NORTHEAST UTILITIES

THE CONNECTICUT LIGHT AND POWER COMPANY
WESTERN MASSACHUSETTS ELECTRIC COMPANY
HOLYOKE WATER POWER COMPANY
NORTHEAST UTILITIES SERVICE COMPANY
NORTHEAST NUCLEAR ENERGY COMPANY

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June 14, 1984

Docket No. 50-423

B11231

Director of Nuclear Reactor Regulation
Mr. B. J. Youngblood, Chief
Licensing Branch No. 1
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Reference: (1) W. G. Counsil letter to B. J. Youngblood, Response to Question 492.6 and Draft SER Open Items CPB-3 and ICSB-14, dated May 18, 1984.

Dear Mr. Youngblood:

Millstone Nuclear Power Station, Unit No. 3
Additional Information for Question 492.6
and Draft SER Open Items CPB-3 and ICSB-14

Attached is the information requested in Appendix I to Generic Letter 82-28 which we committed in Reference (1) to provide at a later date. This information should fully resolve the Staff's concerns regarding this question/open item. If there are any questions, please contact our licensing representative directly.

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY
et. al.

BY NORTHEAST NUCLEAR ENERGY COMPANY
Their Agent

W. G. Counsil

W. G. Counsil
Senior Vice President

WFFee

By: W. F. Fee
Executive Vice President
Engineering & Operations

B001
1/1

STATE OF CONNECTICUT)
) ss. Berlin
COUNTY OF HARTFORD)

Then personally appeared before me W. F. Fee, who being duly sworn, did state that he is Executive Vice President of Northeast Nuclear Energy Company, an Applicant herein, that he is authorized to execute and file the foregoing information in the name and on behalf of the Applicants herein and that the statements contained in said information are true and correct to the best of his knowledge and belief.

Notary Public

My commission expires 3/31/88.

Open Items

Core Performance Branch (CPB)

CPB-3 Item II.F.2 of NUREG-0737 (Draft SER Section 4.4.8)

Provide itemized documentation of a complete ICC system including SMM, CET, and RITs on a schedule that permits the Staff's review before fuel loading.

Response

Refer to the response to NRC Question 492.6.

Open Items

Instrumentation and Control Systems Branch

ICSB-14 NUREG-0737 Item II.F.2 - Instrumentation for Detection of Inadequate Core Cooling (Draft SER Section 7.5.2.5)

The applicant has not described his design for this item. This is an open item.

Response

Refer to the response to NRC Question 492.6.

NRC Letter: May 31, 1983

Question Q492.6 (SRP Section 4.4)

The staff has reviewed the Applicant's submittal (FSAR Section 4.4.6.5) with respect to NUREG-0737 Item II.F.2 requirements and has found that the Applicant's submittal is incomplete. Therefore, the staff will require the Applicant to provide the documentation required by Item II.F.2 of NUREG-0737 for staff review.

Response

In response to NUREG-0737, recommendation for detection for inadequate core cooling (ICC), the applicant provided its position on the installation of additional instrumentation for providing an unambiguous indication of approach to ICC in FSAR Section 4.4.6.5. On December 10, 1982, the NRC Staff forwarded Generic Letter 82-28 which outlined the requirements for the installation of additional instrumentation for detection of ICC for operating plants. Please refer to revised FSAR Section 4.4.6.5 for additional information on the documentation of the proposed instrumentation system. Items 1-9 of the checklist provided in Generic Letter 82-28 (Appendix I) are attached.

The output signal from each accelerometer is amplified by a preamplifier. The amplified signal is processed through a detector filter and discriminator to eliminate noise and signals not indicative of loose parts, and the processed signal is compared to a preset alarm setpoint.

If a measured signal exceeds the preset alarm level, audible and visible alarms at the LPMS console in the control room are activated. The LPMS also automatically initiates a four-channel cassette tape recording of the signals from the alarmed channel and the three other channels in proximity to the alarmed channel. The LPMS also has provision for audio monitoring of any channel. The audio channel can be compared with a previously recorded audio signal, if desired.

The online sensitivity of the LPMS is such that the system will detect a loose part that weighs from 0.25 to 30 pounds and impacts with a kinetic energy of 0.5 foot pound on the inside surface of the RCS pressure boundary within 3 feet of a sensor.

The piezoelectric sensors and hardline cables inside the containment are designed for LOCA or steamline break temperatures, pressures, and humidity. The preamplifiers and other cables inside the containment are designed for a peak temperature of 150°F, but the same pressure and humidity as the sensors. All of the equipment inside the containment are designed to remain functional for the radiation exposures anticipated during their lifetime.

The LPMS will be calibrated prior to plant startup. Capabilities exist for subsequent periodic online channel checks and channel functional tests for offline channel calibrations at refueling outages.

4.4.6.5 Instrumentation for Detection of Inadequate Core Cooling

INSERT (A)

A subcooled margin monitor (SMM) and a core exit thermocouple (CETC) system are used to meet the requirements for detection of inadequate core cooling. The SMM is a stand-alone system which monitors the degradation of the margin to saturation during the early stages of a postulated inadequate core cooling event. The CETC system measures the temperature of the reactor coolant as it leaves the core, giving an indication of fuel cladding conditions. The SMM consists of redundant channels and output trains of wide range hot and cold leg RTD temperatures and reactor pressure signals.

The detection system provides presentation and display of the status of the core heat removal capability to both the plant operators and the technical support center. These parameters are used by the system to display thermocouple temperatures and to calculate saturation temperatures and margin of saturation (Tsat margin), which is often referred to as subcooling. The calculations are performed by the system which is based on microprocessor and data handling devices.

INSERT A

The ICC Monitoring System integrates the processing and display of:

1. Subcooled/Superheat (SC/SH) Monitor

2. Core Exit Thermocouples (CETs)

3. Combustion Engineering - Heated Junction Thermocouple (HJTC) System for inventory tracking.

The information provided by this system allows the plant operators to monitor the reactor status during abnormal plant conditions. The operator uses this information to take corrective action as needed and/or confirm that actions taken produce the desired result. Thus, the approach to, existence of, and recovery from inadequate core cooling conditions can be monitored consistent with the requirements of NUREG-0737, Section II.F.2. The Millstone Unit No. 3 ICC System is designed as Category 1 (Class 1E) with redundant trains (train A and train B). Each train contains stand alone processing electronics and displays, which monitors, alarms, and trends ICC, as shown in FSAR Figure 4.4-11.

Subcooled/Superheat monitors use RCS temperatures and pressures to calculate the degree of Subcooling or Superheat in the reactor coolant either in terms of temperature or pressure. The calculation is based upon the most conservative input temperature and pressures.

Core exit thermocouples are provided with required cold junction temperature compensation. All core exit temperatures are displayed on a digital panel meter, selectable from a switch panel.

The Heated Junction Thermocouple System monitors coolant inventory in the region above the core. Redundant strings of heated junction thermocouples are arranged in the reactor vessel head area to provide indication of conditions at eight distinct levels. The system is a two-channel system each consisting of a string of eight sensors.

Each ICC cabinet (train A & B) has a qualified class 1E display system that includes the following ICC information:

1. Subcooled/Superheat in °F (300°F Subcooling to 45°F Superheat)

2. Core exit temperatures (200°F to 2300°F).

3. % Level in the plenum and head areas.

The primary means of displaying all the ICC information is provided via the Safety Parameter Display System (SPDS). SPDS will receive all the ICC transmitted data with optical isolation provided by ICC. SPDS will have the capability to calculate Subcooling/Superheat based on primary coolant temperatures, T_{hot}, T_{cold}, CET, unheated junction temperatures of HJTC, and RCS pressure. Signal Validation techniques are utilized in the SPDS to insure the quality of the input variables. SPDS displays are designed to incorporate accepted human factors principles so that the displayed ICC information can be readily perceived and understood by plant operators during normal and abnormal plant conditions.

Alarms are provided on Main Control Boards from the ICC Cabinets. There are four alarms, saturation/superheat trouble alarm, CET high alarm, plenum % level alarm, and head % level alarm.

MILLSTONE POINT UNIT 3 NUCLEAR POWER STATION
ICC FUNCTIONAL BLOCK DIAGRAM - TRAIN A
TRAIN B - SIMILAR

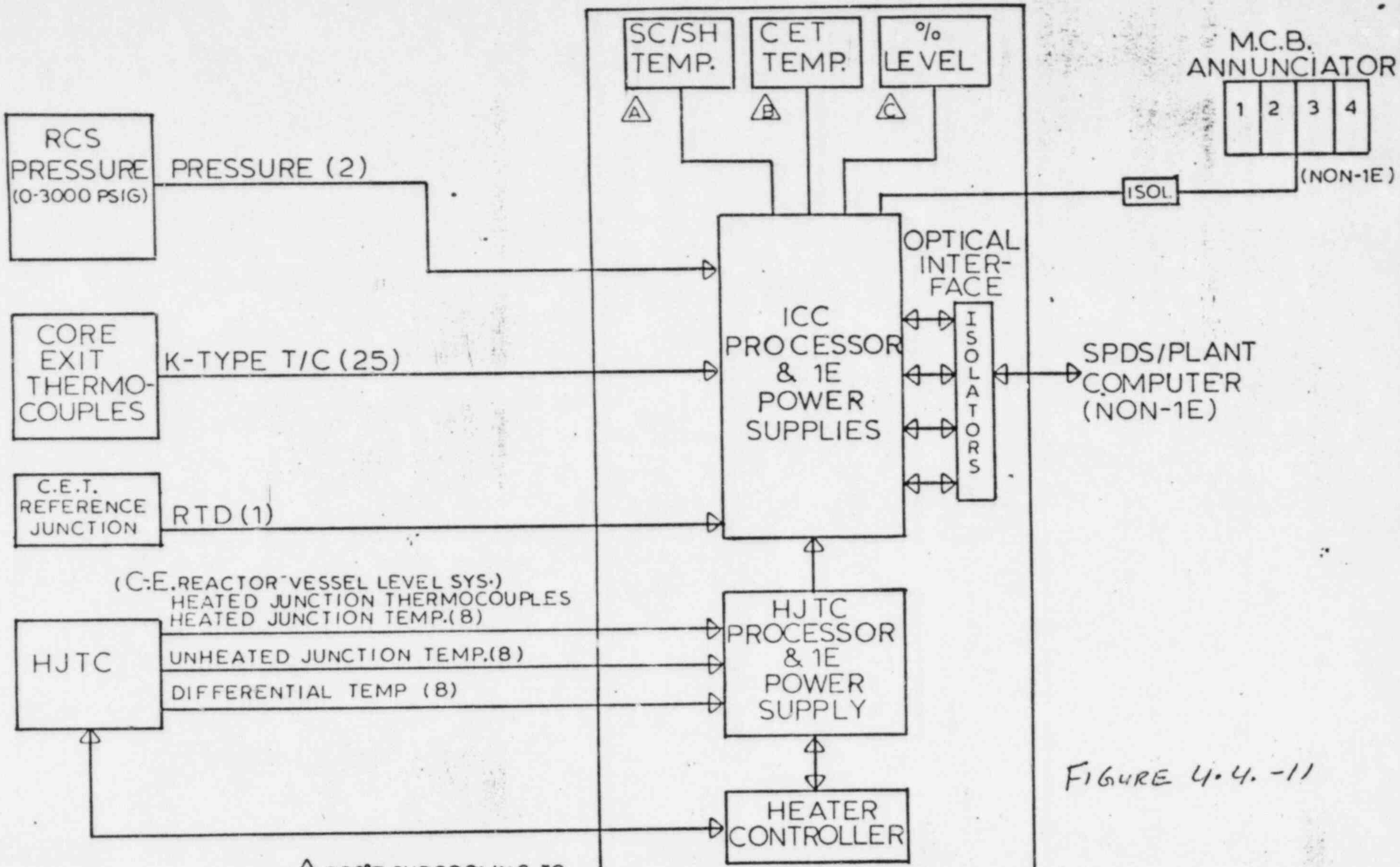


FIGURE 4.4.-11

M.C.B. ANNUNCIATOR
1-SC/SH TROUBLE ALARM
2-C.E.T. HIGH ALARM
3-PLENUM % LEVEL ALARM
4-HEAD % LEVEL ALARM

A 300°F SUBCOOLING TO 45°F SUPERHEAT
B 200°F - 2300°F
C 0-100% LEVEL
SC/SH-SUBCOOLED/SUPERHEATED
( )-NUMBER OF SENSORS

Appendix to Generic Letter 82-28
Millstone Unit No. 3
Plant-Specific Information for the items from NUREG-0737, pp. II.F.2-3 and 4

1. Description of the proposed final system including:

   a. a final design description of additional instrumentation and displays.

   b. detailed description of existing instrumentation systems.

   c. description of completed or planned modifications.

Response:

a. Refer to revised FSAR Section 4.4.6.5

b. Not Applicable

c. Not Applicable

2. A design analysis and evaluation of inventory trend instrumentation, and test data to support design in item 1.

Response:

The Design Analysis and Test Data are described in

1) CEN-181, Question 2, Documentation of ICC for C-E NSSS.

2) CEN-185 (Appendix A), Generic Response to NRC Question on the CE ICC instrumentation.

3) CEN-185 (Section 6) & Supplements 1, 2, & 3, CE Emergency Procedure Guidelines.

4) CEOG Letter from K. Baskin to D. M. Crutchfield (NRC) dated June 1, 1982, Questions 1, 2, 3, and 4.

3. Description of tests planned and results of tests completed for evaluation, qualification, and calibration of additional instrumentation.

Response:

Refer to response to Appendix B

4. Provide a table or description covering the evaluation of conformance with NUREG-0737P: II.F.2, Attachment 1, and Appendix B (to be reviewed on a plant-specific basis)*

Response:

Refer to response to Appendix B.

5. Describe computer, software and display functions associated with ICC monitoring in the plant.

Response:

ICC SYSTEM SOFTWARE

The objective of the inadequate core cooling monitor is to provide the reactor plant operator with a simple indication of core cooling conditions. This objective is achieved by monitoring a number of reactor system measurements, performing certain calculations using these measurements in a digital computer, and providing the operator with the results of these calculations in real time. This section outlines a structured, modular computer program for performing the required calculations.

Input Variables

The measured quantities used as input variables for the inadequate core cooling monitor are RCS pressure, CET's and HJTC.

Calculations

A number of different calculations are performed, using the input variables, to generate output information for the operator's use. These calculations are itemized below:

(1) All input values are converted to engineering units; ^{o}F for temperatures and PSIA for pressures.

(2) All engineering unit values are checked for "reasonableness" before being used in any further calculations. Precise "reasonableness" limits will be defined and verified by careful analysis during the program.

(3) The limiting values module will search through the validated signals for the lowest pressure, the highest CET, and the CET selected for the panel display. (An automatic mode to select the highest will be available.)

(4) The saturation margin module uses the lowest pressure to find the saturation temperature, the highest temperature to find one saturation pressure, and the selected temperature to find the second saturation pressure. Four margins will be calculated: a pressure and temperature margin for the highest temperature and a pressure and temperature margin for the selected temperature. Adapted versions of the subroutines built by McClintock and Silverstri for the ASME steam table will be used for saturation calculations.

(5) The data for the panel displays will be formatted. These data will include the selected temperature, its temperature margin to saturation, and an input error indicator.

System Operation

The inadequate core cooling monitor, once the initial startup is accomplished, will be self-sustaining. All program operations, from input through calculations to output, including periodic testing, will be performed sequentially. The program will cycle asynchronously at a rate determined by the time required to perform the necessary operations. Analog points may also be deleted from the scan using panel switches.

System Diagnosis

A system performance test will be executed periodically to detect software or hardware failures. The test will insert, through software, a set of standard input values, momentarily replacing the actual A/D converter outputs. After one pass through the program, all computed output values will be compared with expected output values for those standard inputs and any deviation reported as a system error. If a system error occurs, all intermediate computational results will be saved to assist the operator in isolating the source of the error.

System and Handler Software

Intel 8086-based software will perform the necessary ICC functions of data validation and conversion, selection of limiting pressures and temperatures, calculation of temperature and pressure margins, maintaining tabular and formatted data files, maintaining tabular and formatted system status files, and controlling the communication through the serial parts.

System software will be based on the iRMX 86 operating system. Applications programming will use the iRMX 86 languages and utilities. The high-level language will be iRMX 86 FORTRAN. Utilities will include iRMX 86 EDIT, iRMX 86 LIB, and iRMX 86 LINK/LOCATE. The iRMX 86 MACRO ASSEMBLER will be available for providing any special interface routines not practicable in the FORTRAN language.

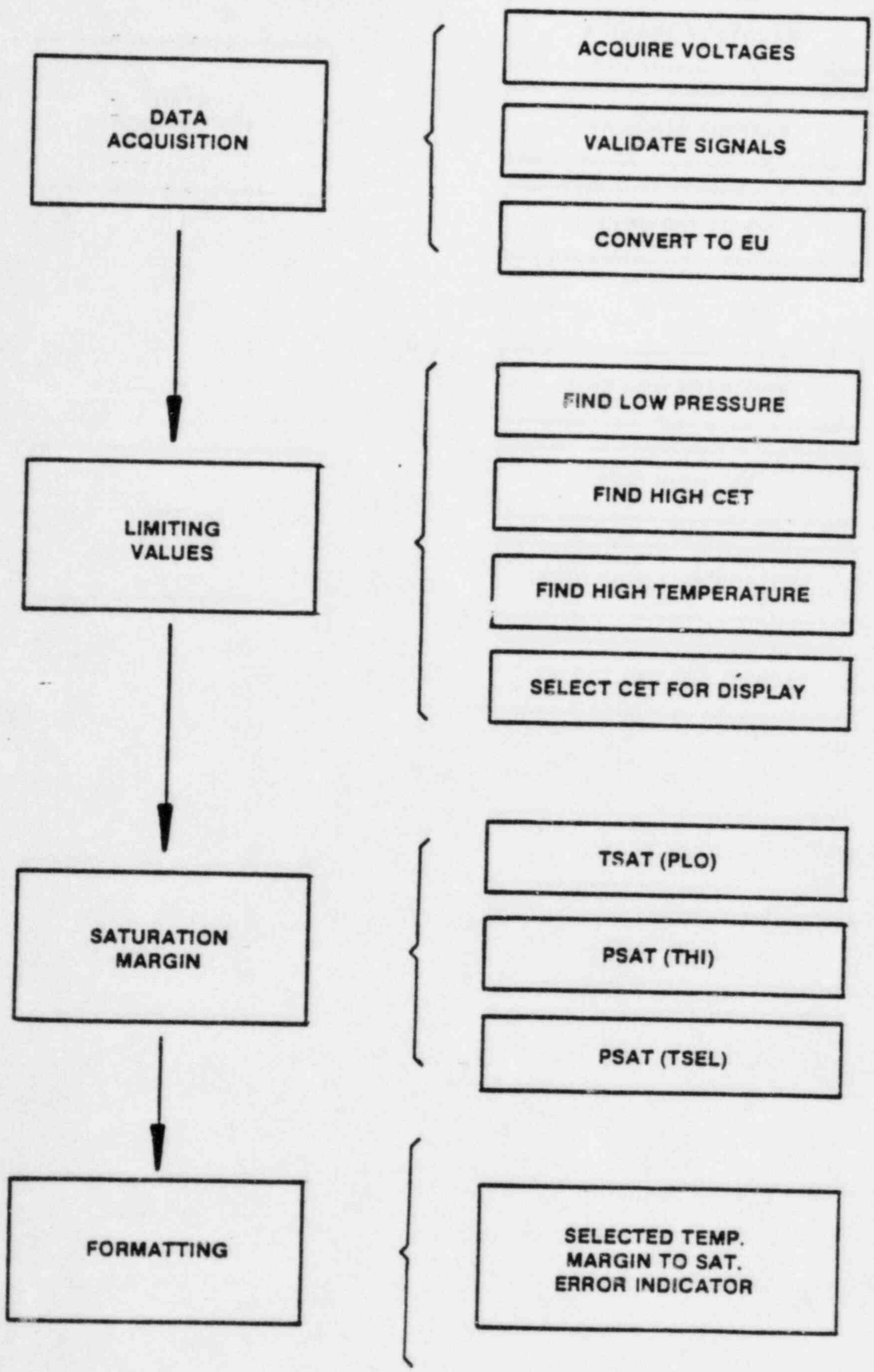
The Intel iRMX 86 operating system is comprehensive multiprogramming system for a microcomputer based on an 8086 microprocessor. It is based on a real-time, and provides a foundation for the process calculations and data communications needed for the ICC application.

The applications program will have two major divisions: one handling process calculations and other handling on-demand communications.

Process Calculations

The process calculations will be broken down into several smaller modules: data acquisition, limiting values, saturation margin, and formatting. These in turn will be split into small modules. The process calculation is shown as a block diagram in Figure 1.

FIGURE 1. PROCESS CALCULATION



Communications

The on-demand communications module will answer the requests from the four serial ports. The module will be broken into six parts consisting of a command interpreter, four different data transmission modules, and an error handling module. The on-demand communications module is shown as a block diagram in Figure 2.

Data Acquisition

The data acquisition module will provide the data validation process. The data will be checked for switched-out, open, shorted, or out-of-range conditions. A different error code will be stored in an array for each input depending upon the error. The data will then be converted to engineering units according to standard temperature (or pressure) conversion curves.

Command Interpreter

The command interpreter will receive a transmitted command and test for proper syntax. For improper syntax, an error flag will be transmitted and if formatted output was requested, a menu of valid requests will also be transmitted. For proper requests, the module will branch to the appropriate data transmission module.

Four data transmission modules will be supplied. Each will transmit tabular or formatted data as directed by an input flag. The four modules are:

(1) ICC: transmit coolant level, CET summary, subcooling margin;

(2) CET: transmit an individual CET or all CET's;

(3) HJTC: transmit a single HJTC pair or all of them; and

(4) SYS: transmit the status of the system and all inputs.

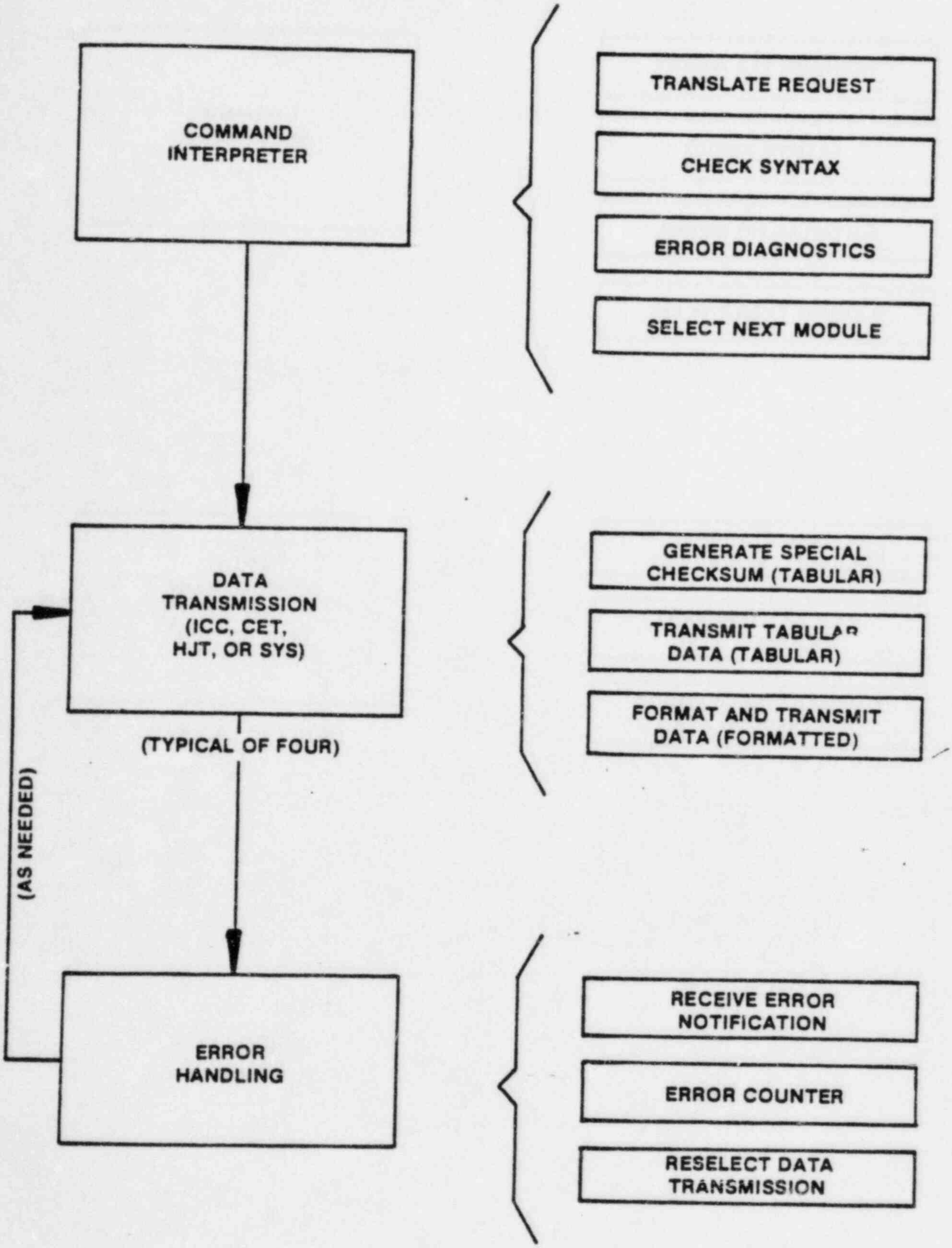
Although four modules will be supplied to satisfy the requirements, the program structure is designed to make adding more modules relatively easy.

The final module in the on-demand communications module handles error correction. Any transmission of data contains parity checking. If the receiver detects a transmission error, the data transmission module will be reentered for another try. After a yet to be specified number of unsuccessful tries, the on-demand communications module will be disconnected.

RVLS

RVLS/HJTC Signal Processor converts the heated junction thermocouple signals into Heater Controller and Operator Interface outputs.

FIGURE 2. ON-DEMAND COMMUNICATIONS



The Heated Junction Thermocouple System (HJTCS) receives sixteen thermocouple inputs; eight heated junction inputs (T_H) and eight unheated (T_U) junction inputs. These signals are transmitted to the HJTCS cabinet from the probe assembly type K thermocouples. At the cabinet the field wires are brought to type K terminal blocks and the type K thermocouple wire is continued as far as the signal conditioning panel mounted on the back of the microprocessor chassis. The signal conditioning panel contains the open thermocouple detection circuitry and the cold reference junction compensation circuitry. Cold junction is accomplished by measuring the barrier temperature utilizing a semiconductor temperature sensor. The temperature sensor circuit produces an output voltage, that is equivalent to the temperature of the barrier strip. To arrive at a compensated output this voltage is added to the measured value of the thermocouple channel. These input data values are converted to digital values by an A/D converter. These digital values are transmitted to an input buffer.

Isolation of the thermocouple input is provided by use of a 'flying-capacitor' approach. This approach reduces the need for expensive or bulky components (i.e. opto isolators or transformers) yet maintains a high common mode rejection ratio. The 'flying capacitor' consists of a capacitor with reed relays to connect either to the thermocouple or to the Analog to Digital conversion circuitry. Normally the reed relay connects the capacitor to the thermocouple input. When the A/D is asked to read the input (inputs read sequentially) reed relays are used to open the connection to the thermocouple signal and to close the connection to the A/D conversion circuitry; thus providing isolation from the input signal.

Data is read from the input buffer and converted to millivolts. This millivolt value is then compensated for thermocouple lead length due to the open thermocouple circuitry. The compensated millivolt value is then converted to an equivalent temperature reading in degrees Fahrenheit (F). Temperature conversion is accomplished by table lookup. Block data exists which has millivolt reading in 5°F steps from 35°F to 2300°F. Linear interpolation is used to find values which fall in between the 5°F steps. (ΔT) is calculated from (T_H) minus (Tu), and is compared against a low setpoint (25°F) and the corresponding error number is set if (ΔT) is less than the setpoint. A low (ΔT) error number indicates that there is a loss of heater power or a heater controller malfunction.

(ΔT) or (Tu) is used to determine % level for both the Head Area and the Plenum Area, as each heated junction thermocouple becomes uncovered. A low-level alarm is generated whenever (ΔT) or (Tu) is greater than 200°F or 700°F respectively. Five degree (5°F) dead bands exist in both the (ΔT) and (Tu) setpoints for uncovered sensor to prevent cycling.

The maximum of the top three (Tu) sensors is selected for the (Tu) value. If all of the top three sensors are removed the (Tu) value will go to zero and the corresponding error number is set.

A maximum (T_H) and a maximum (ΔT) are selected and are used to calculate separate setpoint signals for the heater controllers. The minimum of the two (2) heater controller setpoints signals is selected and sent to each of the heater controllers. The (T_H) and (Tu) heater controller setpoint signals (as shown in Figure 3) are reduced at a constant rate, as their respective (T_H) and (ΔT) values increase above a predetermined value, until it equals zero at the second predetermined setpoint.

The engineering units for the Head Area Level, the Plenum Area Level and the two Heater Controller Setpoint Signals are converted to digital format for output to the D/A converter.

A Watchdog Timer Subroutine Program is reset after every program loop. If not reset, the timer will alarm 20 seconds after it timesout indicating that the processor has stopped running.

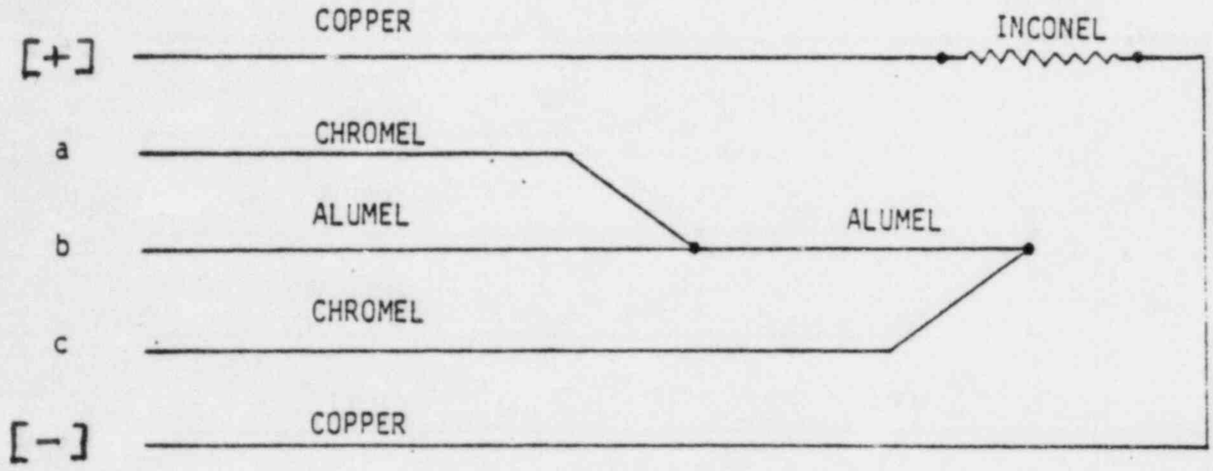
A check Sum Subroutine (cyclical redundancy check - CRC) continually checks all Prom Memory for any single bit change by exclusively "oring" all Prom Memory and setting the corresponding error number if the CRC checked sum is not zero. All RAM is continuously checked by temperorily changing the data and reading the new value. If the data read agrees with the data sent then the original data is replaced. If the data read does not agree with the data sent the corresponding error number is set.

Alarms and errors are brought to the attention of the operator by flashing the Module Digital Indicator. The operator can stop the flashing by pushing the ACK switch. The ACK switch light will stay "on" until all errors and alarm conditions are cleared. Any new error or alarm will start the Module Indicator flashing again until acknowledged by the operator.

The RESET Pushbutton on the Module restarts and initializes the HJTC software program and clears all ram.

Inputs, output and calculated values are sent to the Module for operator interface and indication.

FIGURE 3
ELECTRICAL DIAGRAM OF HJTC



$V(a-b) = V_{TR}$ = ABSOLUTE TEMPERATURE, UNHEATED JUNCTION (T_u)

$V(c-b) = V_{TH}$ = ABSOLUTE TEMPERATURE, HEATED JUNCTION (T_H)

$V_{TH} - V_{TR}$ = DIFFERENTIAL TEMPERATURE (ΔT)

6. Provide a proposed schedule for installation, testing and calibration and implementation of any proposed new instrumentation or information displays.

Reponse:

The installation, testing and calibration will be completed prior to fuel load.

7. Describe guidelines for use of reactor coolant inventory tracking system, and analyses used to develop procedures.

Response:

These quidelines and analyses are described in:

1) CEN-185 (Section 2), Documentation of ICC for C-E NSSS.

2) CEN-181 (Question 2), Generic Response to NRC Question on the CE ICC instrumentation.

3) CEOG Letter from K. Baskin to D. M. Crutchfield (NRC) dated June 1, 1982 (Question 1).

4) CEN-152, Ref. 1, 2, 3, CE Emergency Procedures Guidelines.

5) Westinghouse Emergency Response Guidelines

8. Operator instructions in emergency operating procedures for ICC and how these procedures will be modified when final monitoring system is implemented.

Response:

The operator instructions will be written utilizing the information presented in W ERG's, CEN-152 and CE-NPSD-232. MP-3 plant specific procedures will be available with the Procedures Generation Package (PGP), utilizing the same functional intent as the W ERGS.

9. Provide a schedule for additional submittals required.**

Response:

Not Applicable

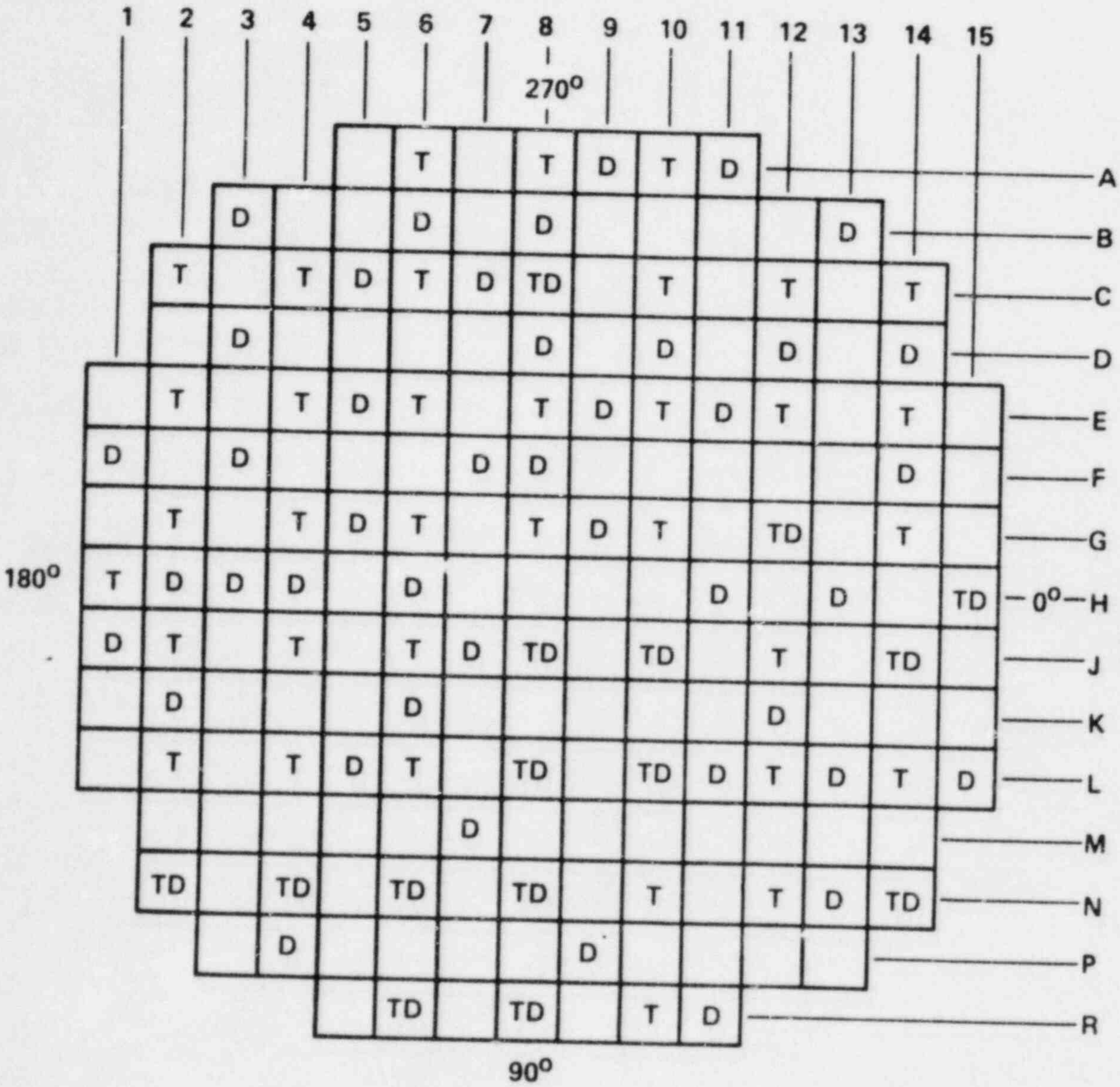
**II.F.2 Attachment 1 (for Core Exit Thermocouples)

In response to item 4 in the above checklist, the following materials should be included to show that the proposed system meets the design and qualification criteria for the core exit thermocouple system.

1. Provide diagram of core exit thermocouple locations or reference the generic description if appropriate.

<u>Response</u>

Refer to FSAR Figure 4.4-10 (Attached)



T = THERMOCOUPLE (50 LOCATIONS)

D = MOVABLE INCORE DETECTOR (58 LOCATIONS)

FIGURE 4.4-10
DISTRIBUTION OF INCORE INSTRUMENTATION
MILLSTONE NUCLEAR POWER STATION
UNIT 3
FINAL SAFETY ANALYSIS REPORT

2. Provide a description of the primary operator display including:

   a. A diagram of the display panel layout for the core map and description of how it is implemented, e.g., hardware or CRT display.

   b. Provide the range of the readouts.

   c. Describe the alarm system.

   d. Describe how the ICC instrumentation readouts are arranged with respect to each other.

Response

The primary means of displaying all the ICC information is provided via the Safety Parameter Display System. (SPDS) The SPDS will receive all the ICC transmitted data via optical isolators provided by the ICC.

a. CRT display showing core map and layouts is being developed and will be provided to the Staff as part of the SPDS revised submittal.

b. Readout Ranges for ICC are as follows.

   i. Subcooled/superheat in °F - 300°F Subcooling to 45°F superheat.

   ii. Core exit temperatures. 200°F to 2300°F.

   iii. % level in the plenum and head areas - 0 to 100%.

c. Alarms are provided on Main Control Board from the ICC Cabinets. These alarms are:

   1. SC/SH Trouble Alarm
   2. CET High Alarm
   3. Plenum % Level Aalrm
   4. Head % Level Alarm

d. All ICC instrumentation readouts are displayed simultaneously providing the following information:

   1. SC/SH in °F.
   2. Core exit temperatures °F.
   3. % level in head and plenum areas.

3. Describe the implementation of the back-up display(s) (including the subcooling margin monitors), how the thermocouples are selected, how they are checked for operability, and the range of the display.

Response

Class 1E back-up display is provided for CET's on the ICC panels located in the Instrument Rack Room.

Selection of specific core exit temperature for display will be performed by two thumb-wheel, BCD-output switches. Also, individual toggle switches will be provided to allow deletion from calculation of any or all sensor inputs. These switches will be mounted on an switch panel and interfaced to parallel I/0 lines in the computer system.

Backup display(s) for subcooling margin monitors are provided as described in revised FSAR Section 4.4.6.5.

4. Describe the use of the primary and back-up displays. What training will the operators have in using the core exit thermocouple instrumentation? How will the operator know when to use the core exit thermocouples and when not to use them? Reference appropriate emergency operating guidelines where applicable.

Response:

The operator instructions will be written utilizing the information presented in W ERG's, CEN-152 and CE-NPSD-232. MP-3 plant specific procedures will be available with the Procedures Generation Package (PGP), utilizing the same functional intent as the W ERGS.

5. Confirm completion of control room design task analysis applicable to ICC instrumentation. Confirm that the core exit thermocouples meet the criteria of NUREG-0737, Attachment 1 and Appendix B, or identify and justify deviations.

Response

The CRDR Task analysis of the Emergency Operating Procedures has identified in each procedure the individual tasks where the operator uses the ICC Cabinet.

The detail information requirements of the displays have not, as yet, been reviewed in view of the fact the cabinets are yet to be installed. This review will be done as part of our Addendum items in the summer of 1985 of our CRDR review. The CETs meet the requirements of Attachment I, Appendix B of NUREG-0737.

6. Describe what parts of the systems are powered from the 1E power sources used, and how isolation from non-1E equipment is provided. Describe the power supply for the primary display. Clearly delineate in two categories which hardware is included up to the isolation device and which is not.

Response

Millstone Unit No. 3 ICC System is designed as Category 1 (Class 1E) with redundant and independent trains. (train A and train B). Each train contains stand alone processing electronics and Class 1E backup displays, which monitors, alarms, and trends ICC. Each train is powered from a separate vital bus. All inputs to the ICC system are powered from vital busses.

The primary display for the ICC system is part of SPDS. SPDS is a non 1E system with its power provided from uninterrupted power sources. 1E to non 1E isolation between the ICC and SPDS is provided by optical isolators which are part of the ICC system. When installed, the SPDS will be tested to insure that the SPDS does not adversely affect the operation of the ICC system.

7. Confirm the environmental qualification of the core exit thermocouple instrumentation up to the isolation device.

Response:

The Core Exit Thermocouples are part of the ICC detection system and as such meet the requirements of Regulatory Guide 1.97 Rev. 3 for the in vessel portion of Type K Thermocouples. The remainder of the system, outside the vessel, is presently undergoing qualification to the requirements of 10CFR50.49, for harsh environment locations and for mild environment locations to the requirements of Reg. Guide 1.89 Rev. 1 which includes up to the isolation devices. The qualification information will be available for review.

Appendix B (of NUREG-0737, II.F.2)

Confirm explicitly the conformance to the Appendix B items listed below for the ICC instrumentation, i.e., the SMM, the reactor coolant inventory tracking system, the core exit thermocouples and the display systems.

1. Environmental Qualification

Response:

ICC Instrumentation Qualification

1. Heated Junction Thermocouple System HJTC/RVLS

   Qualification for out of Reactor Vessel Components has been reviewed and accepted by NNECO. All required documentation is on our file for Staff review. Qualification for the invessel portion of the probe is being reviewed by NNECO. Upon completion, documentation will be available for Staff review.

2. SC/SH and CET processing and display system cabinets are located in the instrument rack room which is a mild environment. Qualification is presently being performed to meet the requirements of Reg. Guide 1.89, Rev. 1. Upon completion, documentation will be available for Staff audit.

3. Core Exit Thermocouples

   See response to item 7 on previous page.

2. Single-Failure Analysis

Response:

The ICC Processing and Display Cabinet utilizes two electrically and physically independent channels. Each channel consists of one HJTC probe assembly (eight sensors), 2 RCS Pressure, and 25 CET's, three signal processing units, two heater power supplies, three operator display, cabling and connectors. The two channels are identical including sensor locations. The two independent displays will continuously display percentage of reactor vessel level above the fuel alignment plate, SC/SH and CET. temperatures.

Most power supply failures, capable of causing an erroneous or ambiguous indication will be automatically detected and a fault signal provided to the operator. Any failure which causes an error in level indication will result in a difference in the level indications on the two operator displays. The operator will then be able to obtain individual thermocouple junction temperatures for operability checking and diagnostic purposes upon manual command at the operator module. This will enable the operator to determine which channel is operating correctly.

3. Class IE Power Source

Response:

Millstone Unit No. 3 ICC System is designed as Category I (Class IE) with independent and redundant trains. (train A and train B). Each train contains stand alone processing electronics and Class IE backup displays, which monitors and alarms ICC. Each train is powered from a separate Class IE vital bus.

IE to non-IE interfaces are provided by utilizing optical isolators.

The primary ICC display is part of SPDS. SPDS is non IE system with its power supplied from uninterrupted power sources.

4. Availability Prior to Accident

Response:

NNECO is presently reviewing documentation for availability prior to accident and this information will be made available to the Staff when the review is completed.

5. Quality Assurance

Response:

The entire ICC system from sensors through processing and display systems is engineered, designed, and constructed as a QA Category I system in accordance with the requirements of 10CFR50 Appendix B.

6. Continuous Indication

Response:

Refer to the revised FSAR Section 4.4.6.5.

7. Recording of Instrument Outputs

Response:

The SPDS/plant computer will periodically read the contents of both ICC trains. This ICC information will be stored on the SPDS historical file which can be accessed upon operator command. The historical file will permit outputs in printed format or trend format for up to two hours pre-event and hours twelve post-event.

8. Identification of Instruments

Response:

Millstone Unit No. 3/ICC Cabinets

Train A - 3CTS* ICC/A

Train B - 3CTS* ICC/B

9. Isolation

Response:

Refer to the response to item 3 of the above Appendix B of this response.

**For the users of either Combustion Engineering Heated Junction Thermocouple (HJTC) System or Westinghouse Differential Pressure (dp) system a detailed response to the plant-specific items stated below should be provided.

A. Westinghouse dp System

1. Describe the effect of instrument uncertainities on the measurement of level.

2. Are the differential pressure transducers located outside containment?

3. Are hydraulic isolators and sensors included in the impulse lines?

Response:

Not applicable.

B. CE HJTC System

1. Discuss the spacing of the sensors from the core alignment plate to the top of the reactor vessel head. How would the decrease in resolution due to the loss of a single sensor affect the ability of the system to detect an approach to ICC?

Response:

For all installations, sensor locations in both probe assemblies will be identical.

The following sensor locations are examples of typical sensor placement:

Sensor	Location
1	Near the top of the vessel head.
2	Midway between sensors 1 and 3.
3	Above the upper support plate
4	Top of the hot leg lip.
5	Midway between sensors 4 and 6.
6	Bottom of the hot leg.
7	Midway between sensors 6 and 8
8	Above the upper core plate.

The primary reason for choosing identical spacing was to provide the operator with the means tu quickly observe system faults by any difference in the level indication between the two channels. With eight sensors, the probe assembly provided indications of the collapsed liquid level at inervals ranging from approximately one to four feet. This resolution will be sufficient to adequately determine the level and trending of liquid inventory above the core.