PROPOSED MARK II AND III DEGB PROBABILISTIC STUDIES TO SUPPORT THE CRGR REVIEW OF TASK ACTION PLAN B-6 FOR BWRs

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ILLUSTRATIONS

1. INTRODUCTION

A presentation before the Committee to Review Generic Requirements (CRGR) on the resolution of Task Action Plan B-6, "Loads, Load Combinations, and Stress Limits", for BWRs is scheduled for early 1985. However, only the Lawrence Livermore National Laboratory (LLNL) Mark I double-ended guillotine break (DEGB) probabilistic studies is in progress or planned prior to the CRGR presentation. Since this is a generic resolution for BWRs, DEGB probabilistic studies for Mark II and Mark III plants must be included in addition to the Mark I studies currently in progress. GE proposes to perform Mark II and III DEGB probabilistic studies in parallel with the LLNL Mark I studies utilizing alternate (simplified) calculational models that can be benchmarked to the rigorous LLNL models. It is also proposed that the NRC review the Mark II and DEGB probabilistic studies in conjunction with the January 31, 1984 submittal on the GESSAR II docket supporting the leak-before-break approach.

Section 2 of this report provides a summary of the proposed Mark II and III probabilistic models and procedures. Section 3 outlines the probabilistic studies and presents a schedule to complete these studies in early 1985. Finally, Section 4 provides descriptions of the two alternate direct and indirect DEGB models. The information included in this report should be sufficient for the NRC to determine the technical acceptability of the approach.

2. SUMMARY OF MODELS AND PROCEDURES

The direct DEGB model described in Section 4.1 is based on the LLNL methodology (References 1 through 3). The indirect DEGB model described in Section 4.2 is based on the Limerick and GESSAR II seismic event analyses (References 4 and 5, respectively). The corresponding LLNL in direct DEGB methodology (Reference 6) is also factored into the indirect model of Section 4.2; however, References 4 and 5 are stressed since the proposed probability studies will utilize their specific results. These models and the corresponding calculational procedures are summarized below:

Direct DEGB Model

1. Based on the LLNL methodology.

2. Since major contribution comes from initial flaw probability, material flow stress and fatigue crack growth constants can be taken as deterministic.

3. Probability calculation becomes a straightforward integration not requiring numerical simulation.

4. Parameters will envelope Mark I, II and III plants.

Indirect DEGB Model

1. Identify potential failure sources:

   (a) Mark I* - LLNL sources:

   (b) Mark II - Utilize Limerick sources, supplemented if required.

   (c) Mark III - Sources defined in Subsection 4.2.1 of this report.

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*For use in benchmarking against LLNL results.

2. Determine seismic fragility of failure sources:

   (a) Mark I* - Brunswick fragilities as developed by LLNL

   (b) Mark II - Limerick fragilities, supplemented as required. Variations will be made on dominant fragilities to envelope Mark II designs.

   (c) Mark III - GESSAR II fragilities, supplemented as required. Variations will be made on dominant fragilities to envelope Mark III designs.

3. Estimate overall probability by summing individual failure source probability utilizing the seismic hazard curves as defined below:

   (a) Mark I* - Brunswick seismic hazard curve (as utilized by LLNL).

   (b) Mark II - Limerick seismic hazard curve with variations to envelope Mark II sites.

   (c) Mark III - GESSAR II seismic hazard curve which already envelopes Mark III sites.

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*For use in benchmarking against LLNL results.

3. PROBABILISTIC STUDIES

GE proposes to complete a DEBG probabilistic study for Mark II and III utilizing the models and procedures outlined in Section 2. The first order of business will be to apply the alternate models to a Mark I plant (probably Brunswick) and benchmark the results with those of LLNL. If necessary, the alternate models will be "adjusted" and the DEGB probabilities estimated per Sections 2 and 4.

There are no plans at this time to include leak probabilities in the study. GE considers that the leakage probabilities being calculated for the Mark I's can be extrapolated to Mark II and III's because of the following:

1. The relationship between leak and break (direct) is strongly material property dependent (initial flow size distribution, flow stress, fatigue crack growth constants).

2. The materials of a given piping system for each BWR is sufficiently similar.

3. Trends in leakage probability will be tracked by the break probabilities.

The proposed schedule for this is shown as the first entry on Figure 3-1. This figure illustrates the relationship between all of the elements of the BWR leak-before-break (LBB) approach. Since it is highly desirable to utilities to utilize the LBB approach on recirculation piping change out, it is important that the recirculation piping get first priority; hopefully, the BWR LBB approach methodology can be approved by late September 1984 and applied and approved on a utility application before the end of 1984. The corresponding approval of the recirculation piping portion of the Mark II and III studies is early December 1984 with the balance of the piping in late January or early February 1985.

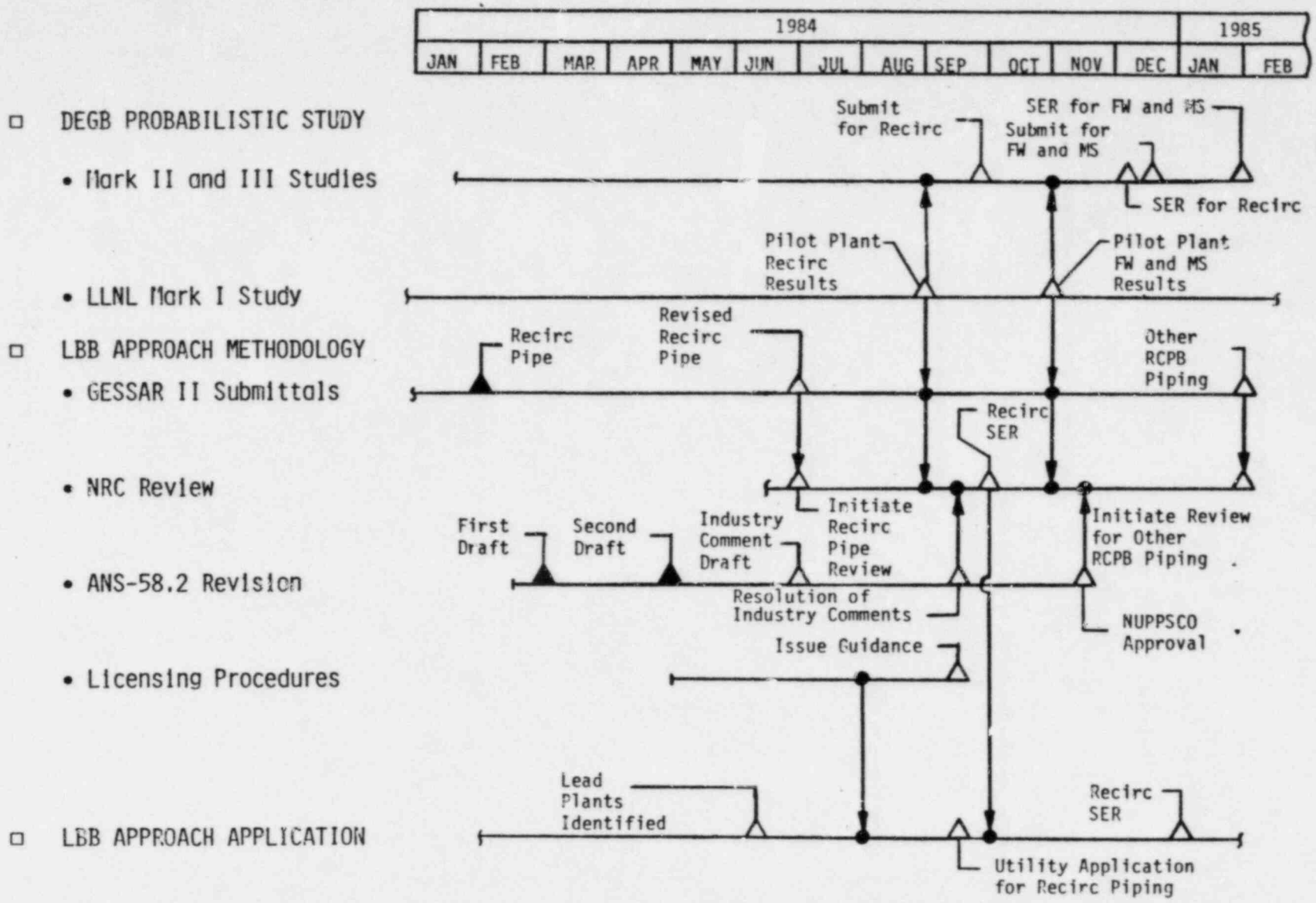

Figure 3-1. Proposed Schedule for NRC Review of BWR LBB Approach