Project No. 675

March 1, 1991

FACILITY: CESSAR-DC

APPLICANT: ABB-Combustion Engineering

SUBJECT: NUPLEX 80+

On February 7, 1991, representatives of Combustion Engineering, Inc. (CE) met with the NRC staff at One White Flint North in Rockville, Maryland. The attendees are listed in Enclosure 1. The purpose of the meeting was to discuss the requirements of 10 CFR 52.47(b) with regard to the demonstration of the use of proven technology or the need for prototype testing of the advanced control complex, NUPLEX 80+. The staff presented its present interpretation of the methods to be used to show conformance with these requirements (Enclosure 2). The staff indicated that its recommendations with regard to these issues would be sent to the Commission in March 1991.

CE then made a presentation of their previous experience in the use of similar technology and its use in a variety of other process technologies (Enclosure 3). They also gave an overview of the NUPLEX 80+ design process. The staff informed CE that the indicated point (dashed line) in the process for completion of design certification was not far enough along in the design process. The staff indicated that demonstration of integration and coordination of the various panels in the main control room should be performed as part of the design certification in order to permit the staff to make its safety finding. CE indicated that, although the presentation only showed dynamic mock-up of the Reactor Coolant System Panel, mock-up of a few other panels were being planned. The staff also indicated that a demonstration test of integrated panels should include the use of standard, written procedures. The staff stated that, if the Commission approves these recommendations, CE had the option of requesting an exception by providing acceptable justification for their approach.

Finally, the afternoon was spent discussing the request for additional information issued by the NRC on December 21, 1990 regarding human factors issues. CE made a presentation on their understanding of the general areas of the staff's informational needs (Enclosure 4). More specific discussions on individual questions were also held.

original signed by
Thomas V. Wambach, Project Manager
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Enclosures:
As stated

Proj. 675

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

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As stated

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ENCLOSURE 1

NUPLEX 80+ Meeting
February 7, 1991

Name	Affiliation
Tom Wambach	NRR/DAR/PDST
Stan Ritterbusch	ABB/CE
Cecil Thomas	NRR/DLPQ
Jerry Wermiel	NRR/DLPQ/LHFB
Donna L. Smith	NRR/DLPQ/LHFB
Richard J. Eckenrode	NRR/DLPQ/LHFB
Richard P. Correia	NRR/DLPQ/LHFB
Jim Stewart	NRR/DST/SICB
Bob Fuld	ABB/CE
Daryl Harmon	ABB/CE
Stu Long	ACRS/NRC
Isabel Herb	NRR/DLPQ/LHFB
Greg Galletti	NRR/DLPQ/LHFB
Mike Waterman	NRR/DST/SICB
Matt Chinamal	NRR/DST/SICB
Charles Brinkman	ABB/CE Rockville
Jerry Wachtel	RES/DSR/HFB
Tom Rotella	ACRS Staff
Roberto Ranieri	NRR-PDST (ENEA-DISP)
Kenneth Scarola	ABB/CE

ENCLOSURE 2

10 CFR 52.47(b)(1) thru 52.47(b)(2)(B)
(1990, PAGES 51 & 52)

(1) THE APPLICATION FOR CERTIFICATION OF A NUCLEAR POWER PLANT DESIGN... MUST PROVIDE AN ESSENTIALLY COMPLETE POWER PLANT DESIGN EXCEPT FOR SITE-SPECIFIC ELEMENTS SUCH AS THE SERVICE WATER INTAKE STRUCTURE AND THE ULTIMATE HEAT SINK.

(2)(i) CERTIFICATION OF A STANDARD DESIGN WHICH DIFFERS SIGNIFICANTLY FROM THE LIGHT WATER REACTOR DESIGNS DESCRIBED ...UTILIZES... OTHER INNOVATIVE MEANS TO ACCOMPLISH ITS SAFETY FUNCTION WILL BE GRANTED ONLY IF...

(B) THERE HAS BEEN ACCEPTABLE TESTING OF AN APPROPRIATELY SITED, FULL SIZE, PROTOTYPE OF THE DESIGN OVER A SUFFICIENT RANGE OF NORMAL OPERATING CONDITIONS, TRANSIENT CONDITIONS, AND SPECIFIED ACCIDENT SEQUENCES ... THE TESTING OF THE PROTOTYPE MUST DEMONSTRATE THAT THE NON-CERTIFIED PORTION OF THE PLANT CANNOT SIGNIFICANTLY AFFECT THE SAFE OPERATION OF THE PLANT.

1.0 PROVEN TECHNOLOGY

HARDWARE
-JUSTIFICATION OF HARDWARE SELECTIONS
- BASED ON HUMAN FACTORS STUDIES AND CONSIDERATIONS
- HOW WILL IT IMPROVE HUMAN PERFORMANCE?
- IMPROVEMENT OF HUMAN PERFORMANCE OVER BASELINE DESIGN SHOULD BE VERIFIABLE

SOFTWARE
-DISCRETE SYSTEMS MODULES (E.G. DIGITAL FEEDWATER CONTROL SYSTEMS) CURRENTLY IN USE ARE FAR LESS COMPLEX THAN AN "INTEGRATED DATA BASE"

- SOFTWARE DEVELOPMENT
  - HUMAN FACTORS GUIDELINES FOR SYSTEM SOFTWARE DEVELOPMENT

- SOFTWARE VERIFICATION AND VALIDATION
  - HUMAN FACTORS ASPECTS OF VERIFICATION AND VALIDATION
  - DEVELOPMENT OF METHODS TO TO ENSURE THE BASELINE SYSTEM MEETS HUMAN PERFORMANCE OBJECTIVES

- SOFTWARE MAINTENANCE AND UPGRADES
  - METHODS OF FEEDBACK TO ENSURE CHANGES AND UPGRADES MEET SYSTEM PERFORMANCE OBJECTS
  - ENSURE PERTURBATIONS FROM BASELINE DESIGN CAN BE IDENTIFIES DURING POST MAINTENANCE TESTING

CONFIGURATION
- FLEXIBILITY FOR RECONFIGURATION
- BACK-UP CONFIGURATIONS FOR HARDWARE AND SOFTWARE FAILURES
- PROVIDE OPERATOR INFORMATION PRESENTATION, RETRIEVAL AND ANALYSIS CAPABILITY AS CLASS 1E

OPERATOR INTERACTION
- GOAL IS TO INCREASE THE RELIABILITY OF HUMAN PERFORMANCE ,OR, DECREASE THE PROBABILITY OF RISK THAT CAN BE ATTRIBUTED TO THE HUMAN COMPONENT OF THE SYSTEM

2.0 PROTOTYPE TESTING

OBJECTIVES
- THE PURPOSE OF THE TESTS
  - PROOF OF CONCEPT
  - SUB-SYSTEM (HARDWARE/SOFTWARE)
  - INTEGRATION (HARDWARE/SOFTWARE/TEAM PERFORMANCE)
  - VERIFICATION AND VALIDATION
  - REGULATORY REVIEW
  - VERIFY THAT THE DESIGN OBJECTIVES (I.E. HUMAN PERFORMANCE GOALS) HAVE BEEN MET

SCOPE
- THE BREADTH AND DEPTH OF THE TEST PROGRAM (HARDWARE, SOFTWARE PERSONNEL SUB-SYSTEM (I.E. HUMAN FACTORS, HUMAN PERFORMANCE, MAN MACHINE INTEGRATION))
- QUANTITATIVE AND QUALITATIVE PASS/FAIL CRITERIA
- RECOURSE FOR COMPONENTS, SUB-SYSTEMS AND SYSTEMS THAT FAIL TO MEET TEST CRITERIA

SCHEDULE
- ESTABLISHMENT OF PROJECT MILESTONES AND TEST SCHEDULE
- SCHEDULE DEVELOPMENT OF PROTOTYPE EARLY IN PLANT'S DESIGN PROCESS
- CHANGE PROTOTYPE AS NECESSARY TO CORRECT IDENTIFIED PROBLEMS

3.0 SUMMARY

- HUMAN FACTORS STUDIES MUST BE THE BASIS FOR THE APPLICATION OF NEW TECHNOLOGY

- CHANGE DOES NOT NECESSARILY = IMPROVED HUMAN PERFORMANCE

- SYNERGISTIC EFFECTS MUST BE CONSIDERED AND ACCOUNTED FOR
  - MIXING EXISTING AND NEW TECHNOLOGIES
  - COMBINING "PROVEN" NEW TECHNOLOGIES INTO UNPROVEN CONFIGURATIONS FOR ADVANCED CONTROL ROOM APPLICATIONS

- BOTTOM LINE: IMPROVEMENT OF HUMAN PERFORMANCE / REDUCTION OF RISK

PROVEN DESIGN - PROGRAMMABLE LOGIC CONTROLLERS (PLCs)

- NINE KNOWN NUCLEAR PLANT APPLICATIONS INCLUDING IN CLASS 1E SYSTEMS

  DIESEL SEQUENCERS
  DIVERSE PROTECTION SYSTEMS
  VARIOUS CONTROL SYSTEMS

- MORE THAN TWENTY-FIVE NON-NUCLEAR UTILITY APPLICATIONS

  SAFETY SYSTEMS
  CONTROL SYSTEMS
  SUPERVISORY SYSTEMS

- PROVEN USE IN VARIETY OF OTHER PROCESS TECHNOLOGIES

  SOLAR POWER PLANTS
  AUTOMOBILE MANUFACTURING
  FOOD PROCESSING PLANTS
  CHEMICAL PROCESS PLANTS

PROVEN DESIGN - PROTECTION SYSTEMS

PLANT PROTECTION SYSTEM

- HARDWARE BASED ON PROVEN PLC TECHNOLOGY
- FUNCTIONALLY SIMILAR TO PPS SYSTEMS OPERATING AT 7 NUCLEAR UNITS (FIRST LICENSED IN 1978)
- PPS DESIGN HAS 50+ OPERATING YEARS

CORE PROTECTION CALCULATORS

- SOFTWARE BASED CLASS 1E SYSTEM FIRST LICENSED IN 1978
- 8 SYSTEMS INSTALLED AT OPERATING NUCLEAR PLANTS
- 50+ CPC OPERATING YEARS

PROVEN DESIGN - CONTROL SYSTEMS

COMPONENT CONTROL SYSTEM

- HARDWARE BASED ON PROVEN PLC TECHNOLOGY
- ESF-CCS PERFORMS FUNCTION OF AUXILIARY RELAY CABINET USED IN 7 NUCLEAR UNITS
- PROCESS-CCS PERFORMS FUNCTION OF CONVENTIONAL PROCESS CONTROL AND ALTERNATE PROTECTION SYSTEMS
- BOTH SYSTEMS REPLACE PLANT DATA ACQUISITION SYSTEM FUNCTION

POWER CONTROL SYSTEM

- HARDWARE BASED ON PROVEN PLC TECHNOLOGY
- CEDMCS DESIGN OPERATING AT 8 NUCLEAR UNITS
- REACTOR REGULATION SUPPLIED WITH ALL C-E PLANTS
- REACTOR POWER CUTBACK USED ON 4 OPERATING NUCLEAR UNITS
- MEGAWATT DEMAND SETTER LICENSED AT ANO-2

PROVEN DESIGN - MONITORING SYSTEMS

DATA PROCESSING SYSTEM

- SIMILAR PLANT MONITORING COMPUTERS DESIGNS OPERATING AT 9 NUCLEAR UNITS
- 7 SPDS (CFMS) SYSTEMS INSTALLED AT NUCLEAR PLANTS
- DPS AVAILABILITY = 99.98% DURING SYSTEMS TESTS

DISCRETE INDICATION AND ALARM SYSTEM

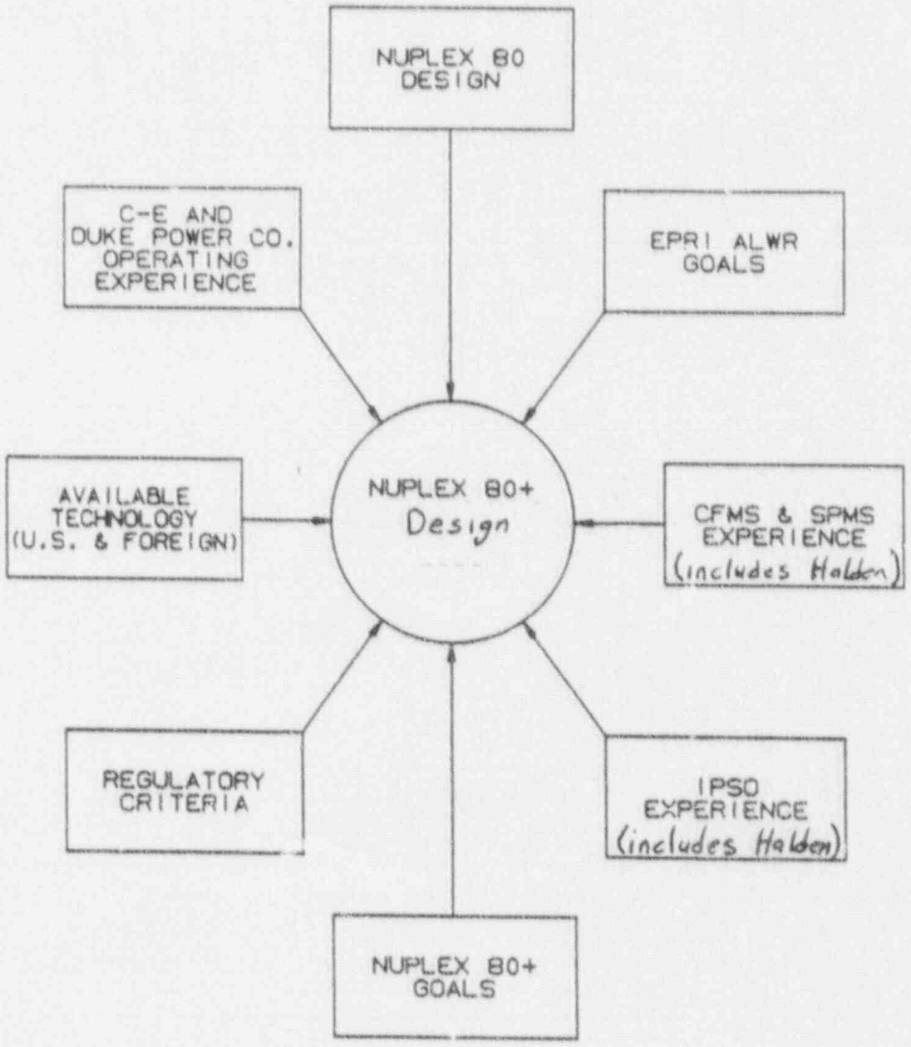
- PC TECHNOLOGY

CLASS 1E
- SUBCOOLED MARGIN MONITORS
- HEATED JUNCTION THERMOCOUPLE SYSTEMS
- QUALIFIED SAFETY PARAMETER DISPLAY SYSTEMS

CEA DISPLAYS AND RPC DISPLAYS

- FLAT PANEL DISPLAY TECHNOLOGY

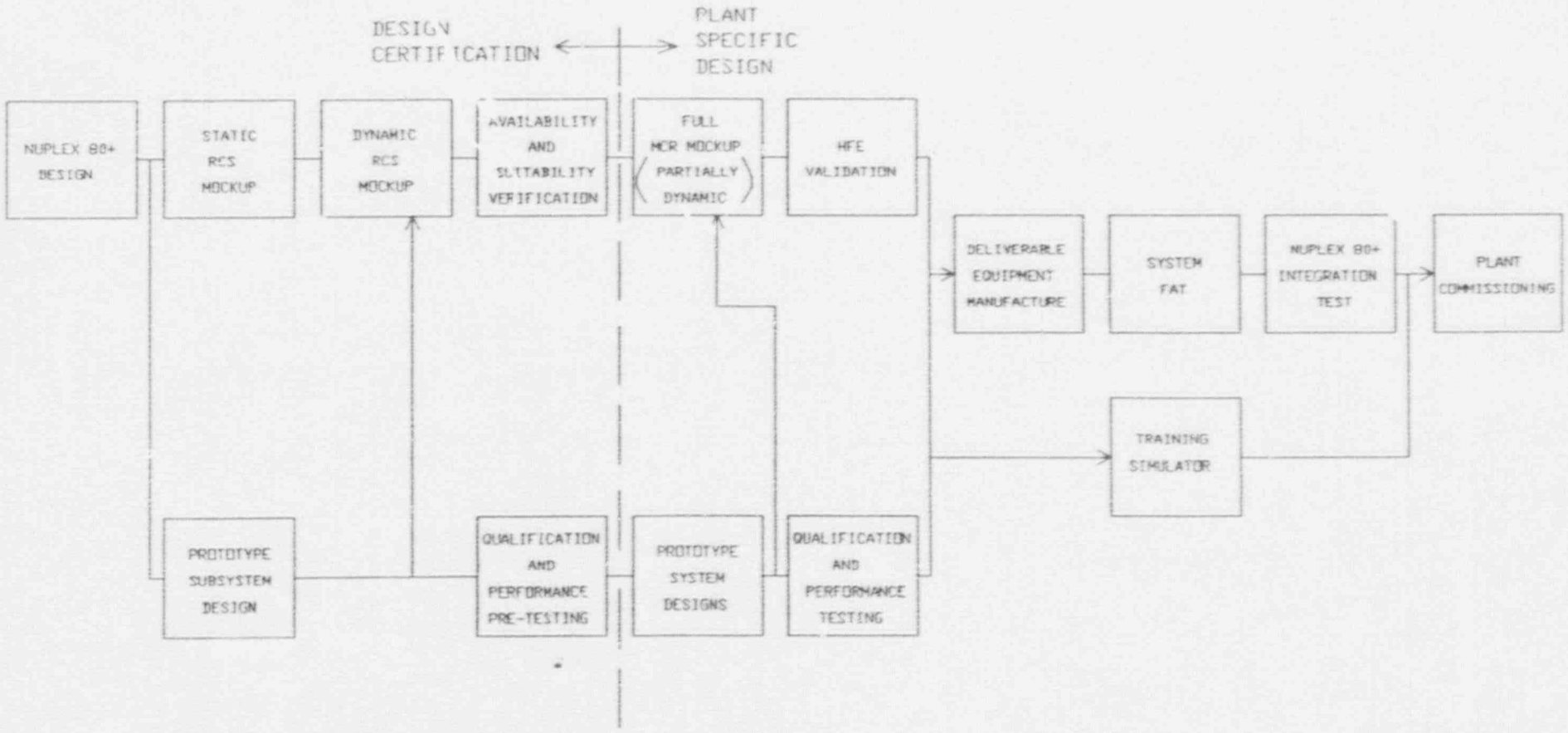
CPC OPERATOR'S MODULE FOR ANO-2
PLANT COMPUTER DISPLAYS
QSPDS



Amendment D
September 30, 1988

SYSTEM 80+™	NUPLEX 80+ MAN-MACHINE INTERFACE PHILOSOPHY	Figure 18.4-5

NUPLEX 80+ DESIGN PROCESS



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DATE 04-FEB-91

RAI I&C KEY ISSUES

- LEVEL OF DETAIL
- SOFTWARE RELIABILITY
- PPS BYPASS AND TESTING METHODOLOGY
- FAILURE MODES AND EFFECTS
- EMI AND RFI QUALIFICATION

RAI HUMAN FACTORS KEY ISSUES

- HUMAN FACTORS PROGRAM PLAN
- HUMAN FACTORS ENGINEERING CRITERIA
- HUMAN FACTORS DESIGN PROCESS
- HUMAN FACTORS VALIDATION