Docket File
52-003

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

September 11, 1995

APPLICANT: Westinghouse Electric Corporation

FACILITY: Advanced Passive 600 Reactor Design (AP600)

SUBJECT: SUMMARY OF MEETING TO DISCUSS PILOT CERTIFIED DESIGN MATERIAL (CDM) FOR THE AP600 DESIGN

A public meeting was held between Westinghouse and the Nuclear Reactor Regulation staff on August 24, 1995, at the Nuclear Regulatory Commission offices in Rockville, Maryland. The purpose of the meeting was to discuss Westinghouse's pilot CDM submittal for the AP600 design, including the inspections, tests, analyses and acceptance criteria (ITAAC) for the design. Attachment 1 is the list of those who attended and Attachment 2 are the viewgraphs presented at the meeting.

Westinghouse opened the meeting by providing an overview of the history of the AP600 CDM/ITAAC. Westinghouse had submitted a complete CDM/ITAAC as part of its design certification application in December 1992. However, since that time, additional precedents for the CDM/ITAAC were established by the reviews of the evolutionary designs. Westinghouse stated that they had generally incorporated those precedents as part of its proposed pilot CDM/ITAAC, and used an industry review group to assist in the incorporation of lessons learned. Westinghouse then presented its methodology for developing the CDM/ITAAC, using one of the pilot CDM/ITAAC as an example. The pilot CDM/ITAAC presented, the "Non-class 1E DC and UPS System", is contained in Attachment 3.

In general, Westinghouse based its selection of CDM/ITAAC design material on the equipment classification of systems, structures and components. Westinghouse stated that it had considered the safety significance of design features and functions of equipment, and its defense-in-depth functions. Westinghouse also used its system design description documents to develop the information in the CDM. Westinghouse is planning CDM/ITAAC for approximately 36 of 91 systems of the AP600 design. The staff noted that 10 CFR 52.97(b) requires that all structures and systems of the design must be addressed in the

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CDM/ITAAC, at a level of detail corresponding to its safety significance, and would evaluate this when the full CDM/ITAAC were submitted. Westinghouse stated that they intended to submit three pilot CDM/ITAAC in mid-September 1995, and the full CDM/ITAAC after receipt of staff comments on the pilots.

Original signed by

Thomas H. Boyce, Project Manager
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Attachments:
As stated

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WESTINGHOUSE AP600
CERTIFIED DESIGN MATERIAL
MEETING ATTENDEES
AUGUST 24, 1995

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STU MAGRUDER	NRR/PDST
CHARLES THOMPSON	DOE
RUSS BELL	NEI
RALPH ARCHITZEL	NRR/PDST
NARINDER TREHAN	NRR/EELB
DALE THATCHER	NRR/EELB
MATTHEW CHIRAMAL	NRR/HICB
JERRY WILSON	NRR/PDST
TOM BOYCE	NRR/PDST
ANDRE STERDIS	WESTINGHOUSE
BRIAN MCINTYRE	WESTINGHOUSE

Attachment 1

WESTINGHOUSE ELECTRIC CORPORATION

PRESENTATION ON THE AP600

PILOT TIER 1 DESIGN DESCRIPTIONS AND ITAAC

TO

UNITED STATES

NUCLEAR REGULATORY COMMISSION

Attachment 2

Andrea L. Sterdis

AUGUST 24, 1995

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INDUSTRY CHRONOLOGY

- 1991 Evolutionary plant efforts begun

  1992 First significant NRC interaction with evolutionary plants (AP600 representatives attended)

- 1992 AP600 Tier 1 / ITAAC submittal (December)

- 1992-94 Significant interactions between staff and evolutionary plant designers

- 1994 GE / CE finalize Tier 1 / ITAAC

- 1995 NEI industry group review of existing AP600 Tier 1 / ITAAC versus evolutionary plant precedents

- 1995 AP600 Tier 1 / ITAAC revised
  - Pilot revisions
  - NRC review / interactions
  - Complete Tier 1 / ITAAC revisions

TIER 1 / ITAAC REVISION

- Reasons for Tier 1 / ITAAC revision
  - AP600 design changes
  - DSER provides better definition of NRC needs for making safety determinations
  - Consistency with evolutionary plant precedents
  - Incorporation of NEI industry task group recommendations

CONSISTENCY WITH EVOLUTIONARY PLANT PRECEDENTS

- Objective to be consistent with evolutionary plant Tier 1 material
- Differ based on the following criteria
  - Design differences
  - Design / licensing philosophy differences
  - An alternative means for accomplishing the same objective
  - Recent regulatory changes / issues since the evolutionary plant work was completed

AP600 Tier 1 Design Description / ITAAC Process

1992 Development Process

- Tier 1 Design Description / ITAAC Screening Criteria
  - Applied to all AP600 systems
  - Criteria identified Tier 1 Design Description / ITAAC functions
- Developed Tier 1 Design Descriptions / ITAACs

AP600 Tier 1 / ITAAC Screening Criteria

- Based on AP600 Equipment Classification
  - Ensure that each system and structure is screened for safety significant design features and functions
- Identify SSC classification within each system
  - Classes A, B, and C are safety-related
    - Provides mitigation functions credited in accident analyses, used for safe shutdown, or other specified safety-related functions
  - Class D is nonsafety-related
    - Contains radioactive waste or provides defense-in-depth functions
  - Classes E and lower are nonsafety-related
    - Do not provide safety-related or defense-in-depth functions

AP600 Tier 1 / ITAAC Screening Criteria

- Systems and Structures With Class A, B, and C Components
  - Tier 1 Design Description
  - Design verification using ITAAC
    - Inspection / test / analyses based on nuclear safety-related industry codes and standards
    - ITAAC acceptance criteria consistent with conservative parameters from safety analyses and test programs and use in the PRA evaluation
  - Some additional performance verification activities completed via the Tier 2 preoperational test program

AP600 Tier 1 / ITAAC Screening Criteria

- Systems and Structures With Class D Components and Defense-in-Depth Functions
  - Tier 1 Design Description
  - Design verification using ITAAC
    - Inspection / tests / analyses based on commercial industry codes and standards
    - ITAAC acceptance criteria consistent with system design calculations as used in the PRA evaluation
    - Other functional and performance verification activities completed via the Tier 2 preoperational test program

AP600 Tier 1 / ITAAC Screening Criteria

- Systems and Structures With Class E or Lower Components
  - Tier 1 Design Description not required
  - Design verification does not require ITAAC

AP600 Tier 1 / ITAAC Screening Criteria

- Results of Criteria Application
  - 36 system Tier 1 Design Description / ITAAC
    - 12 safety-related systems
    - 24 nonsafety-related systems
- Verification of the results during revision process

AP600 Tier 1 Design Description / ITAAC

- Reactor
  - Fuel Handling and Refueling System
  - Reactor Coolant System
  - Reactor System
- Nuclear Safety Systems
  - Automatic Depressurization System
  - Containment System (includes all containment isolation functions)
  - Passive Containment Cooling System
  - Passive Core Cooling System
  - Steam Generator System
  - Main Control Room Habitability System

AP600 Tier 1 Design Description / ITAAC

- Instrumentation and Control
  - Diverse Actuation System
  - Data Display and Processing System
  - Incore Instrumentation System
  - Plant Control System
  - Protection and Safety Monitoring System
  - Radiation Monitoring System

- Auxiliary Systems
  - Component Cooling Water System
  - Chemical and Volume Control System
  - Standby Diesel and Auxiliary Boiler Fuel Oil System
  - Fire Protection System
  - Mechanical Handling System
  - Primary Sampling System
  - Normal Residual Heat Removal System
  - Spent Fuel Pit Cooling System
  - Service Water System
  - Containment Hydrogen Control System

AP600 Tier 1 Design Description / ITAAC

- Steam and Power Conversion Systems
  - Main and Startup Feedwater System
  - Main Steam System

- Electrical Power
  - Main ac Power System
  - Non-class 1E dc and UPS System
  - Plant Lighting System
  - Class 1E dc and UPS System
  - Onsite Standby Power System

- Heating, Ventilating, and Air Conditioning Systems
  - Nuclear Island Nonradioactive Ventilation System
  - Central Chilled Water System
  - Annex/Auxiliary Building Nonradioactive Ventilation System
  - Diesel Generator Building Ventilation System

AP600 Tier 1 Design Description / ITAAC

Nonsystem Tier 1 Design Description / ITAAC

- Human factors
- Nuclear island building
- Safety-related piping
- Interface
- Site Parameters

PILOT SYSTEMS

- Three pilot systems selected for revision
  - Normal Residual Heat Removal System (RNS)
  - Passive Containment Cooling System (PCS)
  - Non-Class 1E dc and UPS System (EDS)
- EDS material provided in preliminary form today
- RNS and PCS revisions going through final review

EDS REVISION

- Reflects the current EDS design (consistent with the material provided in SSAR Chapter 8, Revision 3)

- Addressed industry recommendations

- Consistent with System 80+ and ABWR dc system Tier 1 material

  - Design differences including no safety-related functions, therefore no safety-related criteria (separation, Seismic, independence)

  - Alternative test for system capability requirements (battery sizing tests)

- AP600 EDS revision addresses nonsafety-related dc power supply to a greater level of detail than the evolutionary plants due to the defense-in-depth and RTNSS-important functions

SUMMARY

- Westinghouse submits the three pilot revisions
- NRC review / interaction to agree on format / content of pilot revisions
- Westinghouse develops guidelines for authors to complete revision effort ("boiler plate" based on pilot agreements)
- Westinghouse completes and submits revisions
- Westinghouse provides NRC with an overview of the guidelines used for the revision effort
- NRC review and acceptance of the revised Tier 1 design descriptions and ITAAC

AP600

3.6.2 NON-CLASS 1E DC AND UPS SYSTEM

Design Description

The non-class 1E DC and UPS system (EDS) provides electrical power to the diverse actuation system (DAS), and plant nonsafety-related defense-in-depth (DID) systems equipment. The EDS serves no safety-related functions. Two subsystems of power sources comprise the EDS system, each supporting one of the two load groups. Bus 1 and 3 constitute subsystem 1, and Bus 2 and 4 constitute subsystem 2. Buses 1, 2 and 3 supply power to the DID function.

EDS subsystem Buses 1, 2 and 3 each contain a dc switch board bus, battery charger, battery, inverter and DC/AC distribution panels, interconnected with feeder cables such that:

a. EDS Buses 1, 2 and 3 dc switch board buses are connected to their corresponding battery chargers.

b. EDS Buses 1, 2 and 3 batteries are connected to their corresponding dc switch board buses.

c. EDS Buses 1, 2 and 3 inverters are connected to their corresponding dc switch board buses.

d. EDS Buses 1, 2 and 3 dc distribution panels are connected to their corresponding dc switch board buses.

e. EDS Buses 1, 2 and 3 ac distribution panels are connected to their corresponding inverters.

The EDS subsystem battery chargers are connected to the low voltage ac power sources of the Main AC Power System (ECS).

EDS Buses 1, 2 and 3 batteries are sized to supply their corresponding dc loads, for a minimum of 1 hour without recharging.

EDS Buses 1, 2 and 3 battery chargers are sized to supply their dc loads while maintaining their corresponding batteries charged.

EDS Buses 1, 2 and 3 inverters are sized to supply their corresponding ac loads.

Table 3.6.2-1 (Sheet 1 of 5)

Non-Class 1E DC and UPS System Inspections, Tests, Analyses and Acceptance Criteria

Certified Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. EDS subsystem Bus 1 includes dc switch board bus, battery charger, battery, inverter and distribution panels, interconnected with feeder cables such that:	1. Tests shall be performed by a signal to verify feeder cable continuity between:	1. Continuity of the feeder cable exists between:
1a. EDS Bus 1 dc switch board bus is connected to EDS Bus 1 battery charger	1a. As-built EDS Bus 1 dc switch board bus and EDS Bus 1 battery charger	1a. As built EDS Bus 1 dc switch board bus and EDS Bus 1 battery charger
1b. EDS Bus 1 battery is connected to the EDS Bus 1 dc switch board bus	1b. As-built EDS Bus 1 dc switch board bus and EDS Bus 1 battery	1b. As built EDS Bus 1 dc switch board bus and EDS Bus 1 battery
1c. EDS 1 inverter is connected to EDS Bus 1 dc switch board bus	1c. As-built EDS Bus 1 inverter and EDS Bus 1 dc switch board bus	1c. As built EDS Bus 1 inverter and the EDS Bus 1 dc switch board bus
1d. EDS Bus 1 dc distribution panels are connected to EDS Bus 1 dc switch board bus	1d. As-built EDS Bus 1 dc switch board bus and EDS Bus 1 dc distribution panels	1d. As built EDS Bus 1 dc switch board bus and the EDS Bus 1 dc distribution panels
1e. EDS Bus 1 ac distribution panels are connected to the EDS Bus 1 inverter	1e. As-built EDS Bus 1 inverter and EDS Bus 1 ac distribution panels	1e. As built EDS Bus 1 inverter and the EDS Bus 1 ac distribution panel
2. EDS subsystem Bus 2 includes a dc switch board bus, battery charger, battery, inverter and distribution panels, interconnected with feeder cables such that:	2. Tests shall be performed by a signal to verify feeder cable continuity between:	2. Continuity of the feeder cable exists between:
2a. EDS Bus 2 dc switch board bus is connected to EDS Bus 2 battery charger	2a. As-built EDS Bus 2 dc switch board bus and EDS Bus 2 battery charger	2a. As built EDS Bus 2 dc switch board bus and EDS Bus 2 battery charger
2b. EDS Bus 2 battery is connected to the EDS Bus 2 dc switch board bus	2b. As-built EDS Bus 2 dc switch board bus and EDS Bus 2 battery	2b. As built EDS Bus 2 dc switch board bus and EDS Bus 2 battery

Table 3.6.2-1 (Sheet 2 of 5)

Non-Class 1E DC and UPS System Inspections, Tests, Analyses and Acceptance Criteria

Certified Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
2c. EDS 2 inverter is connected to EDS Bus 2 dc switch board bus	2c. As-built EDS Bus 2 inverter and EDS Bus 2 dc switch board bus	2c. As built EDS Bus 2 inverter and the EDS Bus 2 dc switch board bus
2d. EDS Bus 2 dc distribution panels are connected to EDS Bus 2 dc switch board bus	2d. As-built EDS Bus 2 dc switch board bus and EDS Bus 2 dc distribution panels	2d. As built EDS Bus 2 dc switch board bus and the EDS Bus 2 dc distribution panels
2e. EDS Bus 2 ac distribution panels are connected to the EDS Bus 2 inverter	2e. As-built EDS Bus 2 inverter and EDS Bus 2 ac distribution panels	2e. As built EDS Bus 2 inverter and the EDS Bus 2 ac distribution panels
3. EDS subsystem Bus 3 shall include dc switch board bus, battery charger, battery, inverter and distribution panels, interconnected with feeder cables such that:	3. Tests shall be performed by a signal to verify feeder cable continuity between:	3. Continuity of the feeder cable exists between:
3a. EDS Bus 3 DC switch board bus is connected to EDS Bus 3 battery charger	3a. As-built EDS Bus 3 DC switch board bus and EDS Bus 3 battery charger	3a. As built EDS Bus 3 dc switch board bus and EDS Bus 3 battery charger
3b. EDS Bus 3 battery is connected to the EDS Bus 3 dc switch board bus	3b. As-built EDS Bus 3 dc switch board bus and EDS Bus 3 battery	3b. As built EDS Bus 3 dc switch board bus and EDS Bus 3 battery
3c. EDS 3 inverter is connected to EDS Bus 3 dc switch board bus	3c. As-built EDS Bus 3 inverter and EDS bus 3 dc switch board bus	3c. As built EDS Bus 3 inverter and the EDS Bus 3 dc switch board bus
3d. EDS Bus 3 dc distribution panels are connected to EDS Bus 3 dc switch board bus	3d. As-built EDS Bus 3 dc switch board bus and EDS Bus 3 dc distribution panels	3d. As built EDS Bus 3 dc switch board bus and the EDS Bus 3 dc distribution panels
3e. EDS Bus 3 ac distribution panels are connected to the EDS Bus 3 inverter	3e. As-built EDS Bus 3 inverter and EDS Bus 3 ac distribution panels	3e. As built EDS Bus 3 inverter and the EDS Bus 3 ac distribution panels

Table 3.6.2-1 (Sheet 3 of 5)

Non-Class 1E DC and UPS System Inspections, Tests, Analyses and Acceptance Criteria

Certified Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
4. The EDS subsystem battery chargers are connected to the low voltage AC power sources of the main AC power system (ECS)	4. Tests shall be performed by a signal to verify feeder cable continuity between:	4. Continuity of the feeder cables exists between:
	a. As-built EDS Bus 1 charger and a low voltage MCC of load group 1	a. As-built EDS Bus 1 charger and a low voltage MCC of load group 1
	b. As-built EDS Bus 3 charger and a low voltage MCC of load group 1	b. As-built EDS Bus 3 charger and a low voltage MCC of load group 1
	c. As-built EDS Bus 2 charger and a low voltage MCC of load group 2	c. As-built EDS Bus 2 charger and a low voltage MCC of load group 2
5. EDS Bus 1 battery is sized to supply the DC Bus 1 design loads for a minimum of 1 hour without recharging	5. Test of the as-built battery shall be performed by using real or simulated loads or a combination. The test shall be at [600 ± 5] amps for one hour. The test shall be carried out on a battery that has been connected to the charger and maintained at [135±1] volts for at least 24 hours prior to the test	5. Battery terminal voltage ≥ [105] volts after test
6. EDS Bus 2 battery is sized to supply the DC Bus 2 design loads, at the end-of-installed-life, for a minimum of 1 hour without recharging	6. Test of the as-built battery shall be performed by using real or simulated loads or a combination. The test shall be at [600 ± 5] amps for one hour. The test shall be carried out on a battery that has been connected to the charger and maintained at [135±1] volts for at least 24 hours prior to the test	6. Battery terminal voltage ≥ [105] volts after test

Table 3.6.2-1 (Sheet 4 of 5)

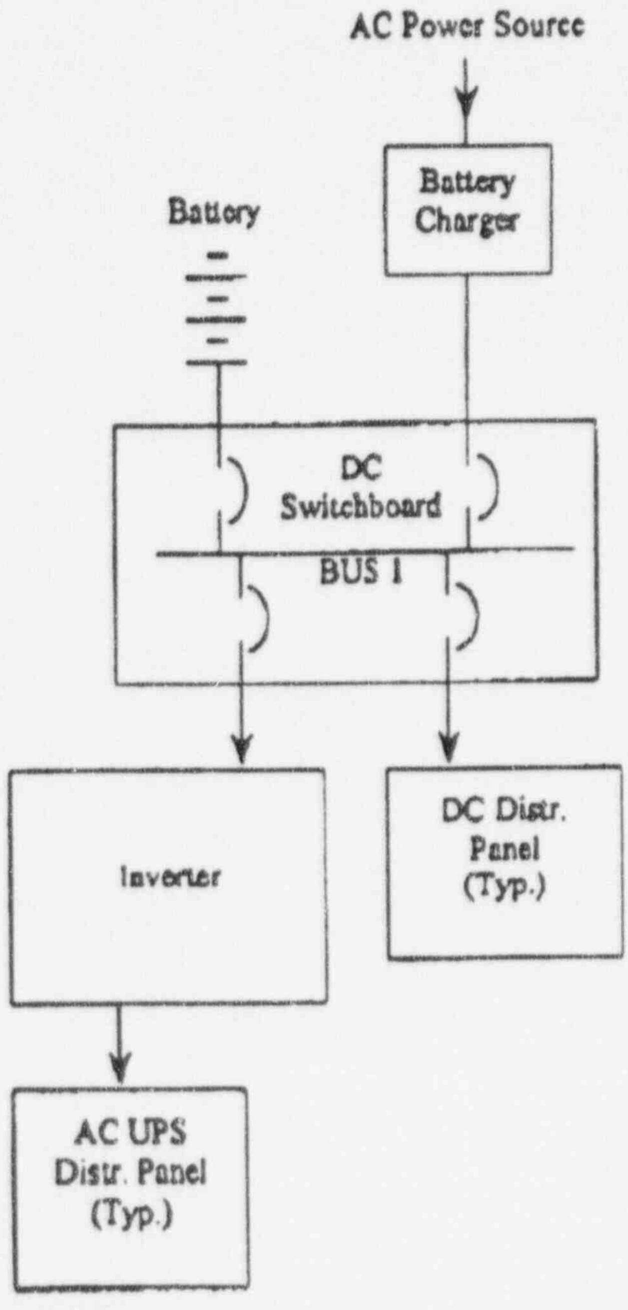
Non-Class 1E DC and UPS System Inspections, Tests, Analyses and Acceptance Criteria

Certified Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
7. EDS Bus 3 battery is sized to supply the DC Bus 3 design loads for a minimum of 1 hour without recharging	7. Test of the as-built battery shall be performed by using real or simulated loads or a combination. The test shall be at [600 ± 5] amps for one hour. The test shall be carried out on a battery that has been connected to the charger and maintained at [135 ± 1] volts for at least 24 hours prior to the test	7. Battery terminal voltage ≥ [105] volts after test
8. EDS Bus 1 battery charger is sized to supply the Bus DC loads while maintaining the battery charge	8. Tests of the as-built battery charger shall be performed by using real or simulated loads or a combination. The test shall be at a steady state current of [600 ± 5] amps	8. The battery charger provides a steady state current of at least [600 ± 5] amps
9. EDS Bus 2 battery charger is sized to supply the Bus dc loads while maintaining the battery charge	9. Tests of the as-built battery charger shall be performed by using real or simulated loads or a combination. The test shall be at a steady state current of [600 ± 5] amps	9. The battery charger provides a steady state current of at least [600 ± 5] amps

Table 3.6.2-1 (Sheet 5 of 5)

Non-Class 1E DC and UPS System Inspections, Tests, Analyses and Acceptance Criteria

Certified Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
10. EDS Bus 3 battery charger is sized to supply the Bus dc loads while maintaining the battery charge	10. Test of the as-built battery charger shall be performed by using real or simulated loads or a combination. The test shall be at a steady state current of [600 ± 5] amps	10. Charger voltage during the test can be adjusted to provide [133 ± 1] volts at the battery terminals
11. EDS Bus 1 inverter is sized to supply ac load	11. Tests of the as-built inverter shall be performed by using real or simulated loads or a combination. The test shall be at [45 ± 1] kW resistive load.	11. Inverter output voltage is [208 ± 2%] volts line-to-line during the test. Inverter output frequency is [60 ± 0.5%] Hz
12. EDS Bus 2 inverter is sized to supply ac load	12. Tests of the as-built inverter shall be performed by using real or simulated loads or a combination. The test shall be at [45 ± 1] kW resistive load.	12. Inverter output voltage is [208 ± 2%] volts line-to-line during the test. Inverter output frequency is [60 ± 0.5%] Hz
13. EDS Bus 3 inverter is sized to supply ac load	13. Tests of the as-built inverter shall be performed by using real or simulated loads or a combination. The test shall be at [45 ± 1] kW resistive load.	13. Inverter output voltage is [208 ± 2%] volts line-to-line during the test. Inverter output frequency is [60 ± 0.5%] Hz



Subsystem Bus
(Typical)

Figure 3.6.2 Non-Class 1E DC and UPS System