I. Reactor Regulation

1. SRP and 10 CFR 50

(2) SRP 15.0.2 REVIEW OF TRANSIENT AND ACCIDENT ANALYSIS METHODS

Do you have any experiences having reviewed topical reports or design certifications in which SRP 15.0.2 was applied?

Answer:

Yes. As an example the use of vendor specific advanced computer code methods for application to an new reactor design was reviewed concurrent with the design certification application using the SRP Section 15.0.2 review guidance in the areas of LOCA, Transients, Stability, and ATWS.

To what extent do you review the User manual?

Answer:

SRP 15.0.2 directs the NRC technical review staff to review the complete code documentation including the User Manual (UM). The staff reviews the contents of the UM to ensure that the code inputs and code options are consistent with the methodology as described in the licensing topical reports.

The UM and licensee/applicant/vendor procedures used to execute the code are reviewed by the staff to ensure that the code is run consistent with the method description approved by the staff.

Do you check if the manual covers the required items, or review the validity of the items?

Answer:

The staff reviews the validity of the items. In many cases codes have several input options that dictate the way the code is run or which models are exercised in the calculation. The staff reviews the UM to ensure that default options are established consistent with the staff's approval of the methodology.

As an example, a code may include several correlations for boiling heat transfer but the staff has only approved one of these correlations. The staff reviews the UM to ensure that the approved correlation is set as the default option in UM or that the UM directs the analyst to select the NRC-approved correlation when performing a licensing analysis.

In certain cases a multi-purpose code will be reviewed by the staff. For multi-purpose codes, different options are preferred based on the type of analysis to be performed. The staff confirms that options are available in the UM description of the code inputs to execute the methodology described in the licensing topical report.

If the later is true, you may need lots of time. How do you review the user manual?

Answer:

The staff reviewing the UM has flexibility in determining the best approach for reviewing the UM. Generally, the staff will establish those aspects of the methodology that are: (1) controlled by user inputs to the code, and (2) important to accurate and acceptable execution of the analysis. The staff will examine those portions of the UM to ensure that the guidance in the UM is appropriate.

As an example, boiling water reactor time domain stability analyses are sensitive to the selection of appropriate time integration methods, time step control algorithms, and node size. When reviewing the UM for a code that is applied to stability analyses, the staff confirms that the code user has sufficient flexibility to specify appropriate combinations of input selections and that the UM or analysis procedures direct the analyst to select appropriate code inputs to conduct the specific analysis.

And we would like to ask the same question about the quality assurance program. How do you review the quality assurance program concretely or actually?

Answer:

SRP 15.0.2 directs the NRC review staff to conduct a review of the code quality assurance program against the criteria of 10 CFR Appendix B. The SRP specifies acceptance criteria that, as a minimum, the program must address with respect to design control, document control, software configuration control and testing, and corrective actions. While the SRP allows flexibility for the staff reviewer to determine the review approach, it provides the option for the reviewer to conduct an audit. The audit allows the staff to review all licensee, applicant, or vendor procedures addressing the aforementioned program aspects. The staff reviews these procedures to ensure that they address the minimum requirements specified in the SRP. The staff then evaluates the acceptability of these procedures by reviewing specific implementations of these procedures.

(4) High Level of Probability

(for comparing an analysis result with safety criteria such as 2200 F)

10CFR 50.46, "(a)(1)(i) … This uncertainty must be accounted for, so that, when the calcualted ECCS cooling performance is compared to the criteria set forth in paragraph (b) of this section, there is a high level of probability that the criteria would not be exceeded…"

How much is it supposed to be as a high level of probability?

Answer:

The term "high level of probability" is associated with evaluations that the computed figure of merit not exceed the regulatory acceptance criterion, such as 2200 °F cladding temperature in LWRs for the case of LOCA analyses. Using the Best Estimate analysis with an estimate of the calculated uncertainty, an estimate of the probability density function (not required for non-parametric statistical approaches) for the figure of merit is computed. There are two approaches to the statement "the criteria are met with high probability" that the NRC has accepted. The differences in approach are related to the **amount of data** used in constructing the probability density function.

(a) The true statistical distribution for the figure of merit is unknown. Thus, the choice of a statistical distribution is verified using applicable engineering data and information. The statistical parameters appropriate for that distribution are estimated using available data and results of engineering analysis. These estimated values are assumed to be the true values of the statistical parameters of the distribution. Based on this probability density function, an upper one-sided probability limit is computed of the 95% level. Thus, high probability is 0.95.

(b) If the assumption that the estimated statistical parameters are the true values cannot be supported by the data, other techniques that account for the uncertainty in the statistical parameters in a more detailed manner need to be used. One acceptable approach is to compute the level of confidence in the estimate of the 95th percentile. An acceptable confidence level is 95%. This leads to a 95% assurance that the upper one-sided computed probability limit is 95%. Thus, high probability is 0.95 with 95% confidence.

II. <u>Topical Report and Consensus Standards</u>

1. Safety Evaluation Reports (SER)

(2) Modification of computer code

In the SER for the topical report BAW-10228P, "SCIENCE", we can find the description as following.

Consequently, any modification to the SCIENCE code package that meet the listed criteria in Tables 5-1 and 5-2 of this submittal will validate the modifications made to the SCIENCE code package, If the changes to the SCIENCE code package meet the criteria, FCF will internally document the changes to the code package and the associated results without notifying the NRC since there were no changes to the uncertainties or their application.

Can they make fundamental modification, ex., change of basic equation and change of neutron cross section data, without NRC review, if the changes meet the criteria?

Answer:

10 CFR 50.59 is the regulation dictating what changes can and cannot be made without prior NRC approval. 10 CFR50.59 c.2 states:

> *A licensee shall obtain a license amendment pursuant to § 50.90 prior to implementing a proposed change, test, or experiment if the change, test, or experiment would:*
> *…*
> *(viii) Result in a departure from a method of evaluation described in the FSAR (as updated) used in establishing the design bases or in the safety analyses.*

In their Safety Evaluation, the NRC staff may clarify what changes to that specific topical report the staff considers a departure from a method of evaluation (those changes would need to be submitted for review and approval) and what changes they would not consider a departure from a method of evaluation (those changes may not need to be submitted for review and approval). This is done to help clarify 10 CFR 50.59 c.2.viii as it applies to the topical report in question.

However, since not all possible changes can be detailed in the Safety Evaluation, the licensees use the 10 CFR 50.59 screening process to determine if a detailed NRC review and approval is required. Using the NRC endorsed process, the licensee evaluates the proposed change to the criterion of 10 CFR 50.59 to determine if the change needs to be submitted to the NRC.

Specifically with reference to computer codes, the NRR staff considers the method of evaluation as the collection of models, solution technique, and its implementation. The staff considers a change in any element of these three areas as a departure from a method of evaluation. The change of a basic equation would be a departure from the method of evaluation and that change must be evaluated against the criteria of 50.59. Depending on the results of that evaluation, the change may require submittal to the NRC.

Changes to a code which are not methodology changes may not be required to be submitted (such as changing code input or output interfaces). The licensee would make the determination using their 50.59 process as well as any guidance in the relevant safety evaluation.

To address the examples provided in the question, the staff may clarify 10 CFR 50.59 to precisely state its position. For example, changing the neutron cross-section libraries may be done so long as the analysis results are conservative or essentially the same. In the example provided regarding SCIENCE the staff provides clarification of the phrase “essentially the same” by specifying a threshold (Tables 5-1 and 5-2) where “there were no changes to the uncertainties or their application.” In essence, the staff is stating that the results would be considered “essentially the same” for the purpose of 50.59 screening if modifications were made but the criteria of Tables 5-1 and 5-2 were met.

2. Approval and Management of Topical Report

(2) How many staff are allocated for the review of topical reports according to the kind of technologies (for example, the newly developed fuel or equipment)?

Answer:

NRR management budgets its technical reviewer resources on a annual basis to work on topical report reviews. The amount of budgeted resources allocated to this work is based on industry submittal projections and other regulatory work load estimates.

In order to plan a specific topical report review, NRR relies on the experience of its technical review staff to determine how much staff effort (number of total staff hours) is necessary to complete the review. Topical reports may require multiple technical reviewers over a variety of disciplines. In that case, the topical report is split up into sections and a specific NRR branch would be responsible for the review of that specific section of the topical report as opposed to the entire report.