their certification program started at the beginning of last year. An urgency to get qualification of ISI procedures and systems applied in nuclear power plants. Some flexibility exists in the qualification process, and this will be analyzed on a case by case basis. Preparation of the documents of the qualification dossier includes defining essential variables. The theoretical and experimental data is in one document. Geometry and dimensions are full scale, base and welding mat are modeled as per the nuclear power plant. Thermal and mechanical fatigue mock ups are funded by Tecnatom.

Related Subjects

A variety of topics on different subjects related to inspection assessment were discussed in this session. The qualification and certification of NDT personnel, probability of detection in tubes components and their weldments by NDE were discussed by representatives from Russia. Additional topics related to assessement of deterioration in reinforced concrete structures and qualification of pipeline construction was discussed.

Risk Based Inspection

The last session consisted of two presentations given by V. Chapman on the newly formed ENIQ Task 4 Risk Based Inspection and F. Ammirato of EPRI on the Risk Based Inspection (RB ISI) in the USA. The ENIQ Task 4 was formed on the premise that the safety of a plant involves structural integrity of the components together with the knowledge of the consequences of failure. ISI can improve the confidence in safety and the inspections must be focused where defects have structural integrity. Risk based methodology is a technically sound, cost effective approach that focuses resources on systems, components and locations most important to safety.

The final discussion period with concluding remarks was chaired by M. Davies and S. Crutzen. The major points of the conclusion session discussion were: 1) actual benefits of qualification ensure a high standard of inspection which must be maintained; 2) technical justification, cost, and judgement required to plan inspections under fire are three areas that require definition; 3) there is a need for harmonization with the operators which presently does not seem to be an important objective in terms of qualification; 4) more attention is needed in characterization of defects in the test blocks; and 5) an international acceptable level of qualification is needed in NDE.

A list of participants is included as attachment 2 to the trip report.

MEETING OF INTERNATIONAL COOPERATIVE GROUP ON PIPING PERFORMANCE

This half day meeting was also held in Petten, The Netherlands on Thursday, March 13, 1997. The purpose of this second meeting of the international group was to discuss activities since the last meeting of September 1996 and discuss future activities. The objective of the international group is to determine if there is a need to develop an international database on piping performance and ISI. Gert Hedner from the Swedish Nuclear Power Inspectorate (SKI) opened the meeting. After opening remarks welcoming everyone, Gert stated that discussions had taken place between utilities and Alan Chockie of The Chockie Group International, Inc. Contacts were also were made with JAPEIC, and regulators in Europe, and Canada. The objective of the discussions with regulators and utility groups were to obtain feedback on their interest in participating/contributing to this international database. One main concern from the discussions was cost sharing and confidentiality. The regulatory organizations of Europe have expressed an interest. ENIQ has a working group that is developing a piping database but there is no concern of duplication/overlap because the EPRI database will task is enormous in comparison. Japan does not want to make a commitment at this point, but would like to wait and see the progression of this group. G. Hedner stated that his objective was to establish a cooperative between the regulators. After discussions with the regulatory and utility groups, G. Hedner concluded that reaching his objective of a cooperative between regulators and utilities may be a problem.

Alan Chockie presented information on the EPRI US Piping Failure Data Base Program that is being developed. The presentation is attachment 3 to this memorandum. The objectives of the EPRI program are to: 1) create a comprehensive and validated database and statistical analysis of piping failures, non-leaking cracks and fabrication defects at US nuclear power plants; and 2) to provide support for US and international activities such as PSA applications, Risk-Informed ISI, Risk-Informed IST, reliability centered maintenance and piping systems analysis.

The EPRI database would validate and provide the missing elements that may exist in the retrospective SKI database developed by Alan Chockie and Spence Bush of PNNL, which is the foundation of EPRI database. When EPRI completes this project the final products for participating utilities will be: 1) an electronic data base of piping failures and non-leaking cracks for each utility's plant and all other US plants; and 2) a report of the data base and a statistical summary. For EPRI members, an appendix will be available on the statistical evaluation process to allow plants to perform their own evaluation. All plant names will be removed to ensure that confidentiality is maintained.

To meet their objectives EPRI has developed a survey which will be sent to plants so to validate existing data and identify unidentified failure data. The existing data was obtained from a review EPRI completed of publicly available records and NPRDS records. The BWR and PWR owners groups identified pilot plants, Hatch 1 & 2 and Surry 1 & 2, that will assess the resources required to obtain the data. The licensees for Surry and Hatch are reviewing their data to present to other licensees.

To ensure consistency of the data that is collected, basic definitions were developed - a pipe, tube and failure type and the fields of the data base were defined. Once completed, EPRI will have a database that would be the foundation for the international piping performance database.

Objectives and scope of the group were discussed. G. Hedner suggested a proposal to set up the database on degradation and damages to piping and decide who would do the analysis of the data. V. Chapman of Rolls-Royce stated that the international data base would be fundamental for risk informed ISI. The best approach may be to develop one for European data and one for U.S. data and eventually combine into an international.

A. Chockie presented an organizational and cost structure for the piping data base. After the presentation, A. Chockie stated that a method to identify individuals with a strong interest in the database must be developed so that an inordinate amounts of time and effort are spent trying to identify interested parties. A. Hofler stated that the German parties would be more interested in PSA data. It was noted that one plant has requested information on erosion/corrosion data.

The quality and completeness of the data were discussed. W. Spekken noted that this depends on what the data will be used for and if data from the secondary side will be considered. Completeness of the data also requires timely updates.

Management of data and operations of the database were discussed. EPRI and NEA have proposed to operate the database. NEA presently has an internal group that manages large scale databases. It was also proposed that the JRC would manage the European data, EPRI would manage U.S. data, and IAEA would be the coordinate with the remaining foreign utilities. It was noted that this database does have commercial value.

The issue of membership, organization of the group, access to data, etc., were addressed. The piping coop started as an independent organization but it was noted that an organization does not exist with utilities and regulatory groups. Questions concerning adoption of new members, problems with public data and confidentiality, rules for release of information outside the group were raised. It was noted that the future direction and structure will need to be coordinated by all participants. A steering committee was formed to solicit commitment from various organizations and to discuss in detail, issues raised at this meeting.

The conclusions reached were: 1) there does not seem to be interest from utility groups at this point; and 2) this effort must be utility driven to be successful. In order for U.S. and international utilities to become interested, we must identify utility employees who are involved with piping and ISI programs so that this information about the piping coop can be disseminated effectively through the organizations. The utilities must be convinced that the data can be used and that it is detailed enough for significant uses.

The group decided to communicate via E-mail until the next meeting which is tentatively scheduled for October 20-22, 1997, during the Water Reactor Safety Information Meeting in Bethesda, MD.

A list of participants is included as attachment 4 to the trip report.

Attachments:
1. NRC Presentation-NDE Meeting
2. List of Participants-NDE Meeting
3. EPRI Presentation at Piping Meeting
4. List of Participants-Piping Meeting

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