The Need for Additional Guidance and Criteria for Applying a Graded Approach to HFE Activities

Human factors engineering (HFE) activities play an important role in ensuring safety and reliability of nuclear power plants. In order to ensure that all required HFE activities are performed at an appropriate level of rigor, and to minimize unnecessary work and focus resources where they are needed to meet safety and reliability goals, a graded approach should be used when performing HFE activities as part of a design effort. Application of a graded approach also is important for regulatory review of both new designs and modifications, again helping to ensure that resources are directed toward areas where they are needed to ensure safety.

Chapter 18 of NUREG 0800 is the primary source of guidance for NRC reviewers and also acts as a guide for designers to ensure that their HFE activities are appropriate and complete in terms of meeting regulatory requirements and expectations. Chapter 18 (Rev. 1, Feb. 2004) in Section I.B, Graded Approach to Review, points out that the NRC staff's evaluation of an applicant's HFE design needs to reflect the specific circumstances of the individual application. It points out two aspects of this:

(1) The need to adjust the review depending on whether it is for a new design or a modification. Chapter 18 Section I.B states that "…the review of the HFE aspects of a new plant will entail a comprehensive, detailed evaluation…while the review of individual modifications to existing designs may be less extensive."

(2) The need for taking a risk-informed approach. Chapter 18 states that "…risk importance is taken into account when deciding which particular items to review and the depth of review necessary."

Section I.B of Chapter 18 goes on to state that "This chapter provides detailed examples of graded review criteria for several reviews." It specifically identifies human-system interface (HSI) modifications (Section II.B) and modifications affecting risk-important human actions (Section II.C) as areas where guidance is provided.

Although this implies that Chapter 18 provides detailed guidance for use of graded HFE approaches, it is important to recognize two key limitations of the Chapter 18 guidance:

- ***Chapter 18 provides no guidance for use of graded approaches in the design of a new plant*** – the only grading or tailoring of the staff's review that is discussed is for modifications to HSIs and modifications to risk-important human actions
- ***The guidance for review of HSI modifications does not address grading based on risk or complexity*** – the guidance primarily addresses the need to tailor the review using a reduced set of review items and criteria appropriate for a modification to an existing design as opposed to a complete new design; it does not address grading the review of a modification based on the level of risk or complexity associated with the modification

Chapter 18 of NUREG-0800 references NUREG-0711 for detailed review guidance. The guidance given in NUREG-0711 reflects the same limitations noted above for Chapter 18. In Section 1.4, Graded Approach to Review, NUREG-0711 states that "In its complete form, the review process provides a comprehensive, detailed evaluation. This approach should be used for the review of a new plant design or an extensive control room modernization." The guidance given for each element of the HFE review suggests how to tailor the review for a modification versus review of a complete new design. It does not provide guidance on grading the review based on risk or complexity of the modification.

NUREG-1764 is also referenced by Chapter 18 of NUREG-0800. NUREG-1764 provides guidance for the review of modifications affecting risk-important human actions, focusing on changes to operator

actions that are credited by the licensee for safety. It does provide guidance on grading the review, based primarily on risk associated with the modification and the associated human actions. However, the guidance is narrowly focused on modifications to risk-important human actions. It does not address broader aspects of plant modifications or control room modernization, and it does not address new plant designs.