

Standard Plant Review
Program Plan

Standardization and Non-Power Reactor Project Directorate
Office of Nuclear Reactor Regulation
January 1988

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I. Introduction

The NRR reorganization which became effective on April 12, 1987 centralized management responsibility for standard plant reviews in the Standardization and Non-Power Reactor Project Directorate, Division of Reactor Projects III, IV, V and Special Projects. At the present time there are five such reviews, either in progress or involving significant predocketing activities. In addition, there is an effort underway to amend the current CESSAR System 80 FDA with respect to updating it and making it forward-referenceable. This amendment effort is not part of the program plan discussed herein.

The purpose of this program plan is to summarize and characterize, in one document, the total ongoing standardization review and licensing activities within NRR. The plan is intended to be used by management for information and decision-making, by staff reviewers and by other interested persons.

The five reviews represent a very important and high-priority effort and will require significant staff resources over the next several years. They have very high visibility, both within and outside of the NRC, and it is important that high-quality, timely reviews be completed by the staff.

The five standard plant review projects covered by this program plan are:

- (1) Electric Power Research Institute (EPRI) Advanced Light Water Reactor (ALWR) Utility Requirements Document
- (2) General Electric Company (GE) Advanced Boiling Water Reactor (ABWR) Final Design Approval/Design Certification (FDA/DC) Application
- (3) Combustion Engineering, Inc. (CE) System 80+ CESSAR-DC Final Design Approval/Design Certification (FDA/DC) Application
- (4) Westinghouse Electric Corporation (W) RESAR SP/90 Preliminary Design Approval (PDA) Application and the anticipated Final Design Approval/Design Certification (FDA/DC) Application.
- (5) Westinghouse Electric Corporation (W) AP-600 Final Design Approval/Design Certification (FDA/DC) Application

Note that GE is currently developing a small (600 MWe) BWR design. However, based on recent discussions with GE, no plans currently exist to submit this design to the NRC for approval.

Section II of this plan presents summary descriptions and brief discussions of each of the five projects. Section III shows the revised target milestone schedules which reflect applicant needs. Note that resource reallocations will be necessary to support these revised schedules. We are in the process of re-estimating resource requirements for these reviews, which will be issued at a later time.

II. Standard Plant Projects

A. EPRI Advanced Light Water Reactor (ALWR) Utility Requirements Document

The ALWR Utility Requirements Document is a comprehensive statement of the utility requirements for design, construction and performance of advanced light water reactor power plants for the late 1990s and beyond. The document is intended to be used with companion documents, such as utility procurement specifications which will cover the detailed technical requirements applicable to units up to 1350 MWe in size (either BWR or PWR).

Development of the Requirements Document is being managed by the Electric Power Research Institute (EPRI), with guidance by a steering committee of utility executives and with participation by equipment suppliers, architect-engineers and constructors. The basic objectives of this effort are to define the utility requirements for an LWR plant that is based on fully proven technology and, compared to current plants, is: (1) greatly simplified with respect to constructability, maintainability and operability; (2) less subject to accident; (3) more stable during operating transients; (4) lower in lifetime costs; and (5) readily licensable.

To provide assurance that the ALWR will be readily licensable, the staff and EPRI have worked together for several years on identification of the NRC generic safety and licensing issues that are applicable to the ALWR design. For those which are unresolved, EPRI has been submitting "topic papers" with proposed resolutions for staff consideration. In the same manner, EPRI is proposing technically supportable alternatives (called "plant optimization subjects") to current regulatory requirements that represent optimization of plant design, construction and operation. Those resolutions and alternatives that are found acceptable by the staff for the ALWR have been, or will be, reflected in the Requirements Document. Thus, an important aspect of this review may lead to changes in regulatory requirements for all future LWR plants.

The staff began its review of the Requirements Document upon receipt of Chapter 1 (concerning the overall design requirements) in July 1986 and the Draft SER (DSER) was issued on September 24, 1987. Chapter 2 was submitted in October 1986 and Chapters 3 and 4 were submitted in July 1987. The remaining 9 chapters are scheduled for submittal to NRC on various dates from December 1987 through December 1988. As previously agreed with EPRI, the staff is evaluating EPRI's utility requirements for licensing acceptability and will issue a draft SER on each chapter. As a result of these evaluations, EPRI expects to make changes in the Document which will require additional review by the staff prior to issuance of its final SER in January 1991.

EPRI is planning to develop a set of alternative requirements for large scale use of passive safety systems, such as gravity drain injection and natural circulation cooling, which could substitute for active, more conventional systems in 600 MWe size plants. These alternative requirements will be presented primarily in parallel sets of chapters 3, 4, 5 and 6 beginning late in 1988. Additional staff resources will be needed to review this material. The degree to which the latter part of the above review schedule will be affected by this development is not yet known.

B. General Electric Advanced Boiling Water Reactor (ABWR)

The ABWR is the result of a cooperative development effort by General Electric, Tokyo Electric Power Company (TEPCO), Hitachi and Toshiba. GE also is receiving financial support for the Design Certification licensing effort as part of DOE's Design Verification Program.

The ABWR incorporates several improved design and operational features, based on worldwide BWR experience. The scope of the application will consist of the nuclear island, which includes all safety-related structures, systems and components. Safety-related interfaces will be defined for the balance of plant, including the turbine building, cooling water systems and site.

The staff and GE have developed a set of review guidelines defined in a Licensing Review Bases document. These guidelines are intended to define the review process and certain key acceptance criteria for the ABWR by addressing certain regulatory and licensing issues that have caused problems and delays in the past reviews of standardized plants.

The ABWR application and Volumes 4, 5, 6, and 15 of the Safety Analysis Report were submitted on August 29, 1987. The remaining volumes of the SAR will be submitted in 3 groups through January 1989. The application is for a Design Certification of the ABWR. The staff's Safety Evaluation Report will be issued in sections as portions of the review are completed. At the end, the staff will integrate these sections along with the ACRS comments and issue a final Safety Evaluation Report.

Review of the ABWR application will proceed more-or-less concurrently with the review of the EPRI Requirements Document for the Advanced Light Water Reactor (ALWR) program. To the extent practicable, the ABWR will reflect the EPRI requirements, but neither the staff review scope nor the review schedules of the two projects will be coupled.

The ABWR is undergoing licensing review in Japan and the U.S. simultaneously. Tokyo Electric Power Company is building a two-unit station, Kashiwazaki-Kariwa, using the ABWR design. A license application will be submitted in 1988 and the units are scheduled for operation in 1996 and 1998. GE has been selected to supply the NMSS, nuclear fuel and turbine generators.

C. Combustion Engineering - System 80+ Design, CESSAR-DC

The System 80+ design, CESSAR-DC is the result of the cooperative effort of Combustion Engineering, the Department of Energy and the Electric Power Research Institute (EPRI). CE is receiving financial support for the Design Certification licensing effort as part of the DOE's Design Verification Program.

The System 80+ design, CESSAR-DC, is a revision of the System 80, CESSAR-F, which has been given a Final Design Approval, FDA-2. The scope of the System 80+ consists of the NSSS, Containment, Control Room, Emergency Feedwater System and Standard Functional Requirements for the balance of plant (BOP). Also to be submitted on the System 80+ docket will be the topic papers of Severe Accident Issues developed by the DOE sponsored Advanced Reactor Severe Accident Program (ARSAP).

CE has proposed a set of review guidelines as GE has done. These guidelines (Licensing Review Bases) have been found not to be complete and, therefore, CE will resubmit them to include not only administrative procedural guidance but design guidance too.

CE has proposed that the System 80+ design be submitted on a new docket with the docket file of the System 80 design (CESSAR-F) to be a part of the new docket file. We have found such a proposal acceptable. The CESSAR-DC will be submitted as revisions to the CESSAR-F a few chapters at a time. The areas of revisions will be marked by vertical bars in the right margin. Submittals have been made in September 1987 and November 1987, with the remainder to be submitted before March 1989. Submittals of topic papers from the ARSAP will commence in December 1987. Review will be for a revision of FDA-2 and Design Certification. The staff Safety Evaluation Report will be issued in sections in draft form, as portions of the review are complete. At the end, the staff will perform an integrated review and issue a final Safety Evaluation Report.

Review of the System 80+ CESSAR-DC will proceed more-or-less concurrently with the review of the EPRI Requirements Document for the Advanced Light Water Reactor (ALWR) program. CE has stated the System 80+ design will reflect the EPRI requirements, but neither the review scope nor the schedule of the two projects will be coupled.

The System 80+ Design, CESSAR-DC, is planned to be available for use in the 1990s.

D. Westinghouse Advanced Pressurized Water Reactor (WAPWR) - RESAR SP/90

The WAPWR is the result of a cooperative development effort by Westinghouse and Mitsubishi Heavy Industries (MHI). The WAPWR includes several design features not present in other Westinghouse plant designs, including an advanced core design and control room design.

The scope of the application consists of a Nuclear Power Block (NPB), which includes all buildings, structures, systems and components that are essential to the safe operation of the nuclear power plant. Specifically excluded from the NPB scope are the turbine building, the waste disposal building, the service building, the administration building, the service water/cooling water structure and the ultimate heat sink.

Westinghouse tendered the RESAR SP/90 application for a Preliminary Design Approval (PDA) in October 1983. The Safety Analysis Report was submitted one module at a time; the final module was submitted in March 1987.

Although draft SERs have been written on several sections of the application, no final SERs have been issued to date. Since all of the modules have now been submitted by Westinghouse, the staff is performing an integrated review of the PSAR, and will issue one SER on the entire application in late 1988. (Draft SERs will be issued in sections during 1988 to support ACRS review).

Westinghouse has indicated that it plans to follow the PDA review immediately with an application for Final Design Approval (FDA) and Design Certification. Initial FDA application submittals are tentatively scheduled for early 1989. However, development of the Licensing Review Bases will begin in early 1988.

The WAPWR application is not tied to the EPRI Requirements Document for the Advanced Light Water Reactor (ALWR) program, although the design satisfies many of the EPRI requirements.

Kansai Electric Power in Japan has indicated it plans to build the first APWR plant using the RESAR SP/90 design.

E. Westinghouse 600 MWe Advanced Light Water Reactor Plant - AP-600

Westinghouse Electric Corporation, in conjunction with Burns and Roe, Inc. and Avondale Industries, Inc., is currently developing a design for an advanced light water reactor plant of approximately 600 MWe capacity suitable for U.S. electric generation needs in the 1990's and beyond. This effort is being performed in cooperation with the United States Department of Energy and the Electric Power Research Institute.

The 600 MWe Advanced Passive Pressurized Water Reactor Plant (referred to as AP-600) was developed on the basis of proven light water reactor technology while incorporating major safety improvements and plant simplifications as compared to existing nuclear plants. The AP-600 design is characterized by a simplified reactor coolant loop configuration with canned motor reactor coolant pumps, a low power density core, passive safety systems, aggressive simplification of all major plant systems, and development of innovative construction methods. The conceptual design is intended to be responsive to all regulatory issues while meeting the industry objectives of improved safety margins, improved operability and maintainability, shorter construction schedules, and reduced cost. The AP-600 is expected to comply with the EPRI Requirements Document.

By letter dated November 30, 1987, and during a December 1, 1987 meeting with the Commission, Westinghouse informed the staff of its intent to submit an application for an FDA/DC approval for this design. The applicant requested the Commission make staff resources available in mid-1988 for a three month safety review to determine the licensability of the design, after which Westinghouse intends to submit the FDA/DC application (February 1990).

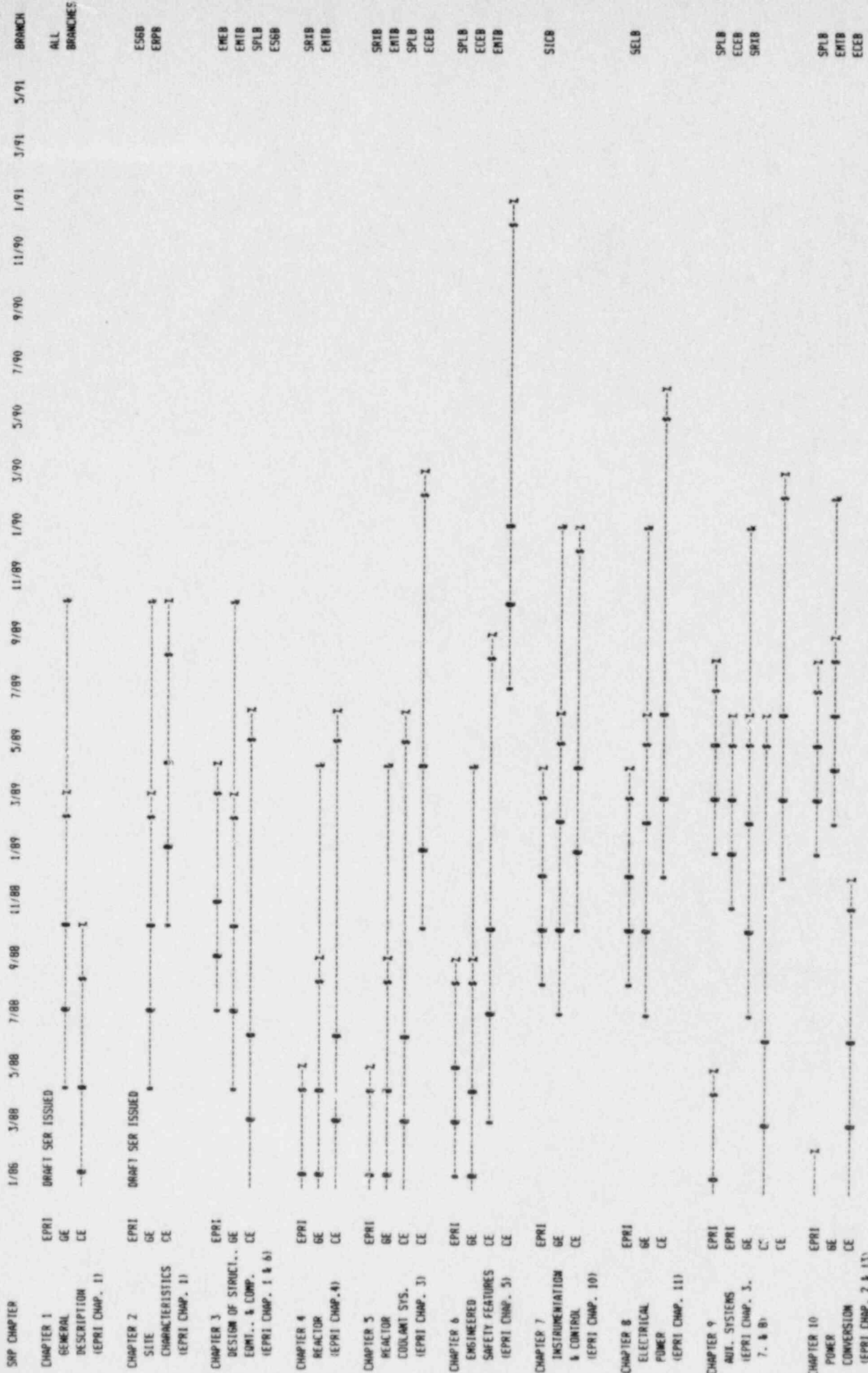
In order to facilitate the Safety/Licensability Review, Westinghouse is developing a design description document for the AP-600 plant. This document will describe the plant design concept, assess the design features with regard to current regulatory requirements, and present the basis for the design in response to unresolved safety issues and potential future licensing requirements. The design description document will also provide the results of early safety analyses and outline the engineering program that will finalize the plant design features. The engineering and design information to be provided in the document will include a summary description of all of the principal plant design features, but will place special emphasis on upgraded features which differ from standard Westinghouse practice and which have not been previously reviewed by the NRC staff.

Resources for this Safety/Licensability Review as well as the FDA/DC review have not been included in the current budget. In order to meet the applicant's requested review schedule, reallocations of 1988 staff resources will be necessary to support the 3 month review, and the FDA/DC application will need to be factored into the 5 Year and Strategic Plans.

III. Project Schedules

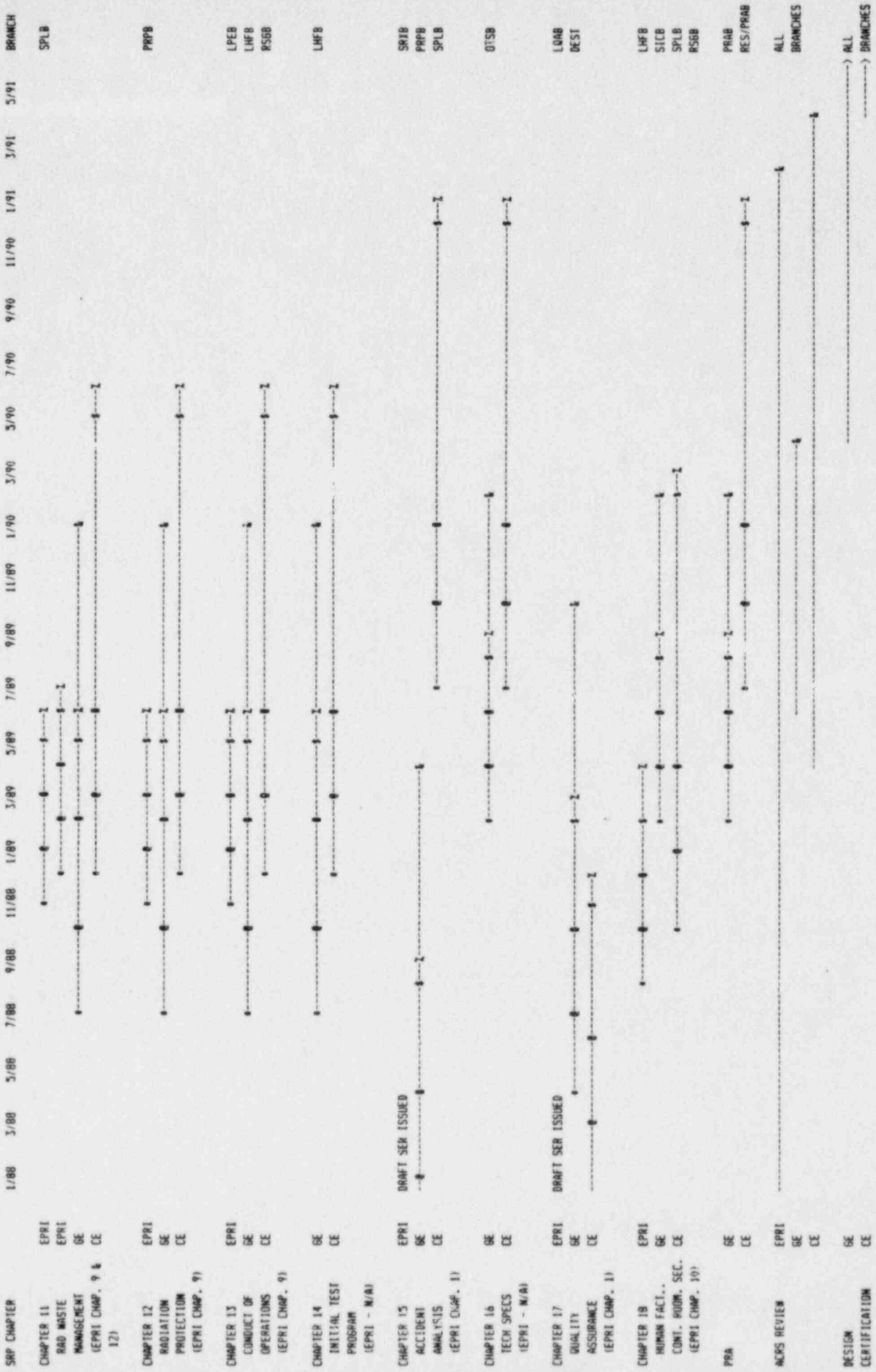
The revised target schedules, showing major milestones for each project are shown on the following charts. A composite chart for the EPRI, GE and CE reviews has also been prepared to show the relationship among the three projects.

COMPOSITE ADVANCED PLANT REVIEW SCHEDULE



LEGEND: ● = SSAR REC'D
 ○ = RAL
 ■ = RESP TO RAL
 ● = DRAFT SER TO PM
 ▮ = DRAFT SER ISSUED
 ▮ = FINAL SER ISSUED

COMPOSITE ADVANCED PLANT REVIEW SCHEDULE
(CONTINUED)



LEGEND: * = SSAP REC'D
 # = RAI
 @ = RESP TO RAI
 \$ = DRAFT SER TO PH
 Z = DRAFT SER ISSUED
 & = FINAL SER ISSUED

ALWR REQUIREMENTS DOCUMENT (EPRI) REVIEW SCHEDULE

CHAPTER 1/88 3/88 5/88 7/88 9/88 11/88 1/89 3/89 5/89 7/89 9/89 11/89 1/90 3/90 5/90 7/90 9/90 11/90 1/91 3/91 5/91

(1) OVERALL REQUIREMENTS DRAFT SER ISSUED

(2) POWER GENERATION CONVERSION -----Z

(3) PRIMARY COOLANT & NON-SAFETY AUX. SYSTEMS --●-----Z

(4) REACTOR SYSTEMS --●-----Z

(5) SAFETY SYSTEMS ●-----Z

(6) ARRANGEMENTS ●-----Z

(7) FUELING & REFUELING ●-----Z

(8) PLANT COOLING WATER SYSTEM ●-----Z

(9) SITE SUPPORT SYSTEMS ●-----Z

(10) INSTRUMENTATION & CONTROL SYSTEMS ●-----Z

(11) ELECTRIC POWER SYSTEMS ●-----Z

(12) RADIATION PROCESSING SYSTEM ●-----Z

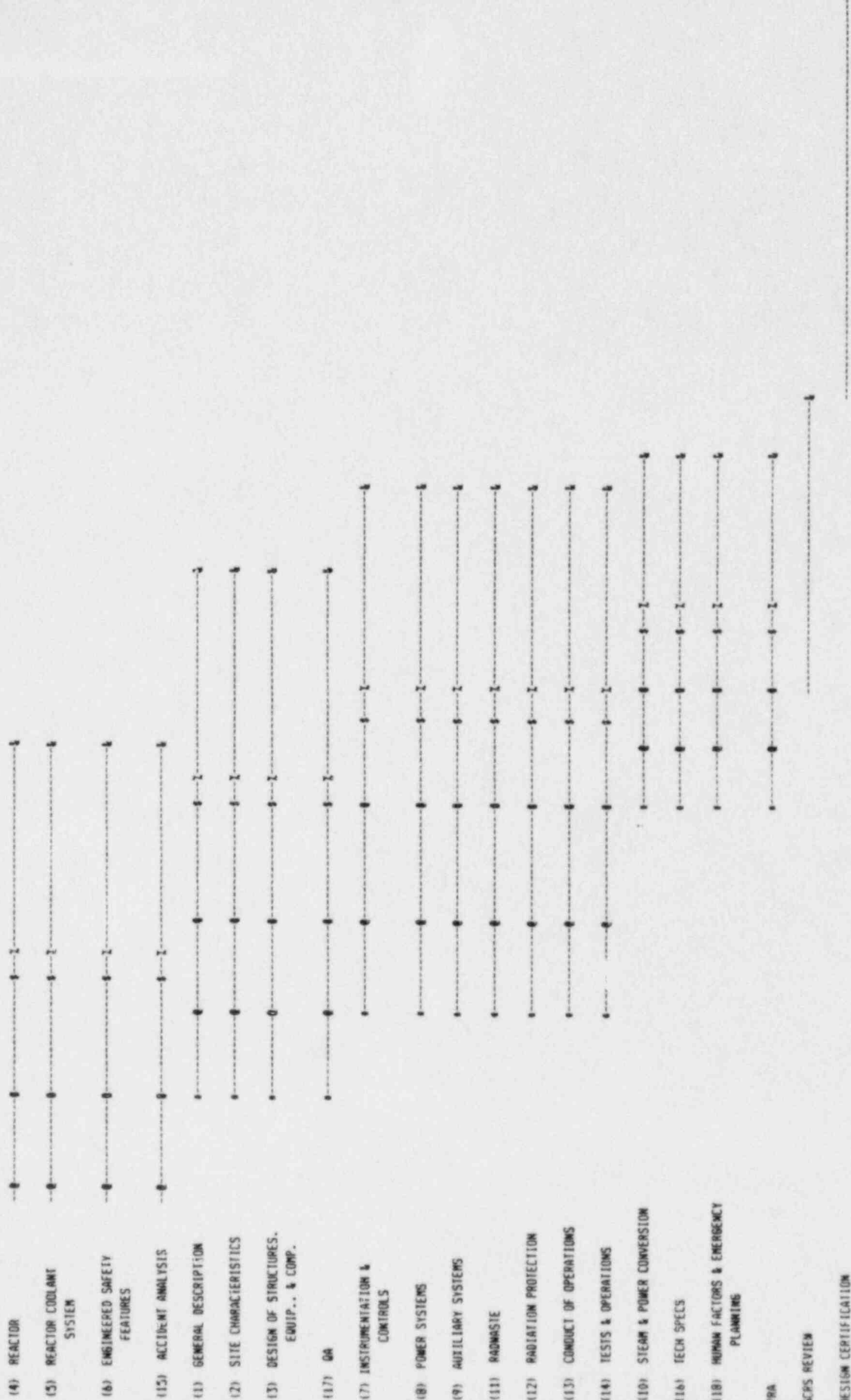
(13) TURBINE GENERATOR SYSTEM ●-----Z

ACRS REVIEW

LEGEND: ● = SSAR REC'D
 ● = RAI
 ● = RESP TO RAI
 ● = DRAFT SER TO PH
 Z = DRAFT SER ISSUED
 ● = FINAL SER ISSUED

GE ABWR REVIEW SCHEDULE

SRP CHAPTER 1/88 3/88 5/88 7/88 9/88 11/88 1/89 3/89 5/89 7/89 9/89 11/89 1/90 3/90 5/90 7/90 9/90 11/90 1/91 3/91 5/91



LEGEND: ● = SSAR REC'D
 ▮ = DRAFT SER ISSUED
 — = RESP TO RAI

CE SYSTEM 80+ REVIEW SCHEDULE

SRP CHAPTER 1/88 3/88 5/88 7/88 9/88 11/88 1/89 3/89 5/89 7/89 9/89 11/89 1/90 3/90 5/90 7/90 9/90 11/90 1/91 3/91 5/91

(1) GENERAL DESCRIPTION

(10) POWER CONVERSION

(17) QA

(3) STRUCTURES & EQUIPMENT

(4) REACTOR

(5) REACTOR COOLANT SYSTEM

(9) AUXILIARY SYSTEMS

(6) ENGINEERED SAFETY SYSTEMS

(2) SITE

(7) INSTRUMENTATION & CONTROL

(8) ELECTRICAL POWER

(11) RADIOACTIVE MANAGEMENT

(12) RADIATION PROTECTION

(13) CONDUCT OF OPERATIONS

(14) INITIAL TEST PROGRAM

(15) ACCIDENT ANALYSIS (PPA)

(16) TECH SPECS

(18) HUMAN FACTORS

ACRS REVIEW

DESIGN CERTIFICATION

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LEGEND: ● = SSAR PECC 0
 ● = RAI
 ● = RESP TO RAI
 ● = DEPT SER TO PW
 I = DRAFT SER ISSUED
 I = FINAL SER ISSUED

ADVANCED PLANT REVIEW SCHEDULE

1/88 3/88 5/88 7/88 9/88 11/88 1/89 3/89 5/89 7/89 9/89 11/89 1/90 3/90 5/90 7/90 9/90 11/90 1/91

RESAR SP/90

PDA EFFORT

PPA 1ER FIRST SECOND ACRS FINAL PDA FSAR
 ISS. DRAFT DRAFT FULL SER ISS. SUBMITTAL
 | SER SER COMM. ISS.
 M RESP ISS. ISS.
 TO Qs |
 | M RESP
 LATE TO LATE
 Qs ISS. Qs

SAFETY/LICENSIBILITY REVIEW

FDA EFFORT

AP-600 *

DESIGN Qs M SER
 DESCRIP. ISS. RESP ISS.
 SUBMITTED TO Qs

FSAR
 SUBMITTAL
 BEGINS

1/91 3/91 5/91 7/91 9/91 11/91 1/92 3/92 5/92 7/92 9/92 11/92 1/93 3/93 5/93 7/93 9/93 11/93 1/94

RESAR SP/90

PDA EFFORT

SER FDA RULEMAKING
 ISS. ISS. BEGINS

(7)

FDA EFFORT

RULEMAKING EFFORT

AP-600 *

SER FDA RULEMAKING
 ISS. ISS. BEGINS