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TELEPHONE: AREA 704
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April 23, 1981

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Attention: Ms. E. Adensam, Chief
Licensing Branch No. 4

Subject: McGuire Nuclear Station
Docket Nos. 50-369 and 50-370

Dear Mr. Denton:

On January 23, 1981 the NRC issued License No. NPF-9 to Duke Power Company for fuel loading and zero power testing of McGuire Nuclear Station Unit 1. Condition 5 of this license requires that Duke provide a schedule for bringing McGuire in compliance with Regulatory Guide 1.97, Revision 2. The attached pages discuss those areas where the McGuire design meets this Regulatory Guide and provides a schedule for upgrading the remaining areas. Duke requests a meeting with the appropriate NRC personnel to discuss those areas identified in the attached as needing clarification.

Very truly yours,

William O. Parker, Jr.

THH:pw
Attachment

cc: T. J. Donat
Senior Resident Inspector
McGuire Nuclear Station

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REG GUIDE 1.97 RESPONSE

A detailed review of the McGuire Nuclear Station instrumentation has been performed per the guidance given in Regulatory Guide 1.97 (Rev. 2) and a Duke Power Company position established. The significant points of this position and the compliance of McGuire Nuclear Station are discussed in this document.

Variables

All of the variable measurement channels required to assess plant and environment conditions during and following an accident are presently installed and operating at McGuire Nuclear Station (Refer to following table). Certain variables tabulated in the 1.97 document are not measured by McGuire instrumentation. These particular variables either do not apply to the McGuire plant design or would not be utilized for operator action and accident analysis. An example of this type of variable is "heat removal by the containment fan heat removal system" as listed in Table 2 under Type D variables. This variable does not apply to the McGuire station since the containment is of ice condenser design and no credit is taken for ventilation system cooling during an accident.

Some new instrumentation (e.g. reactor vessel level) is being installed at McGuire as a result of new requirements stemming from the TMI-2 accident. This instrumentation has been or will be installed per the commitments and schedules provided previously in the document "Duke Power Company, McGuire Nuclear Station, Response to TMI Concerns."

Duke Power Company Positions on Regulatory Guide 1.97 Rev. 2

Type A Variables

Regulatory Guide 1.97 Rev. 2 provides no new significant guidance concerning Type A variables.* The McGuire station Type A variables have been addressed previously in licensing documents submitted by Duke to the NRC.

Nuclear Safety Related Equipment

The instrumentation installed at McGuire Nuclear Station as nuclear-safety related per the FSAR licensing basis meets the intent of the RG 1.97 Rev. 2 definition of Category 1 instrumentation.

* As defined in RG 1.97 Section C.1.1 and including footnote 2 which defines primary information.

Qualification

The environmental qualification of Category 1 instrumentation located in a harsh environment has been addressed in the Duke response to NUREG-0588, "Interim Staff Position of Environmental Qualification of Safety Related Electrical Equipment," dated October 14, 1980. Seismic qualifications are discussed in McGuire FSAR Chapter 3, "Design Criteria." Environmental qualification of Category 2 instrumentation will require further discussion and clarification.

Quality Assurance

Information concerning the Quality Assurance program followed for McGuire Nuclear Station may be found in the McGuire FSAR, Chapter 17, "Quality Assurance." QA requirements for Category 2 instrumentation will require further discussion.

Ranges

The Duke analysis has determined that more than 98% of the existing McGuire ranges for variables listed in Table 2 of RG 1.97 Rev. 2 are adequate for system operation under normal and accident conditions. (Refer to the attached table) However, these ranges do not always envelope the RG 1.97 Rev. 2 ranges. Examples of this are the reactor coolant hot and cold leg temperatures, which are specified to be 50-750° F. in the RG 1.97 Table 2 listing. The Duke range of 0-700°F. is adequate since at 700°F. the saturation pressure is 3090 psia and system relief design pressure is well below that point.

For certain variables, plant accident procedures such as direct sampling of a variable are utilized to gather primary information where wide range instantaneous data is either unavailable or unnecessary. During accident conditions, these procedures are the preferred means of gathering this information due to accuracy considerations. An example of this is the reactor coolant radioactivity monitor, which was not designed to quantify accident conditions and could not be assured of flow after RCP's are tripped. Direct sampling would then be a more accurate and appropriate means of measuring activity during and after an accident.

The instrumentation (<2%) which Duke has determined requires recalibration of the existing range for accident conditions will be modified by June, 1983 or by the end of the first refueling outage thereafter.

Diversity

A diverse means of information verification has been provided at McGuire Nuclear Station for Category 1 instrumentation where failure of one channel could result in information ambiguity that could lead operators to defeat or fail to accomplish a required safety function.

Controls Layout

Instrument grouping and identification will be addressed in the Duke response for Task 1.D.1 of NUREG-0660 and the yet-to-be issued NUREG-0700.

Meteorological Variables

A discussion of the McGuire Meteorological System capabilities as they pertain to NUREG-0654 is contained in an April 3, 1981 letter from Mr. W. O. Parker to Mr. Harold R. Denton. This letter deals with the McGuire Nuclear Station Emergency Plan.

Laboratory Capabilities and Environs Monitoring

The plant portable instrumentation, sampling and laboratory analysis capabilities which now exist at McGuire Nuclear Station are adequate for normal and accident conditions and meet the intent of RG 1.97 Rev. 2. Further information can be obtained in the McGuire FSAR Chapter 12, "Radiation Protection," and "Duke Power Company, McGuire Nuclear Station, Response to TMI Concerns."

Information concerning fixed radiation exposure meters at McGuire Nuclear Station will be provided as part of the Duke response for NUREG-0654 which is currently under development.

Processing Equipment

Most of the variables specified in RG 1.97 Rev. 2 are monitored by independent, dedicated instrument loops. Instrumentation to monitor the remaining variables is contained in the following McGuire systems: process instrumentation hardware, radiation monitoring hardware and incore thermocouples.

Process Instrumentation Hardware

The Process Control System (PCS) is divided into Protection Cabinets and Control Cabinets.

The PCS Protection Cabinets were provided as nuclear safety related equipment and were seismically qualified. The instrumentation loops are separated into four redundant channels with each having its own independent, safety-related vital power source.

Each instrument loop within a channel has an output isolation device which provides a signal for a control board indicator and a second output isolation device which provides a signal for a strip chart recorder and the plant operator-aid computer.

The signal being provided to the computer is isolated such that an open circuit or short circuit will not affect the signal to the recorder or the control board indicator.

Cable separation has been provided between the four instrumentation channels from the sensor up to and including the output isolation device. In addition, instruments previously defined as post-accident-monitoring (PAM) devices have had one channel per variable separated from the other channels. This separation is from the output isolation device to the indicating device on the main control board.

Due to the above considerations, Duke concludes that the instrumentation in the Protection Cabinets meets the intent of the RG 1.97 Rev. 2 definition for Category 1 instrumentation. Refer to the McGuire FSAR, Chapter 7, "Instrumentation and Control" for further discussion.

The PCS Control Cabinets were provided as high-quality instrumentation for use in non-safety related application. The power for these Control Cabinets is supplied from both a battery-backed auxiliary control power bus and a reliable regulated AC bus. See the McGuire FSAR Chapter 8 for a description of the McGuire power systems. Output signals to indication and/or recording equipment is provided through output isolation devices.

Due to the above-listed considerations, Duke concludes that the instrumentation in the PCS control cabinets meets the intent of the RG 1.97 Rev. 2 definition of Category 2 instrumentation.

Radiation Monitor Hardware

Each instrument loop of the McGuire Radiation Monitoring System has an individual power supply which is powered from a reliable battery-backed auxiliary control bus. All process radiation monitors are continuously indicated and recorded in the main control room, with additional hardware for trending capability. All area radiation monitors are continuously indicated in the main control room, with monitors pertinent to station operation providing inputs to the operator-aid computer.

Due to the above considerations, Duke concludes that the instrumentation in the Radiation Monitoring System meets the intent of the RG 1.97 Rev. 2 definition of Category 2 instrumentation. Refer to McGuire FSAR, Chapter 11, "Radioactive Waste Management, " Chapter 12, "Radiation Protection," and "Duke Power Company, McGuire Nuclear Station, Response to TMI Concerns" for further discussion of this system.

Incore Thermocouples

Refer to Appendix 2.

APPENDIX 1

Subcooling Monitor

The McGuire Subcooling Monitor meets the requirements for Category 2 equipment, as called for in RG 1.97 Rev. 2. The subcooling margin is continuously monitored and is powered by a high reliability battery-backed power source (computer has a dedicated inverter). The display is a CRT in the main control room, with a "quick" call-up feature as well as normal graphic display. The "quick" call-up utilizes one button for display access. The functional specifications for the Subcooling Monitor are given on page 11-9 of "Duke Power Company, McGuire Nuclear Station, Response to TMI Concerns."

This response is in answer to questions pertaining to NUREG-0737, Item 11.F.2.

APPENDIX 2

Incore Thermocouples

The following analysis is in response to NUREG-0737, Item II.F.2 Attachment 1, "Design and Qualification Criteria for Pressurized-Water Reactor Incore Thermocouples." Points are addressed in the same order and format as followed in Attachment 1 of II.F.2:

(1) The McGuire Incore Thermocouples are located at the core exit for each quadrant, and in conjunction with core inlet RTD data, are sufficient to provide indication of radial distribution of the coolant enthalpy rise across representative sections of the core. There are a total of 65 core-exit thermocouples.

(2) The primary operator display is on the operator-aid computer CRT. This system has the following capabilities:

(a) A spatially oriented core map is available on demand which indicates the temperature at each core exit thermocouple location. This map can be displayed or printed on demand.

(b) An example of the McGuire selective readings is an on-demand tabular listing of all instantaneous incore thermocouple values. This listing can be displayed or printed on demand.

(c) Direct readout of average and instantaneous values, as well as hard-copy capabilities, are provided for all thermocouple temperatures. The range is 0-2300° F.

(d) Trend capability showing temperature-time histories is designed into the system. Strip chart recorder points are available to assign to any incore thermocouples on demand. In addition, a point-value trend printout is available on the control room typer.

(e) Alarm capability is provided in conjunction with the Subcooling Monitor, which uses the average of all valid thermocouple readings in its calculations and alarms when the value drops below the setpoint.

(f) The CRT displays are designed for rapid operator access and ease of viewing data. In addition, the incore program has a validity-check comparison which reduces the probability of accessing false readings.

(3) A back-up analog readout is provided with the capability of selective reading of any thermocouples in the system. The range will be extended to 2300° F. as discussed in a telephone conversation with the NRC on March 24, 1981 and described in a letter of March 25, 1981 by Mr. W. O. Parker to Mr. H. R. Denton.

(4) The displays for incore thermocouples take the human-factors criteria listed into account. The same display is utilized for both normal and abnormal plant conditions. The validity-check feature only allows valid readings to be displayed. In addition the operators are trained in the use of this type of graphic display.

(5) Duke has reviewed the feasibility of upgrading the qualification of the existing McGuire incore thermocouples. This review has revealed that thermocouples which meet all of the NUREG 0737 requirements are not available at this time. However, Duke will continue to pursue the development of such incore thermocouples.

(6) Isolation between the primary and backup channels is implemented in the form of electrical switches. The primary and back-up display channels are powered by a highly reliable battery-backed power source.

(7) (8) (9) The existing incore thermocouple system is a very simple set of hardware which should, by virtue of its very simplicity, be a highly reliable and accessible system. The reliable and accessible normal CRT display and the existence of a backup display are additional factors which contribute to the overall system reliability.

VARIABLE	RG 1.97 RANGE	DUKE RANGE	RG 1.97 CATEGORY	NUMBER OF CHANNELS	NOTES
Reactor Vessel Level	Core bottom to RV top	Core bottom to RV top	1	2 channels 2 indicated (I) 1 recorded (R) 2 computer points (CP)	
Containment Sump Level	0 to 600,000 gal. level	0-1,000,000 gal. level	1	2 channels 2 I 1 R 2 CP	
Containment Hydrogen Concentration	0 to 30%	0 to 30%	1	2 channels 2 I 1 R 2 CP	
Containment High Range Radiation Monitor	10^0 to 10^7 R/hr	10^0 to 10^8 R/hr	1	2 channels 2 I 1 R 2 CP	
Containment Isolation Valve Position	Closed-Not Closed	Closed-Not Closed	1	1 channel 1 I 1 CP	Switch lights, monitor lights
Pressurizer Level	Top to bottom	0-100%	1	3 channels 3 I 3 CP Sel. Rec.	PCS Protection Cabinet
Steam Generator Wide Range Level	Tube Sheets to Separators	0-100%	1	1 channel per SG 1 Rec.	PCS Protection Cabinet

VARIABLE	RG 1.97 RANGE	DUKE RANGE	RG 1.97 CATEGORY	NUMBER OF CHANNELS	NOTES
Neutron Flux	10^{-6} - 100% Power	10^{0} - 10^{6} cps 10^{-11} - 10^{-3} A 0 - 120% power	1	2 Source Range 2 Intermediate 4 Power Range Selectable Rec. capability	
Incore Instrumentation (core-Exit Thermocouples)	200°F-2300°F	200°F-2300°F	1	Computer Display and Printout. Backup is an analog indicator.	
Auxiliary Feedwater Guaranteed Source	Plant Specific		1		Guaranteed source for Aux. Feedwater is provided by the Nuclear Service Water System. See McGuire FSAR, Chapter 9, "Auxiliary Systems" for further information.
NC Pressure	0 to 3000 psig	0 to 3000 psig	1	2 channels 2 I 1 R 1 CP	PCS Protection Cabinet
NC Hot Leg Temp.	50 to 750° F	0 to 700° F	1	1 channel per loop 1 R 1 CP	PCS Protection Cabinet
NC Cold Leg Temp.	50 to 750° F	0 to 700° F	1	1 channel per loop 1 R 1 CP	PCS Protection Cabinet
NC Radioactivity	5×10^{-1} - 3×10^{4} uCi/gm	10^{-2} - 10^{3} uCi/ml	1	1 channel 1 I 1 CP 1 Selectable Rec.	

VARIABLE	RG 1.97 RANGE	DUKE RANGE	RG 1.97 CATEGORY	NUMBER OF CHANNELS	NOTES
Steam Release Rad. Monitoring	10^{-1} to 10^{3}uCi/cc	10^{2}to10^{3}R/hr	2	1 channel per steamline 1 1	Location will determine range in uCi/cc. Total steam release program is being developed.
RHR Heat Exchanger Outlet Temperature	32-350°F	50-400°F	2	2 channels (1 per heat exchanger) 2 R	PCS Control Cabinet
NI Accumulator Tank Level	10-90%	0-100% (0-14 INWD)	2	2 channels per Accumulator 2 1 per Accum.	PCS Control Cabinet
Containment Spray Flow	0-110% of design	0-400 gpm	2	2 channels (1 per header) 2 1	PCS Control Cabinet
Volume Control Tank Level	Top to bottom	0-100%	2	1 channel 1 1	PCS Control Cabinet
Residual Heat Removal Flow	0 to 110% Desigr	0 to 2500 gpm 0 to 5000 gpm (3000 gpm design)	2	2 channels (1 ea. per heat exchanger) 2 1 1 CP	Computer point is common return flow. PCS Control Cabinet
Boric Acid Charging Flow	0 to 110% design	0-40 gpm (35 gpm design)	2	1 channel 1 1 1 CP 1 R	PCS Control Cabinet
High Pressure Inj. Flow	0 to 110% design	0 to 1000 gpm (boron inj., 550 gpm design)	2	1 channel 1 1 1 CP	PCS Control Cabinet
		0 to 800 gpm (safety Inj., 650 gpm design)	2	2 channels (1 per header) 2 1	PCS Control Cabinet

VARIABLE	RG 1.97 RANGE	DUKE RANGE	RG 1.97 CATEGORY	NUMBER OF CHANNELS	NOTES
Containment Wide Range Pressure	-5 to 60 psig	-5 to 60 psig	1	2 channels 1 I 1 R 2 CP	
Accumulator Isol. Valve Position	Open-Closed	Open-Closed	2	1 channel per vlv. 2 I 1 CP	Annunciator, Monitor light
Pressurizer PORV's	Open-Closed	Open-Closed	2	1 channel per vlv. 2 I 1 CP	
Pressurizer Code Relief Valves °	Open-Closed	Open-Closed	2	1 channel per vlv. 2 I	Annunciator
Low Pressure Inj. Flow (RHR Flow)	0 to 110% design	0 to 2500 gpm 0 to 5000 gpm (3000 gpm design)	2	2 channels (1 ea. per header) 2 I 1 CP	Computer Point is common return flow PCS Control Cabinet
Main Steam Flow	0 to 110% design	0-120%	2	2 channels (per SG) 2 I 2 CP	PCS Control Cabinet
CVCS Makep-up Flow In	0 to 110% design	0 to 200 gpm (100 gpm design)	2	1channel 1 I	PCS Control Cabinet
CVCS Letdown Flow Out	0 to 110% design	0 to 200 gpm (120 gpm design)	2	1 channel 1 I	PCS Control Cabinet
Degree of Subcooling	200°F subcooled to 35° super-heat	calculated value	2	1 channel 1 graphic	Calculations done continuously by OAC. Displayed on demand.

VARIABLE	RG 1.97 RANGE	DUKE RANGE	RG 1.97 CATEGORY	NUMBER OF CHANNELS	NOTES
Emergency Vent Damper Position	Open-Closed	Open-Closed	2	1 channel per damper (at least)	Switch indicator and/or status light. Active dampers and isolation valves which are actuated under accident conditions whose failure could result in a radioactive release to atmosphere are indicated. Also, Control Room isolation is indicated.
Pressurizer Relief Tank Level	Top to bottom	0-100% (0-100 INWD)	2	1 channel 1 I 1 CP	PCS Control Cabinet
Containment Release Gas Rad. Monitor	10^{-6} to 10^{-2} uCi/cc	N/A	2		Monitor is not required, release is through Unit Vent.
NI Accumulator Tank Pressure	0 to 750 psig	0 to 750 psig	2	2 channels per tank 8 I	PCS Control Cabinet
Pressurizer Heater Status	current	Bkr. status contactor status	2	1 channel per device 1 I ea. 1 CP ea.	
SG Pressure	0 to 20% above low safety valve set point	0 to 1300 psig (0 to 10% above low safety valve set point)	2	3 channels per loop 3 I/loop 3 CP/loop	PCS Protection Cabinet
Unit Vent Radiation Monitoring	10^{-6} to 10^{4} uCi/cc for 0 to 110% vent flow	10^{-6} to 10^{3} uCi/cc 10^{0} to 10^{8} R/hr	2		

VARIABLE	RG 1.97 RANGE	DUKE RANGE	RG 1.97 CATEGORY	NUMBER OF CHANNELS	NOTES
Other Release Point Radiation Monitoring (Contaminated Materials Whse. and Interim Radwaste Facility)	10^{-6} to 10^{2} uCi/cc	10^{-6} to 10^{-1} uCi/cc	2	1 channel per device 1 I/device	
Containment Heat Removal by AHU	plant specific	N/A	2		
Containment Sump Water Temperature	50 to 250° F	none	2		Variable is not used for operator action nor necessary for accident analysis.
Area Radjation Monitoring	10^{-1} to 10^{4}R/h	10^{-1} to 10^{4} m R/hr	2	1 channel per device 1 I/device	
Auxiliary Feedwater Flow	0 to 110% design	0-400 gpm	2	4 channels (1 per SG) 4 I	
RWST Level	top to bottom	0 to 160" WD	2	3 channels 3 I 3 CP	
		160 to 500" WD	2	1 channel 1 I 1 CP	
Component Cooling Water Temperature to ESF	32 to 200° F	50 to 150° F	2	1 channel (per header) 1 CP	
Component Cooling Water Flow to ESF	0 to 110% design	0 to 6000 gpm (5000 gpm design)	2	1 channel (per header)	

VARIABLE	RG 1.97 RANGE	DUKE RANGE	RG 1.97 CATEGORY	NUMBER OF CHANNELS	NOTES
Containment Atmosphere Temperature	40 to 400°F	0 to 300° F	2	8 channels (4 in upper Containment and 4 in lower containment) 8 CP	
Safety Power Status	Current, voltage	status and alarms	2		All safety power systems are alarmed in the control room to indicate abnormal operation. Local indication is provided for analyzing system trouble.
High Level Radwaste Tank Level	Top to bottom	0-100%	2	1 channel 1 CP	Local indicator and High Level Annunciator also available.
Boron Concentration	0-6000 ppm	0-5000 ppm	3	1 channel 1 I 1 R	
Pressurizer Relief Tank Temperature	50 to 750° F	50 to 300° F	3	1 channel 1 I	PCS Control Cabinet
Condensate Storage Tank Level	Plant specific	0 to 100% (0 to 12 ft.)	3	1 channel 1 I	Annunciator alarm when tank is not full.
Radioactive Gas Holdup Tank Press	0 to 150% design	0 to 150 psig (100 psig design)	3	1 channel 1 CP	
NC Pump Status	Motor Current	0 to 800A	3	1 channel per pump 1 I	

VARIABLE	RG 1.97 RANGE	DUKE RANGE	RG 1.97 CATEGORY	NUMBER OF CHANNELS	NOTES
Pzr. Relief Tank Pressure	0 to design	0 -100 psig (100 psig Disc rupture)	3	1 channel 1 CP	PCS Control Cabinet
Feedwater Flow	0 to 110% design	0 to 120%	3	2 channels per SG 2 I 2 CP	PCS Protection Cabinet
Control Rod Position	Full in-Not Full in	Full in-Not Full in	3	1 channel	Annunciator