ENIQ RECOMMENDED PRACTICE

ENIQ Recommended Practice 11

Guidance on Expert Panels in Risk-Informed In-Service Inspection

Issue 2

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NUGENIA Association

c/o EDF, Avenue des Arts 53, 1000 Bruxelles, BELGIUM

Email: secretariat@nugenia.org

Website: http://www.nugenia.org

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Foreword - Brief Revision History of RP11

The first issue of ENIQ Recommended Practice 11 (RP11) was developed by the ENIQ Task Group for Risk and was approved by the ENIQ Steering Committee for publication in June 2008. A number of smaller changes were made for the second issue of the document reflecting the development on the field in the last 9 years.

EXECUTIVE SUMMARY

This Recommended Practice (RP) has been developed as a consensus document amongst the members of NUGENIA Technical Area 8 (TA8) - ENIQ. This recommended practice is meant to assist users of RI-ISI applications in how to form, prepare, conduct and facilitate an expert panel as a part of a RI-ISI process. It will give guidance on responsibilities, composition, planning, conduct and documentation of the expert panel. Users are free to use this RPs at national level, as they see fit.

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1. Introduction

The European Framework Document for Risk-Informed In-Service Inspection (RI-ISI) [1] is intended to provide general guidelines to utilities on how to develop RI-ISI approaches and to use or adapt already established approaches to the European nuclear environment, while taking account of national regulatory requirements and utility-specific characteristics.

The Framework Document recommends the use of an expert panel to review the selection of safety-significant sites before the inspection programme is finalised. However, more detailed guidance regarding the responsibilities, composition and working procedures of an expert panel is not provided.

The development of guidelines for the expert panel process in this area has also been recommended by the Nuclear Regulators Working Group (NRWG), which explicitly advocates the use of Expert Panels in its report on the regulatory experience of RI-ISI [2]. However, the NRWG specifically acknowledged that the use, function and necessity of an expert panel will depend on the RI-ISI methodology applied.

In the drafting of this document, European experience and US recommendations and practice on the use of expert panels have been considered [3] [4] [5] [6] [7].

The main objectives of this recommended practice are to give guidance on:

- Responsibilities of the expert panel
- Composition of the expert panel
- Planning and preparation of the expert panel
- Conduct of the expert panel
- Documentation of the expert panel

It is important to recognise that an expert panel can have a different role and composition, depending on the organisation and resources of the RI-ISI project. An expert panel can be an independent review body, as described in the Framework Document [1] in the context of a possible management structure, which largely consists of members external to the RI-ISI project so far. On the other hand, an expert panel can also be formed for an internal review of the failure probability and consequence analyses, without broad external involvement. In this case, it is a forum to ensure a systematic review of analyses and balanced use of information and expertise from several disciplines in the decision-making process.

Although the guidance provided in this document mainly targets an expert panel to review risk ranking, a similar approach can be adopted to forming and conducting a panel for the purposes of making the final selection of inspection sites. Furthermore, an expert panel can be used to review and approve periodic re-assessments and to assess the impact of Probabilistic Safety Assessment (PSA) / Probabilistic Risk Assessment (PRA) updates on the RI-ISI programme.

2. Role and responsibilities of expert panels in RI-ISI

Risk-informed applications, such as RI-ISI, make use of probabilistic safety assessments (PSAs), together with other relevant analyses, with the final goal of making safety-related decisions. This requires not only a comparison of quantitative risk estimates and deterministic calculations, but also a balanced combination of more qualitative expertise from several technical areas. A risk measure calculated with the aid of PSA models is not the only decision criterion, as insights from several other disciplines must be integrated in the decision-making process.

In general, the role of an expert panel is to synthesise the views of various experts and identify and characterise the uncertainties in their analyses. A structured approach is needed in order to find a balance between the (often contrasting) arguments of experts representing different disciplines. Furthermore, an expert panel is important as it compels the different experts to openly discuss the technical bases of their arguments both among each other and with the decision-maker.

The overall responsibility for an expert panel process lies with the plant operator (licensee), who is responsible for ensuring that the panel is composed of suitably qualified and experienced persons, and that the combined experience of panel members is appropriate to the task at hand.

Within a RI-ISI process, the expert panel is responsible for reviewing all the pertinent information that has led to the initial risk ranking and for proposing the final risk ranking of the elements or segments within the scope of the RI-ISI application.

The initial risk ranking is based on the evaluations of probabilities and consequences of failures (COF) of structural elements or segments. In its review, the expert panel should consider the sensitivity of results, identify limitations in analyses and consider additional aspects that may influence the final ranking and selection of sites to be inspected.

The expert panel should use qualitative and quantitative information from PSA and failure probability evaluations, in combination with traditional engineering insights, and design basis information. In all its activities, the expert panel has to take account of the key role of the defence-in-depth concept [8] [9].

More in detail, the expert panel review process should cover:

- Verification that the technical basis for defining the scope of the programme is sound.
- Verification that the system boundaries are clearly defined and that the delineation of piping segments can be justified.
- Verification that the failure consequences assessed for each segment are accurate (both direct and indirect).
- Verification that the procedures for estimating failure probability have been based on appropriate databases, analytical methods and/or Structural Reliability Models (SRMs).
- Verification that, when SRMs have been used, the limitations in the models and in the key input parameters have been assessed [10].
- Verification that the estimated failure rates have addressed the limiting failure type (small leak, disabling leak or break), the relevant failure mechanisms and ageing effects, normal and design-limiting loadings, design and fabrication factors and material properties.
- Verification that the estimated failure rates are consistent with plant operating history.
- Verification of the consistency of classification among segments within a system and between systems.

- Verification that uncertainties have been properly considered and treated.
- Review of the selected piping segments in order to identify any proposed relaxation in inspection requirements from prior practices and assess their effect on plant safety.
- Consideration of strategies other than inspection.

The expert panel may upgrade the risk classification of a segment or an element based on economic and other non-safety-related considerations. The expert panel may also downgrade the risk classification of a segment or element if properly justified.

An important responsibility of the panel is to ensure complete transparency of the process, properly recording and documenting all decisions and the underlying justifications, so that the process is open to scrutiny.

3. Composition of an expert panel

The following principal players are identified: the decision-maker, the RI-ISI project leader, the panel leader, the panel members and the panel technical secretary.

The **Decision-Maker**, typically a senior employee of the utility, is the person responsible for approving the final decisions of the panel. The decision-maker is typically not a member of the panel itself, but may take part in the discussions of the panel.

The **RI-ISI Project Leader** is the person responsible for the RI-ISI application. He/she has to ensure that all the relevant information is made available to the expert panellists. To avoid conflicts of interest, the RI-ISI project leader should not serve as a member of the expert panel.

The expert panel should be guided by a **Panel Leader** (chairperson, facilitator). This should be an individual with thorough knowledge and experience of the whole technology process of the nuclear power plant (NPP). He/she should be independent from the process itself (i.e. not involved in any of the technical analyses or calculations carried out to obtain the initial risk ranking). The panel leader should be skilled in leading a team of people who are not necessarily under his/her management line. Independence from the process is meant to allow the leader to take an objective, unbiased view. The leader should have appropriate interpersonal skills to facilitate the process and help the group to overcome contrasting opinions and personalities to ultimately achieve a consensus.

The expert panel should contain several **Panel Members**, individuals with expertise in all the relevant technical areas related to the RI-ISI process. The panel members should be experts in their specialist field and, additionally, have a good general understanding of the risk-informed ISI methodology, good knowledge of plant and system operation, good understanding of the existing ISI programme and knowledge of the piping failures experienced at the plant. The experts could be from either inside or outside the utility.

The following expertise should be covered by the members of the expert panel:

- probabilistic safety assessment (PSA);
- structural integrity and piping design and stress analyses;
- materials engineering and piping failure operating experience;
- in-service inspections and non-destructive evaluation (NDE);
- plant operations;
- plant maintenance;

- plant engineering.

Finally, the expert panel should also have a member with responsibility for taking accurate minutes of proceedings, known as the **Technical Secretary**. This person should not be an ordinary secretary, but rather an individual familiar with the RI-ISI process, to ensure that all the important technical points discussed are appropriately captured in the minutes and thus duly included in the process documentation. He/she could additionally support the panel leader, for instance, by noting suggestions and deferred problems and bringing them up at a later date.

It is the responsibility of the utility to ensure that the expert panel has sufficient size and resources to carry out and complete its work properly. Non-voting Experts in Attendance can be invited by the panel leader to provide additional information and support the work of the expert panel on specific issues, as needed. Table 1 summarises the various roles of the participants in an expert panel.

It is recommended that a representative of the **Safety Authority** join the expert panel meeting as an observer. This enables the safety authority to understand the work of the expert panel, and provides the authority with the technical background needed to judge the final decisions of the panel. Early involvement of the safety authorities is likely to be advantageous for all parties involved in the acceptance of the RI-ISI programme.

Table 1: Expert panel participants and their roles

Participant	Role
Panel Leader	• Leads discussions • Facilitates communication between experts • Works towards achieving a consensus • Assists the Technical Secretary in reporting • Develops forms/worksheets for facilitating the panel's work, if needed • Designates an expert panel member to act as vice-Panel Leader
Panel Members (technical experts)	• Review the analyses, take part in discussions • Suggest changes or agree with the analyses • Comment on the summary report
Technical Secretary	• Takes minutes of the proceedings • Assists the Leader in structuring the discussion • Prepares a summary report, summarising the discussions and the results of the expert panel process
Other (non-voting) participant(s)	• Provide information and support to the expert panel, as required
Other parties involved (not members of the independent Expert Panel)	
Decision-maker	• Presents the strategic view and role of the decision • Responsible for making the final decision • May take part in panel discussions
RI-ISI Project Leader	• Responsible for collecting information for the panel • Presents the case to the panel and takes part in discussions • Comments on and accepts the final report

4. Planning and preparation of the expert panel

To ensure that the expert panel process is a success, a certain amount of preparatory work is needed. This includes the collection of all the relevant material and information on which decisions will be made and the training of panel participants. It is also worth using standard forms for information summaries and reporting.

4.1 Collection of material and preparation of forms for facilitating the panel

The project leader should ensure that all the relevant material is available for all panellists well before the beginning of work. This information should include the following:

- Relevant background information concerning the nuclear power unit of which the system is a part;
- A schematic representation of the system which clearly illustrates boundaries and segments;
- System description, including the design function of the system and a clear definition of the safety functions;
- Segment boundaries;
- Current ISI programme;
- PSA analyses, and all other relevant assessments, carried out to evaluate the failure consequences;
- Analyses carried out to evaluate the failure probabilities;
- Other considerations (shutdown risk, flood, fire, seismic, operation and maintenance insights, other deterministic insights, etc.);
- Resulting risk ranking.

To aid the expert panel, it may be useful to prepare in advance element/segment information forms. These forms or worksheets should include the necessary information in a structured and easily readable form. The worksheets can be used during the panel sessions to document and review discussions and comments on each element/segment discussed. These forms should be distributed to the experts in advance.

4.2 Training for participants of the expert panel

All participants of the expert panel should receive sufficient training in the RI-ISI application. This should include the application of risk analysis techniques for ISI. The following is a list of training topics:

- risk ranking process (risk importance measures, threshold values, the impact of assumptions and uncertainties on the results);
- failure probability models;
- failure mode assessment;
- consequence of failure assessment.

It is advisable that at least one working day should be set aside for the training of panel members prior to commencement of the real work of the expert panel. A crucial element of the training is to ensure that the panel members have a clear and common understanding of their responsibilities and of the objectives of the process. These issues should be made very clear before starting the panel sessions. Training should be duly documented.

4.3 Time planning

Experience has shown that approximately one working day should be planned for the analysis and review of a piping system, but of course this is highly dependent on the number of elements/segments to be reviewed.

The need for iteration should be envisaged. Some time should be pre-allocated should the panel require the collection of additional information or the completion of further calculations in order to reach a consensus.

5. Conduct of the expert panel

5.1 Expert Panel Sessions

One of the key outputs of the expert panel is to consider the safety significance of the segments or elements. During the expert panel sessions, this evaluation should be made not only with reference to risk insights, but also other considerations, such as traditional engineering evaluations, sensitivity studies, operational experience, engineering judgment, and current regulatory requirements.

It is responsibility of the panel leader to make sure that all participants have the possibility to express their opinions, and that the discussions are documented, especially conflicting opinions.

All changes proposed to the initial risk ranking should be justified and clearly documented as part of the panel process.

If the expert panel is an independent review body, it could invite — as necessary — the technical experts or engineers who have been personally involved in the RI-ISI analyses to present their results and to answer technical questions. If the panel is formed for an internal review, these experts should already be members of the panel.

The crucial elements of risk ranking are the failure probability and failure consequences analyses. These should be reviewed in detail during the expert panel sessions.

5.1.1 Review of the failure probability assessment

A structural/material technical expert or engineer who has been involved in the failure probability assessment should present the analysis of failure potential to the panel.

As a minimum, the following questions should be addressed in the panel discussion:

- What are the possible degradation mechanisms?
- What stressors (loadings, chemistry, temperature) are affecting the element?
- What are the material properties (relevant to degradation potential)?
- What are the main uncertainties in the analysis?

5.1.2 Review of the consequence analysis

An expert who has been involved in the consequence assessment should present the consequence analysis to the panel.

As a minimum, the following questions should be addressed in the panel discussion:

- What are the consequences of a leak and a break? For example:

- What safety functions are supported by the system?
- What other systems are impacted by the failure of this system?
- Address core damage and containment performance (e.g. isolation, bypass)

- What are the main uncertainties in the analysis?
- What is the resulting quantitative estimate or ranking?

Specific attention should also be paid to the following issues:

- What were the limitations of the PSA model with respect to the consequence analysis of the element/segment in question? In particular, does the PSA cover external events and low power and shutdown conditions?
- Do operator actions have an impact on the consequence analysis, and how they were treated?
- How have indirect impacts (pipe whips, flooding, etc.) been evaluated?

5.1.3 Review of risk ranking results

A technical expert or engineer who has been involved in the risk ranking process should present the analysis to the panel.

As a minimum, the following questions should be addressed in the panel discussion:

- What are the impacts of assumptions in the failure potential and consequence assessment on the risk ranking results?
- What are the impacts of uncertainties in the failure potential and consequence assessment on the risk ranking results?
- How is defence-in-depth maintained?
- Is consideration of strategies other than inspection appropriate?

5.2 Panel decision

As described above, the panel should make a decision, based on the review of the analyses, on whether the initial scope of analysis and classification of the segment can be approved or not.

The panel members should have received the complete documentation of all piping segments and all the additional information required for decision-making. However, the panel might identify specific needs for additional background information or analyses. In such cases, the decision should be postponed until the required additional input is obtained. The project leader is responsible for collecting the additional information and distributing it to the panel.

The decisions taken by the expert panel should be reached by consensus. Consensus means that unanimous acceptance or agreement is obtained among the panel members. If a unanimous decision cannot be reached, the panel should identify the reasons behind the differing opinions. Whenever possible, the panel should take appropriate measures (for instance, obtain additional information, request additional analyses, etc.) to facilitate a convergence of the differing views.

Rules should be agreed upon at the beginning of the expert panel process to allow a conclusive decision to be reached in the eventuality that a unanimous decision cannot be achieved even after additional information has been gathered.

For instance, it could be considered sufficient to have a two-thirds majority of the members for decision-making. The panel leader should allow enough time between sessions for deliberation. If a sufficient majority still cannot be reached, the chairperson could take the final decision, for instance by shifting a segment or a structural element to a higher risk category.

A complete record of the proceedings and of the final decisions should be kept, documenting in particular those instances where a consensus was not reached and the reasons why. Every member of the panel should have the right to have an opinion officially recorded.

6. Documentation of the expert panel

For the acceptance of the RI-ISI, it is essential that the justifications of the risk-informed selection to be included in or excluded from the ISI programme are documented transparently so that the bases for decisions can be traced and audited. It is important to record the panel decisions in sufficient detail so that problematic issues may be easily understood at a later stage by others who were not present during the panel sessions.

Therefore, the documentation of the expert panel should include, as a minimum, the following information:

- description of the panel participants (for each, name and a summary of the relevant expertise);
- summary of the final classification of the elements/segments;
- justifications for changes;
- relevant discussions and conflicting opinions;
- additional information supplied to the panel;
- supporting documentation and calculations.

Any other document concerning issues related to the analyses and risk ranking prepared by any one of the panel members should also be annexed to the report.

REFERENCES

[1] *European Framework Document for Risk-Informed In-Service Inspection, Issue 2*, ENIQ Report No. 23, EUR 21581 EN, 2005.

[2] NRWG*, Report of the regulatory experience of risk-informed in-service inspection of nuclear power plant components and common views*, EUR 21320 EN, 2004.

[3] ASME, *Code Case N-577-1: Risk-Informed Requirements for Class 1, 2 or 3 Piping, Method A, Section XI, Division 1*, 2000.

[4] Pulkkinen, U. and Simola K. *An expert panel approach to support risk-informed decision making*, STUK-YTO-TR 170, 2000.

[5] Westinghouse Owners Group, *Application of Risk-Informed Methods to Piping In-service Inspection*, Topical Report no. WCAP-14572, Rev. 1-NP-A, 1999.

[6] Westinghouse Owners Group, *Clarification of Application of Risk-Informed Methods to Piping In-service Inspection*, Topical Report no. WCAP-14572, Rev. 1-NP-A, Supplement 2, 2006.

[7] *US NRC Regulatory Guide 1.178: An Approach for Plant-Specific Risk-Informed Decision-Making In-Service Inspection of Piping*, Rev. 1, 2003.

[8] *IAEA Safety Reports Series no. 46: Assessment of Defence In-Depth for Nuclear Power Plants*, 2005.

[9] *ENIQ TGR Discussion Document on the Role of In-Service Inspection within the Philosophy of Defence-in-Depth*, ENIQ Report no. 29, EUR 22230 EN, 2007.

[10] *ENIQ Recommended Practice 9: Verification and Validation of Structural Reliability Models and associated Software to be used in Risk-Informed In-Service Inspection Programmes, Issue 2*, ENIQ Report No. 52, NUGENIA Association, 2017.

APPENDICES

Appendix 1: Example of an Expert Panel Worksheet

Expert Panel Worksheet

SEGMENT: XX-XXX-XXX

System and Pipe Segment Identification

System Name: Reactor coolant system

Segment Description: Loop 1 (hot leg), main coolant piping (29”) from RPV RCPCRV -01 to SG RCPCSG-01

Drawing Number: 3007772 C3

Direct Consequence Description

<u>Without Operator Action:</u>

Initiator: None [RCNone]

Mitigating System: None [RCNone]

Initiator + Mitigating: Large, medium or small LOCA and loss of LPR and HPR to hot leg loop 1 and RHR train from hot leg loop 1 [RC001]

<u>With Operator Action:</u>

Initiator: None [RCNone]

Mitigating System: None [RCNone]

Initiator + Mitigating: No change [RCSame]

<u>Containment Performance Impact:</u>

Indirect Consequence Description

<u>Without operator action:</u>

Initiator: None

Mitigating system: None

Initiator + Mitigating: None

<u>With operator action:</u>

No change

Comments

LPI/HPI to hot legs is normally not used. Transfer to hot legs takes place after approximately 5 hours in recirculation mode.

Failure Probability

Failure Mechanism: Thermal Fatigue

Comments: Large LOCA = 60 000 l/min, Medium LOCA = 6 600 l/min, Small LOCA = 300 l/min

Test Interval: Continuous

Failure Probability (Basis for Failure Probability, see failure probability)

Small Leak Case		Large Leak Cases		
W/O ISI	With ISI	Probability Type	W/O ISI	With ISI
4.62E-07	4.06E-12	Large LOCA	1.48E-08	7.07E-11
		Medium LOCA	1.48E-08	7.07E-11
		Small LOCA	1.48E-08	7.07E-11

Conditional Treatment, CDF and LERF Importance Measure Calculations

Treatment: LLOCA	**Without OA**	**With OA**
Conditional CDF due to Pressure Boundary Failure	4.05E-02	4.05E-02
Conditional LERF due to Pressure Boundary Failure	2.44E-03	2.44E-03

Treatment: MLOCA	**Without OA**	**With OA**
Conditional CDF due to Pressure Boundary Failure	1.60E-02	1.60E-02
Conditional LERF due to Pressure Boundary Failure	4.87E-04	4.87E-04

Treatment: SLOCA	**Without OA**	**With OA**
Conditional CDF due to Pressure Boundary Failure	4.74E-03	4.74E-03
Conditional LERF due to Pressure Boundary Failure	1.98E-04	1.98E-04

CDF and IMPORTANCE MEASURE CALCULATIONS		**Without OA**	**With OA**
Total Segment Pressure Boundary Failure Core Damage Frequency (FP * CDFcond)		1.19E-10	1.19E-10
CDFpb	**RAW**	8.22E+03	2.28E+04
Importance Measure Values	**RRW**	1.000	1.000

LERF and IMPORTANCE MEASURE CALCULATIONS			Without OA	With OA
Total Segment Pressure Boundary Failure Large Early Release Frequency (FP * LERFcond)			6.07E-12	6.07E-12
Importance Measure Values	**LERFpb**	**RAW**	2.83E+03	4.47E+04
		RRW	1.000	1.000

Risk Category: ☐ HIGH SAFETY SIGNIFICANT ☐ LOW SAFETY SIGNIFICANT

ACRONYMS

CDF:	Core Damage Frequency
COF:	Consequence of Failure
ENIQ:	European Network for Inspection and Qualification
HPI:	High Pressure Injection
ISI:	In-Service Inspection
JRC:	Joint Research Centre
LERF:	Large Early Release Frequency
LLOCA:	Large Loss of Coolant Accident
LOCA:	Loss of Coolant Accident
LPI:	Low Pressure Injection
MLOCA:	Medium Loss of Coolant Accident
NDE:	Non-Destructive Evaluation
NPP:	Nuclear Power Plant
NRWG:	Nuclear Regulators Working Group
OA:	Operator Action
POF:	Probability of Failure
PRA	Probabilistic Risk Assessment
PSA:	Probabilistic Safety Assessment
RAW:	Risk Achievement Worth
RHR:	Residual Heat Removal
RI-ISI:	Risk Informed In-Service Inspection
RPV:	Reactor Pressure Vessel
RRW:	Risk Reduction Worth
SLOCA:	Small Loss of Coolant Accident

Contributors to Drafting and Editing of Issue 2

Jorma Ahonen	ex-Fortum	Finland
Otso Cronvall	Technical Research Centre of Finland Ltd. (VTT)	Finland
Anders Lejon	Ringhals AB (Vattenfall AB)	Sweden
Kaisa Simola	European Commission – Joint Research Centre	European Commission
Oliver Martin	European Commission – Joint Research Centre	European Commission

Contributors to Drafting and Editing of Issue 1

Carlos Cueto-Felgueroso	Tecnatom S.A.	Spain
Luca Gandossi	European Commission – Joint Research Centre	European Commission
Anders Lejon	Ringhals AB (Vattenfall AB)	Sweden
Anna Mengolini	European Commission – Joint Research Centre	European Commission
Kaisa Simola	Technical Research Centre of Finland Ltd. (VTT)	Finland

ABOUT NUGENIA and ENIQ

NUGENIA is an international non-profit association under Belgian law established in 2011. Dedicated to the research and development of nuclear fission technologies, with a focus on Generation II & III nuclear plants, it provides scientific and technical basis to the community by initiating and supporting international R&D projects and programmes. The Association gathers member organisations from industry, research, safety organisations and academia.

The activities of NUGENIA cover plant safety & risk assessment, severe accidents, reactor operation, integrity assessment and ageing of systems, structures & components, development of fuel, waste & spent fuel management & reactor decommissioning, innovative light water reactor design & technologies, harmonisation and in-service inspection & their qualification.

The European Network for Inspection and Qualification (ENIQ) is a utility driven network working mainly in the areas of qualification of non-destructive testing (NDT) systems and risk-informed in-service inspection for nuclear power plants. Since its establishment in 1992 ENIQ has issued nearly 50 documents. Among them are the "European Methodology for Qualification of Non-Destructive Testing" and the "European Framework Document for Risk-Informed In-Service Inspection". ENIQ is recognised as one of the main contributors to today's global qualification guidelines for in-service inspection. ENIQ became Technical Area 8 of NUGENIA in 2012.

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