September 12, 1997

FOR: The Commissioners

FROM: L. Joseph Callan /s/
Executive Director for Operations

SUBJECT: ELEVATION OF THE CORE DAMAGE FREQUENCY OBJECTIVE TO A FUNDAMENTAL COMMISSION SAFETY GOAL

PURPOSE:

To respond to Chairman Jackson's July 2, 1997, memorandum, providing the staff's views and recommendations on elevating the subsidiary objective of core damage frequency to a fundamental safety goal.

BACKGROUND:

The Commission's Safety Goal Policy Statement, issued in 1986, expressed "the Commission's views on the level of risks to public health and safety that the industry should strive for in its nuclear power plants." Two qualitative goals were established:

- Individual members of the public should be provided a level of protection from the consequences of nuclear power plant operation such that individuals bear no significant additional risk to life and health.

- Societal risks to life and health from nuclear power plant operation should be comparable to or less than the risks of generating electricity by viable competing technologies and should not be a significant addition to other societal risks.

To quantify these goals, two quantitative health objectives (QHOs) were also established:

- The risk to an average individual in the vicinity of a nuclear power plant of prompt fatalities that might result from reactor accidents should not exceed one-tenth of one percent (0.1 percent) of the sum of prompt fatality risks resulting from other accidents to which members of the U.S. population are generally exposed.

- The risk to the population in the area near a nuclear power plant of cancer fatalities that might result from nuclear power plant operation should not exceed one-tenth of one percent (0.1 percent) of the sum of cancer fatality risks resulting from all other causes.

Several other key points regarding the policy statement include:

- The policy statement noted that "the Commission intends to continue to pursue a regulatory program that has as its objective providing reasonable assurance...that a severe core damage accident will not occur at a U.S. nuclear power plant." This intention was not, however, explicitly defined in the policy statement as a qualitative goal, nor was a corresponding quantitative goal for core damage frequency (CDF) defined. Commissioner Bernthal, in his separate views attached to the Safety Goal Policy Statement, suggested such a CDF goal be included in the policy statement and implied 10^{-4}/RY as the goal for the current population of plants. Subsequent to publication of the policy statement, a subsidiary CDF objective of 1×10^{-4} per reactor year for accident prevention was proposed by the ACRS in a May 13, 1987, letter to Chairman Zech as one element in a hierarchical structure for safety goal implementation. The Commission, in a November 6, 1987, SRM requested the staff to develop a safety goal implementation plan that included the elements in the May 13, 1987 ACRS letter. The staff proposed such a plan in SECY-89-102 and the Commission approved the use of a 10^{-4}/RY CDF as a subsidiary benchmark for accident prevention in their June 15, 1990, SRM.

- The original intended use of the safety goals, as indicated in the policy statement and the Commission's June 15, 1990, SRM, was for examination of regulations and other generic matters, and not for making plant-specific decisions. In this context, the staff developed and the Commission endorsed criteria based on the Safety Goal subsidiary objectives (including the 1×10^{-4} per reactor year CDF objective) to screen potential backfits for their risk significance. This process and the criteria are described in the Regulatory Analysis Guidelines (NUREG/BR-0058, Rev 2).

The safety goals are not substitutes for the NRC's regulations or the defense-in-depth concept, nor are they a statement of adequate protection. As stated in the June 15, 1990, SRM, the safety goals are intended to define "how safe is safe enough."

The policy statement proposed for further study a "general performance guideline" in terms of a large release of radioactive material with an associated frequency of

1×10^{-6} per reactor year. As discussed in SECY-93-138, the staff attempted to define a guideline using this frequency, but was unable to do this without making the guideline significantly more restrictive than the QHOs. Work on defining a large release of radioactive material with this associated frequency was terminated in 1993.

- The policy statement indicated that mean values should be used for comparison with the QHOs, and that "quantitative techniques used for regulatory decision making take into account the potential uncertainties that exist so that an estimate can be made on the confidence level to be ascribed to the quantitative results." In practice, staff uses of the safety goals have not included quantitative statements on associated confidence levels.

Recent activities in developing guidance for use of probabilistic risk analysis (PRA) in the regulatory process have raised several issues related to the Commission's safety goal policy:

- The staff recommended draft guidelines for plant-specific decision making that are derived from the Commission's current Safety Goals and the subsidiary objectives. The Commission approved publication of the draft guidelines (draft Regulatory Guides and Standard Review Plans) for public comment.

In DG-1061, the staff proposes to use two subsidiary objectives to the QHOs - core damage frequency (with a value of $1x10^{-4}$ per reactor year) and large early release frequency (LERF) (with a value of $1x10^{-5}$ per reactor year) for purposes of examining proposed changes to the current licensing bases (CLB) of individual plants.

- The Commission has instructed the staff to "develop a methodology for assessing changes in risk that uses statistical concepts and gives considerations to uncertainties."

In an August 15, 1996, letter (Attachment 1), the ACRS recommended that the $1x10^{-4}$ CDF subsidiary objective be raised to a fundamental safety goal. Further, in a June 17, 1997, letter (Attachment 2), the ACRS discussed the concept of defense-in-depth, as it relates to PRA and the safety goals, and recommended that a new policy statement be developed which "would provide more guidance on the extent and nature of defense-in-depth expected by the Commission."

Chairman Jackson's July 2, 1997, memorandum requested that the staff provide its views on the ACRS recommendation (in their August 15, 1996, letter) on elevating the CDF to a fundamental safety goal, including pros and cons and a proposed mechanism for stating CDF as a fundamental goal. The staff's views are provided below, along with discussion of other issues related to the safety goals.

In a July 23, 1997, letter (Attachment 3), NEI noted Chairman Jackson's July 2, 1997, memorandum, indicated that they believed "the safety goals should retain their current, direct focus on public health and safety," and provided several reasons for this belief.

DISCUSSION:

Chairman Jackson's July 2, 1997, memorandum, defines a number of pros and cons, with which the staff is in general agreement. In the staff's view, the key benefits of modifying the Safety Goal Policy Statement to include CDF as a fundamental goal include:

It clearly states the Commission's philosophical expectation regarding the prevention of core damage accidents, whether or not such accidents have serious public health consequences. Such a goal may be more clearly understood by the public than health goals, and is not as uncertain (e.g., it is not affected by the highly variable post-core-melt physical processes).

- The CDF, in conjunction with the QHOs, would provide the Commission's views on the relative importance of accident prevention versus mitigation. Such a statement could help to relate better the traditional defense-in-depth concept with PRA and the safety goals, thereby addressing the ACRS concern in this area.

The key detriments include:

- A CDF goal of 1×10^{-4} per reactor year would be more restrictive than the QHOs. Some plants, which are considered "safe enough" from a QHO perspective, would not be "safe enough" from a CDF perspective.

- Statement of a CDF goal without a corresponding containment performance goal (e.g., the DG-1061 LERF goal) will lead to placing a higher importance on preventive features than on mitigative features, and thus foregoing the Commission's traditional defense-in-depth policy. For example, a CDF goal set at 1×10^{-4} per reactor year, without a containment performance (LERF) goal, could be taken to imply little need for accident mitigative capabilities in plants if the QHOs are the only expressions of mitigation. That is, plants meeting the CDF goal could have poor containment capability and still meet the QHOs.

A further consideration to note in deciding whether to proceed to establish an additional safety goal is that, in practice, the staff is already using a 1×10^{-4} per reactor year CDF as a benchmark for accident prevention in both generic and plant-specific activities. As noted above, the CDF objective was used in the Regulatory Analysis Guidelines to develop criteria to screen potential backfits and is used in draft DG-1061 in the CLB-change review process. Elevation of this benchmark to a fundamental safety goal will have little practical impact on these activities.

Furthermore, initiation of staff work to make changes to the policy statement at this time would divert resources away from ongoing, high priority activities associated with risk-informed regulatory approaches.

As discussed above, the staff's recent risk-informed guidance development activities have identified three issues related to the policy statement - use of the goals in plant-specific regulatory activities, an appropriate definition for LERF as a subsidiary objective to

the safety goals, and the development of a methodology which gives consideration of uncertainties in risk-informed decision making. Regarding the first issue, the Commission tentatively approved, in a January 22, 1997, SRM, use of the Safety Goals in a plant specific manner, but requested that the legal ramifications be explored prior to finalizing the draft risk-

informed guidance documents. The staff believes that the impact of this decision, if final approval is obtained, is sufficiently large as to justify a modification of the policy statement. The second issue, relating to the definition of LERF, is an integral part of the decision making process described in DG-1061, and thus is being assessed as part of the public comment and guide finalization process. If the current LERF definition remains, or a similar definition is developed, it would likely require a modification to the policy statement to replace the general performance guideline proposed in the policy statement. The resolution of the third issue will be addressed as part of the finalization of the risk-informed regulatory guides; associated policy issues on this will be raised to the Commission and decisions reflected in the final version of DG-1061. The results of Commission decisions on this issue could also necessitate a change in the policy statement.

Should the staff undertake a modification of the policy statement to address these issues, it may be appropriate to address other issues. Concerns which have been noted since publication of the policy statement include:

- The second qualitative goal and its corresponding QHO address societal risk; however, the supplemental discussion in the Safety Goal Policy associated with this goal lead to a practice of calculating risk to an individual for comparison to the QHO, in lieu of risk to society. Concern with this approach was discussed in the separate views of Commissioner Bernthal, attached to the Safety Goal Policy Statement.

- The goals and QHOs are described in terms of health risks; no goal has been established with respect to potential land contamination and interdiction. As evidenced by the Chernobyl accident, this can be a major societal impact of accidents involving core damage and containment failure.

- The QHOs are expressed in terms of annual average frequencies. It may be appropriate to also provide a quantitative goal on risks during temporary plant configurations such as during PWR mid-loop operations, where risk can be substantially higher for a short period of time.

- The relationship between the safety goals and "adequate protection," as raised in the ACRS's April 11, 1997, letter, may merit further discussion in the policy statement.

- Further discussion of the relationship among the defense-in-depth concept, PRA, and the safety goals, as raised in the ACRS's June 17, 1997, letter, should be considered in the policy statement.

COORDINATION:

This paper has been coordinated with OGC, which has no legal objection.

The Office of the Chief Financial Officer has reviewed this Commission Paper for resource implications and has no objections.

RECOMMENDATIONS:

The present Safety Goal Policy Statement could benefit from revision to reflect Commission policies and decisions of the past several years, including recent decisions made in the context of developing risk-informed regulatory guidance. One potential change is the elevation of core damage frequency to a fundamental safety goal. The principal benefit to be achieved from this change would be to state more clearly that, as a matter of public policy, the Commission is acting to prevent core damage accidents. The change may be achievable whether the proposed new goal is qualitative or both qualitative and quantitative (as are the present goals) in nature, and should be considered in the context of a possible associated defense-in-depth goal such as LERF.

This benefit notwithstanding, the staff recommends that the decision to proceed with modifying the policy statement, including elevating CDF to a fundamental goal be deferred, for the following reasons:

- The staff's risk-informed regulatory guides are being circulated for public comment, with comment explicitly sought on issues such as the appropriateness of 1×10^{-4} per reactor year as a CDF acceptance guideline, use of safety goals in plant-specific decision making, an appropriate LERF definition, and treatment of uncertainties. Consideration of public comments on these issues will help shape their use in the final versions of the regulatory guides, and could also help better define the need for changes to the policy statement.

- As noted above, the Regulatory Analysis Guidelines and draft DG-1061 already make use of the CDF subsidiary objective. Therefore, the elevation of the CDF subsidiary objective alone to a fundamental goal will have, in practice, little effect on ongoing staff activities. However, if the policy statement is to be revised, the additional issues noted above (e.g., the development of a goal on land contamination) should be considered. These other issues have the potential to impact regulatory activities and, since they have not been the subject of extensive internal staff discussion, nor have they been discussed with the ACRS, time for these discussions is needed.

- The Safety Goal Policy Statement is closely related to the PRA Policy Statement, to fundamental staff concepts such as defense in depth, adequate protection, and the need for compliance with existing regulations, as well as to the backfit process. Possible revisions to the policy statement will require detailed review by the staff and OGC to assure that a CDF goal is properly defined and characterized with respect to these issues.

As such, the staff recommends that a decision on modifying the policy statement be made after finalization of DG-1061 and related documents, scheduled for December 31, 1997, and after staff discussions with the ACRS. The staff recommends that a Commission paper providing staff recommendations be prepared after these activities are completed, with a proposed completion date of March 31, 1998. The staff notes that, pending a Commission decision, no staff or contractor resources have been allocated in planning documents to modify the policy statement. A decision to proceed will require reprogramming available resources from other, lower priority, work. The staff estimates that the effort would require approximately 2 FTE per year for a two-year period. This estimate assumes the normal process for policy statement revisions would be followed (i.e., initial ACRS, CRGR and

Commission interaction, public comment and final ACRS, CRGR and Commission interactions) as well as at least one public workshop to discuss the issues.

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Attachments: As stated