A.1 Introduction

In order to satisfy the objective of this Proactive Material Degradation Assessment it is necessary that, as Sir Francis Bacon and Shakespeare recognized, the various modes of degradation (e.g., stress corrosion cracking, crevice corrosion, thermal embrittlement, etc.) be defined and, in order to be proactive, there should be quantitative life-prediction capabilities for each of them. Some of the challenges to having an adequate prediction capability were discussed in Section 2.4, with examples taken specifically for the case of stress corrosion cracking. In this Appendix, a wider range of materials degradation modes are described, together with a brief description of the mechanisms and system parameters that control the extent of degradation. This information serves as an introduction to more extensive discussions in the topical reports given in Appendix B. These latter discussions outline the dependency of the various degradation modes on specific system parameters, and thereby lay the background behind the panelists' susceptibility, confidence, and knowledge scoring of degradation in the various Light Water Reactor (LWR) systems.

Since many of the degradation modes involve corrosion, a brief primer is included in Appendix A on corrosion basics so as to orient the reader to phraseology and concepts. The materials and degradation modes considered in the following sections in Appendix A are:

- A.2 Materials of Construction
- A.3 Corrosion Basics
- A.4 Description of Degradation Modes and their Predictability in LWRs
  - A.4.1 "Uniform" Corrosion
    - General Corrosion
    - Boric Acid Corrosion
    - Flow-Accelerated Corrosion and Erosion-Corrosion
  - A.4.2 Localized Corrosion
    - Crevice Corrosion
    - Pitting Corrosion
    - Galvanic Corrosion
    - Microbiologically-influenced Corrosion (MIC)
    - Environmentally Assisted Cracking
      - Intergranular Stress Corrosion Cracking (IGSCC)
      - Transgranular Stress Corrosion Cracking (TGSCC)
      - Primary Water Stress Corrosion Cracking (PWSCC)
      - Irradiation Assisted Stress Corrosion Cracking (IASCC)
      - Low-temperature Crack Propagation (LTCP)
  - A.4.3 Under-clad Cracking and Clad Disbonding
  - A.4.4. Fatigue
  - A.4.5 Loss of Fracture Resistance
    - Irradiation Effects
      - Neutron Embrittlement
      - Void Swelling Effects
    - Thermal Aging