D R A F T

ILRT Type A Test Interval Optimization Methodology
Expert Elicitation Process

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1.0 INTRODUCTION

This report section provides an overview of the expert elicitation process [11] [12] and its application to the solicitation of expert opinion for the ILRT Type A Testing Interval Optimization Project. The process is based on the "Recommendations for Probabilistic Seismic Hazard Analysis: Guidance on Uncertainty and Use of Experts" (NUREG/CR-6372) and "Branch Technical Position on the Use of Expert Elicitation in the High-Level Radioactive Waste Program" (NUREG-1563).

The goal of the expert elicitation process is to obtain frequency and magnitude estimates for significant containment leakage that would not be detected by other inspections, tests, or alternative means.

There are five functional requirements of the expert elicitation process. These five requirements are:

- Requirement 1: Identification of the expert judgment process
- Requirement 2: Identification and selection of experts
- Requirement 3: Determination of the need for outside expert judgment
- Requirement 4: Utilization of either the TI or TFI process
- Requirement 5: Responsibility for the expert judgment

The five functional requirements of the expert judgment process identify the issue, identify the experts, outline the process used in the solicitation of their opinion and specify the use of their judgment in the ILRT Type A Testing Interval Optimization process. Each of the five functional requirements is discussed in detail in the following report Sections 3 through 6.

2.0 EXPERT ELICITATION SUMMARY

The goal of the expert elicitation process is to determine of the probability and magnitude of significant containment leakage events. The probability and magnitude of significant containment leakage events will be used in the determination of the risk impact associated with the ILRT Type A Testing Interval Optimization.

The expert elicitation process inputs are derived from an ILRT events database, consisting of information collected via NEI surveys, LER's, and NRC reports (NUREG-1493). The expert elicitation process uses a facilitated expert meeting which considers data, containment design, maintenance, and testing. The process was consistent with the approach described in the references 11 and 12.

Using the process outlined in references 11 and 12, the ILRT Type A Testing Interval Optimization has been assigned a Degree of Importance of Degree II and a Level of Complexity of C. These assignments indicate that a Technical Integrator (TI) process is sufficient for the expert panel process. In the case of a Level of Complexity of Level C, a facilitated expert panel meeting(s) are required to solicit the opinions of the technical community. Through a nomination process, experts are selected. Each of the experts has significant expertise in areas related to containment structures and/or containment testing.

The technical integrator facilitates the expert panel meeting in which the problem statement is provided. The problem statement includes an ILRT events

database and potential approaches (in addition to expert elicitation) and their results. The expert panel then provides their individual judgments. The technical integrator integrates the individual results to obtain the community distribution. The community distribution is provided to the expert panel to ensure agreement with the final community distribution. The results are then used in the risk impact assessment.

3.0 REQUIREMENT 1: IDENTIFICATION OF THE EXPERT JUDGMENT PROCESS

There are several forms the expert elicitation process can take depending on the complexity of the issue, the resources available to address the issue and other factors. This requirement provides the outline of the expert judgment process based on these factors. Three topics are discussed in the following report sub-sections that assist in the determination of the details of the expert elicitation process. These topics are:

- Defining the specific issue
- Determining the degree of importance and degree of complexity of the issue
- Deciding whether to use a Technical Integrator (TI) or Technical Facilitator / Integrator (TFI)

3.1 Defining the Specific Issue

The technical issue for which expert judgment is to be applied needs to be defined clearly and narrowly enough that it is possible to identify the relevant expertise and to use it correctly. Defining the technical issue requires:

- Clearly identify the issue such that one or more technical experts can be selected
- Define how the issue fits into the PRA
- Allow the experts to redefine the issue that allows the experts to provide input

The issue associated with the optimization of ILRT Type A Testing interval has been clearly defined in the ILRT Problem Statement. Therefore, this requirement is assumed satisfied.

3.2 Determining the Degree of Importance and Level of Complexity

In the following report sub-sections, the process used to determine the degree of importance and level of complexity of the ILRT testing optimization are discussed.

3.2.1 Determining the Degree of Importance

To assist the experts in the expert elicitation process as well as to define the form of the process, it is necessary to classify the technical issue into on of three degrees. These three degrees are defined as Degree I, Degree II and Degree III are intended for use in the determination of the expert elicitation process to use. The determination of the degree of importance is based on technical criteria only. The degree characterizations are as follows:

Degree I: Non-controversial issue, and/or not significant to the overall results of the analysis.

Degree II: Issue has significant uncertainty or diversity of opinion; controversial; moderately significant to the overall result of the analysis; and/or moderately complex.

Degree III: Highly contentious issue; very significant to the overall result of the analysis; and/or highly complex.

In assigning the degree of importance of an issue, there is some judgment necessary since the degree categories represent a course partition of the range of potential degrees.

In the case of the optimization of the ILRT testing intervals, Degree II is selected. Degree I is not chosen since the results of the expert elicitation process are indeed significant to the results of the analysis. In fact, a case could be made that the results of the expert elicitation process are very significant to the results of the analysis necessitating an assignment of a Degree III. However, the sensitivity of the results of the analysis to the expert elicitation process are mitigated by the availability of significant amounts of data. This data, although not complete enough to perform the analysis, does provides information upon which the experts can base their judgments. In addition, experts will be chosen for the knowledge of the mechanisms that can result in significant containment leakage events and therefore provide additional assurance that their judgment is only moderately significant to the overall result. Lastly, the issue of testing extension and specifically ILRT Type A test optimization is not considered highly complex or is the issue considered highly contentious. Therefore, the assignment of Degree of Importance of Degree II is appropriate.

3.2.2 Determining the Level of Complexity

Once the degree of the issue has been selected, it is necessary to select the Level of Complexity. There are four levels of complexity defined as Level A, B, C or D. A key input to the assignment of the level of complexity is the degree of importance. The degree of importance captures how complex the issue is and

how controversial the issue is, but alone is not sufficient for the choice of the level of complexity.

In summary, levels of complexity of A, B or C are characterized by the Technical Integrator (TI) approach. In the technical integrator approach, the technical integrator plays the role of "evaluator". Input to the technical integrator varies depending of the level of complexity assigned to the issue from basing judgments on his/her own experience and literature to obtaining input through the communication with other experts.

With an issue of a level of complexity of A, the technical integrator's role is to evaluate and weight models based on literature review and experience. With a level of complexity of A, the technical integrator would estimate the community distribution.

With an issue assigned a level of complexity of B, the technical integrator's role is to conduct a literature review and contact those individuals who have developed interpretations or who have particular relevant experience and develop the community distribution.

With an issue assigned a level of complexity of C, the technical integrator's role is to gain additional insight by bringing together experts and focusing their interactions. In the sessions with the technical experts, the experts are given an opportunity to explain their hypotheses, data and basis. Proponents or advocates of particular technical positions are asked to describe and defend their positions to the other experts. As with levels A and B, the technical integrator develops the community distribution.

Levels of complexity of D are characterized by the Technical Facilitator / Integrator (TFI) approach. In level D, a group of expert "evaluators" are identified and their judgments elicited. The technical facilitator / integrator is responsible

for identifying the roles of the proponents and evaluators and for ensuring their interactions provide an opportunity for focused discussion challenge. In the level D analysis, resources permit and the situation dictates multiple evaluators and hence a technical facilitator integrator takes responsibility for the aggregated product. The TFI organizes and manages interactions among the proponents and evaluators, identifies and mitigates problems that potentially develop during the course of the study (e.g., an expert who is unwilling or unable to play the evaluator role), and ensures that the evaluators' judgments are properly represented and documented.

Regardless of the level of the study, the goal in the various approaches is the same: to provide the community distribution, which is defined as a representation of the informed technical community's view of the important components and issues and, finally, the result. Also, regardless of the level of the study a peer review is performed to review the process and substance of the study.

The level of complexity of the ILRT Type A Testing Optimization is chosen as Level C. The factors affecting this assignment include but are not limited to regulatory issues, public and technical community perception and resource constraints.

A level of complexity of D is not chosen since empirical data is available that provides an indication of the range of the result of the final analysis. In addition, the phenomena related to significant containment leakage events are generally understood. In addition, the conceptual models that are involved in the optimization of the ILRT testing interval and potential significant containment leakage events are relatively limited. Given the required resources and the above discussion a complexity level of D is not chosen.

Assignment of a level of complexity of A is rejected since it does not significantly involve the technical community in the development of the analysis. Given the

regulatory nature of the analysis, it is important to involve the technical community is the development of the analysis.

While a level of complexity of B does involve the technical community, it does not provide a forum for the exchange of alternate conceptual models. Therefore, a level of complexity of B is also not chosen.

A level of complexity of C provides the optimum use of resources since it allows for the technical community to participate in the development of the analysis results and the proposal of alternate conceptual models while limiting the resources associated with the solicitation of the expert judgment.

4.0 REQUIREMENT 2: IDENTIFICATION AND SELECTION OF EXPERTS

One or more evaluators (individuals capable of evaluating the relative credibility of multiple alternative hypotheses to explain the available information) need to be identified. In addition, other experts such as proponents (experts who advocate a particular hypotheses or technical position) as well as resource experts (technical experts with knowledge of a particular area of importance to issue) will also be identified and nominated for participation.

Experts will be nominated to the panel by the ILRT Optimization project manger. Experts should have extensive experience in containment structure testing and/or maintenance and one or more of the following additional areas:

- Performing ILRTs or interpreting/characterizing ILRT test results
- Statistics / Probability Theory / Probabilistic Risk Assessment
- Failure mechanics

5.0 REQUIREMENT 3: DETERMINATION OF THE NEED FOR OUTSIDE EXPERT JUDGMENT

In the case of the ILRT Type A Testing Optimization, the decision to seek outside (i.e., expert elicitation process) expert judgment has already been made as opposed to using members of the ILRT Optimization Project Team. As previously mentioned, the regulatory nature of the analysis requires that technical community be involved in the development of the analysis. The selection of the participant will be in accordance with Section 3 of this report.

6.0 REQUIREMENT 4: UTILIZE THE TI OR TFI PROCESS

This requirement is used to determine whether the TI process or the TFI process will be used and to specify the requirements of the process chosen. Since a Level C analysis has been chosen, and there is no other basis to decide differently, then the Technical Integrator (TI) process is to be used. As described earlier, the TFI process is applied to only Level D analysis. The TI process includes the following significant elements:

- Identifying available information and analysis and information retrieval methods;
- Accumulating information relevant to the issue;
- Performing the analysis and the data diagnostics;
- Developing the community distribution

6.1 Identifying available information and analysis and information retrieval methods

The TI is responsible for assembling all relevant technical databases and other information important to the analysis problem at hand, including any data that have been gathered specifically for the analysis. The TI also identifies technical

researchers and proponents that he/she intends to contact during the course of the study to gain insight into their positions and interpretations (in a Level C analysis, this means identifying those individuals that he/she intends to assemble for discussion and interactions). In addition, the TI defines the procedures and methods that will be followed in conducting the analysis.

6.2 Accumulating information relevant to the issue, performing the analysis and developing the community distribution

The TI is responsible for understanding the entire spectrum of technical information that is brought to bear on the issue, including written literature, recent works by other experts, and other technical resources. (In advanced technical work, it is always the responsibility of the investigator to learn about the most recent advances in the field, often by direct contact with other experts through personal correspondence, personal meetings, telephone conversations, and so on.) In a level C study, members of the technical community are brought together and the TI orchestrates interactions and possibly, workshops to focus the discussions on the technical issues of most significance to the analysis, and to be sure that he/she is aware of the diversity in interpretations for these key issues. The TI uses all this information to develop a community distribution of the range of uncertainty for the particular issue being addressed.

6.3 Performing the Peer Review

The TI needs to use the peer review team as a sounding board to learn whether the full range of technical views have been identified and assimilated into the project. The ILRT Optimization Project Team will serve as the peer reviewers for the expert panel. In addition, the expert panel will be free to consult other resources as they see necessary.

7.0 REQUIREMENT 5: RESPONSIBILITY FOR THE EXPERT JUDGMENT

A basic principle is that it is an absolute requirement that there must be a clear definition of the ownership of expert judgments, opinions, and/or interpretations, both as expressed by the individual experts and as integrated together.

In the case of the ILRT Type A Testing Optimization, the owner of the process and the results is the technical integrator. The individual expert will own their individual judgments and interpretations.

Degrees of Issues and Levels of Study

Issue Degree	Decision Factors	Study Level
Degree I Non controversial; and/or insignificant to the result		Level A TI evaluates/weights models based on literature review and experience; estimates community distribution
Degree II Significant uncertainty and diversity; controversial; and complex	Regulatory concern	Level B TI interacts with proponents and resource experts to identify issues and interpretations; estimates the community distribution
Degree III Highly contentious; significant to result and highly complex	Resources available	Level C TI brings together proponents and resource experts for debate and interaction; TI focus debate and evaluates alternative interpretations; estimate community distribution
	Public perception	Level D TFI organizes panel of experts to interpret and evaluate; focus discussions; avoids inappropriate behavior on the part of the evaluators; draws picture of evaluators' estimate of the community's composite distribution; has ultimate responsibility for project