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SUBJECT: Forwards design info for NUREG-0737 Items II.F.1.4, "Containment Pressure Monitors," II.F.1.5, "Containment Water Level Monitors" & II.F.1.6, "Containment Hydrogen Monitors."

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MONTICELLO NUCLEAR GENERATING PLANT
Docket No. 50-263 License No. DPR-22

Design Information Related to Modifications Required by
NUREG-0737, Items II.F.1.4, II.F.1.5, and II.F.1.6

NUREG-0737 requires that documentation for the following required modifications be provided for the information of the NRC Staff:

- II.F.1.4 Containment Pressure Monitors
- II.F.1.5 Containment Water Level Monitors
- II.F.1.6 Containment Hydrogen Monitors

This information is required to be submitted prior to January 1, 1982. The NRC Staff will perform a postimplementation review of these modifications.

The requested design information is provided in the attachment. Please contact us if you require additional information or have any questions related to our submittal.

L. O. Mayer

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Manager of Nuclear Support Services

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cc Regional Administrator-III, NRC
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Attachment

Monticello Nuclear Generating Plant
Design Information for NUREG-0737 Items II.F.1.4, II.F.1.5, and II.F.1.6

Containment Pressure Monitors

Two pressure transmitters will be installed in the Reactor Building, elev. 962', adjacent to Instrument Rack C-55 and at elev. 985', south wall, to monitor drywell pressure (Figure 1).

Pressure Transmitter PT-7251A (adjacent to C-55) will have its process tap line constructed of stainless steel fittings and 3/8" OD tubing, connected to the drywell sense line coming from penetration X50E. A cable from the transmitter will be routed through Division I conduits and trays to the Division I section of control room panel C-03 via panel C-18. In panel C-03 a recorder (PLR 7251A) will be installed and PT-7251A connected to pen #1. Power for this system will come from Y10 CKT 2 via a power supply installed in panel C-03.

Pressure transmitter PT-7251B (adjacent to C-56) will be connected identical to PT-7251A except to the Drywell sense line from penetration X29F. The cable from PT-7251B will be routed through DIV II conduits and trays to the Division II section of control room panel C-03. A recorder in panel C-03 (PLR-7251B) will be installed and PT-7261B connected to pen #1. Power for this system will come from Y20 CKT 23 via a power supply installed in C-03.

Rosemount Model 1153AA7A22PB transmitters and Westronic Model T4E recorders will be used. Range of these instruments will be - 5 to 250 psig. Requirements of NUREG-0737, Item II.F.1.4 will be satisfied except for Appendix B. As stated in our December 30, 1980 letter we have taken exception to some of the Appendix B requirements. Criteria 1 of Appendix B invokes Regulatory Guide 1.89 which in turn requires qualification of equipment to the IEEE 323, 1974 Standard. There are presently no transmitters or recorders available that are qualified to the 1974 IEEE 323 standard. Therefore, we will use the 1971 version of the standard.

Criteria 2 of Appendix B requires redundant channels of instrumentation to be separated in accordance with Regulatory Guide 1.75. Our existing plant separation scheme does not allow us to fully meet this requirement. Therefore, we will use the existing separation scheme.

Criteria 3 requires a Class IE power source. Monticello does not have a complete Class IE instrument AC system. The existing instrument AC system, which has diesel generator and battery backup, will be used.

Containment Water Level Monitors

New piping will be installed for the addition of two differential pressure transmitters for wide range torus water level (Figure 2). Penetrations and piping will conform to ASME Code requirements. An analysis, including seismic, will be performed to demonstrate acceptable stresses.

Two level transmitters will be installed in the torus compartment to monitor level. Level transmitter LT7338A will be connected to recorder PLR7251A pen #2 in the Division I section of C-03. Cable will be routed through Division I conduits and trays via panel C-18. Simularly, level transmitter LT7338B will be connected to recorder PLR7251B pen #2 in the Division II section of C-03. Cable will be routed through Division II conduits and trays. Power will come from the Division I and II power supplies located in panel C-03.

Zero level is set at normal torus water level. Range of each channel will be -8 to +5 feet. Rosemount Model 1153DA5A22PB level transmitters will be used.

Requirements of NUREG-0737, Item II.F.1.5 will be satisfied except for Appendix B. As stated in our December 30, 1980 letter we have taken exception to some of the Appendix B requirements. These exceptions were listed in the previous section.

Containment Hydrogen Monitors

Additional piping and supports will be added to the primary containment nitrogen control system piping for new hydrogen and oxygen monitors and to obtain gas samples for the post-accident sampling system. Samples from the inlet and outlet of the recombiner systems currently being installed will also be tied into this system.

The system will consist of two independent (redundant) monitoring divisions. Each division consisting of an analyzer panel, associated valves and piping, heat tracing with control cabinet, separate sample points, and associated electrical control and indication powered from one of the emergency divisions. The heat tracing will keep samples free from moisture. Line temperature will be 280^{o}F.

The penetration to the drywell will be made through an existing penetration, X-27; to the suppression chamber through X 220 and X 215; and the return line through penetration X 214.

The analyzers and bottle racks will be located on the 935'-0" elevation in the reactor building. All lines will be stainless steel. All requirements of the ASME Code will be met. Piping will be analyzed using NUTECH's PISTAR program and a stress analysis will be performed for the new supports. Span gas holders are provided with seismic supports.

The analyzers will be Comsip-Delphi Model K-IV combination hydrogen/oxygen analyzers. (See the attached "K-IV System Description" for more information). The analyzer design requires that the sample lines be heat-traced and maintained at 270° to 300°F. This will be accomplished by a heat tracing system.

The analyzer system includes a remote control panel for each analyzer that will be located at control room panels C259 and C260. The panel provides control of analyzer operation mode, calibration adjustment, status indication and hydrogen and oxygen concentration indication. A recorder provides a record of hydrogen and oxygen concentration. Alarms are provided on panel C259 for high hydrogen or oxygen concentration and anlayzer trouble. Heat tracing system trouble is also annunciated.

Power for the analyzers and heat tracing will be supplied from MCC's 133 and 143 (redundant 480 VAC safeguards supplies).

The analyzer sample valves are controlled from control room panels C259 and C260. The containment isolation valves are automatically closed on a Group 2 isolation signal (including reactor building vent plenum high radiation and fuel pool high radiation), but the isolation can be manually bypassed for post-accident sampling. The bypass is annunciated on panel C259, and is automatically removed upon reset of the Group 2 isolation logic.

Control room indicators and controls for the analyzers and associated systems will be located in new panels C259 and C260. Cable routing for this design change conforms to the original plant separation criteria. Separation is provided between inboard and outboard isolation circuits and between redundant analyzer circuits.

The equipment to be installed for this Design Change has been environmentally and seismically qualified in accordance with IEEE 323-1974, IEEE 344-1975 and applicable daughter standards to conditions that bound those anticipated for their location.

Requirements of NUREG-0737, Item II.F.1.6 will be satisfied except for Appendix B. As stated previously, certain exceptions must be taken to the Appendix B requirements.

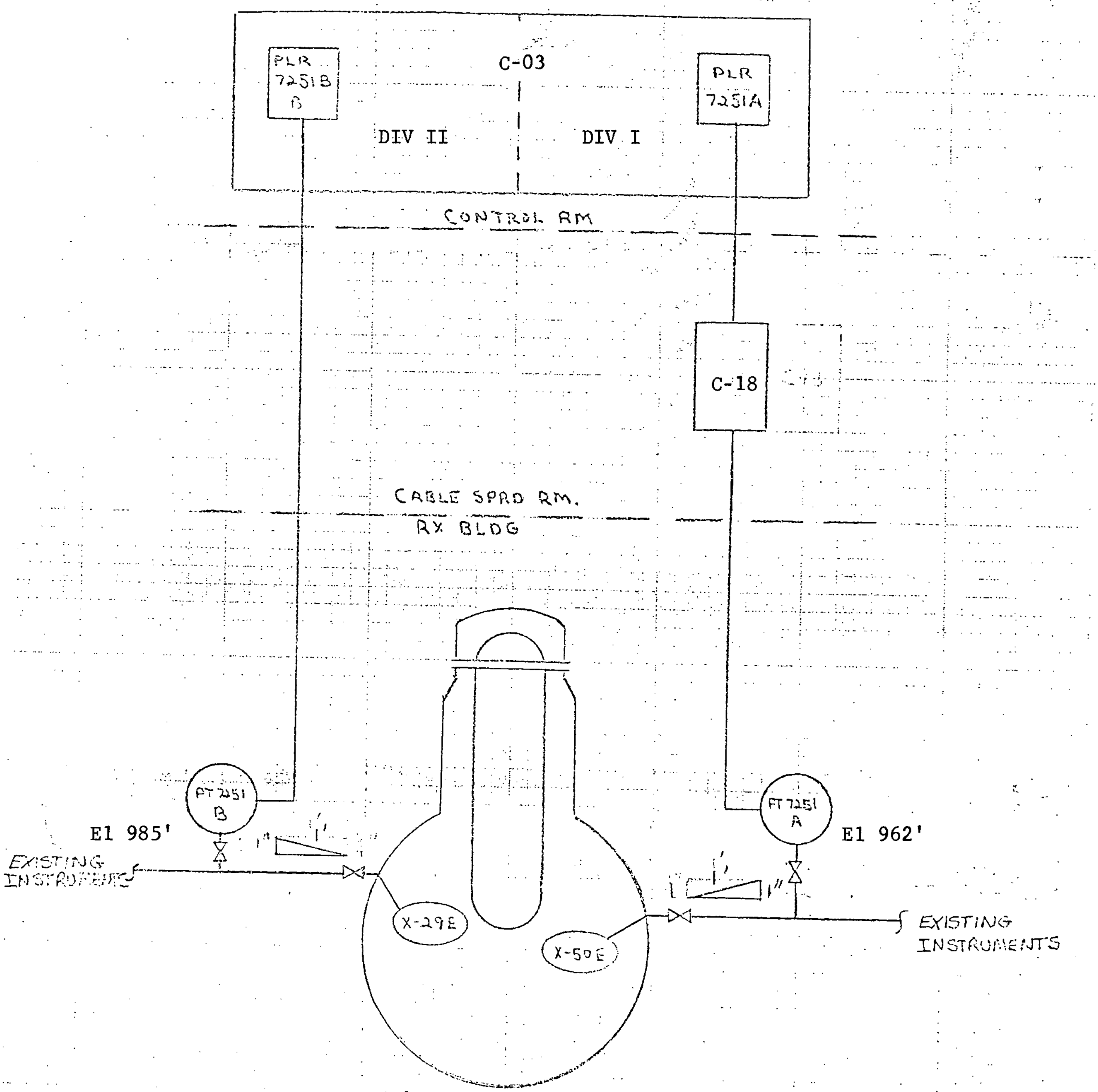

Figure 1 Containment Pressure Monitors

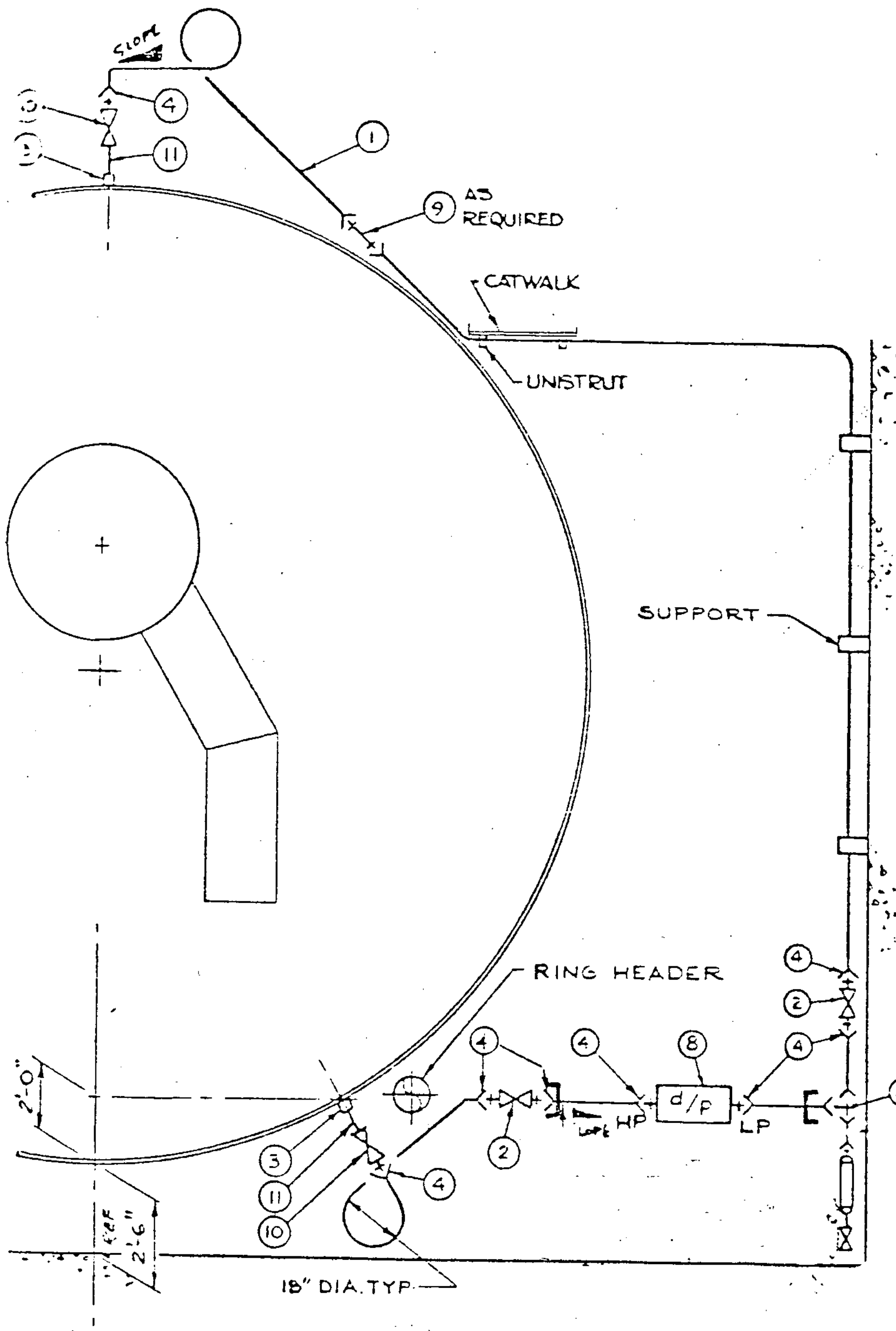

Figure 2 Containment Water Level Monitors

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instrument and control systems

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K-IV SYSTEM DESCRIPTION

The K-IV system is used to monitor the hydrogen concentration inside the containment of a PWR or BWR nuclear reactor. Sample is withdrawn from the containment, analyzed, and returned to the containment under normal, LOCA and post LOCA conditions.

Physical Description

The Monitoring System is housed in a 72"H x 30"W x30"D steel cubicle. The cubicle is constructed of welded steel plates (1/4" front, 3/16" sides and top and 14 gauge rear door) inside a 2" x 2" square tube frame. The panel is usually painted ANSI #61 grey, using high quality baked enamel paint. Sample tubing is 3/8" x .065" wall, stainless steel SA-213, GR316 eddy current and hydrostatic tested with Mill Certification provided.

FUNCTIONAL DESCRIPTION

Sample Conditioning

The K-IV monitoring system is designed to monitor containment gas for percentage by volume of hydrogen and oxygen. The operating range is -2 to 60 psig, 40 to 290°F and relative humidity from 0 to 100%. After sample passes through entry valve, it enters the heated cell housing with the temperature maintained at 300°F. The sample then passes through a combination moisture separator and air vent, where 150 cc/min of the steam is directed to the sample measuring cells, and the remainder of the gas and any moisture droplets is passed through a back pressure regulator to the system exhaust.

The back pressure regulator provides a constant pressure differential across the measuring cells and the sample flowmeter. The sample, reference and bypass flows are cooled by natural convection to less than 150°F and returned to the containment by a diaphragm pump.

Calibration

Instrument calibration is performed by actuating the appropriate solenoid valve directing zero or span gas through a flow controller and into the cell.

Alarms

Alarms are provided for high hydrogen concentration, high oxygen concentration, cell failure and loss of power. These alarms are available on the analyzer itself and as signals to the customers annunciator. Additional alarms on the analyzer itself include low instrument temperature, low sample flow, low gas pressure and common failure.

Gas Measurements, General Discussion

Analysis is accomplished by using the well established principle of thermal conductivity measurements of gases. This technique utilizes a self-heating filament fixed in the center of a temperature-controlled metal cavity. The filament temperature is determined by the amount of heat conducted by the presence of gas from the filament of the cavity walls. Thermal conductivity varies with gas species, thereby causing the filament temperature to change as the gas in the cavity changes. Filament resistance changes with temperature therefore, by using two filaments in separate cavities and connecting them in an electrical bridge, the difference in thermal conductivity of gases in the separate cavities may be determined electrically.

Electrical zero is set by first introducing the same gas to both cavities, then adjusting the electrical bridge to balance, resulting in a zero output. As different gases are introduced to the two individual cavities, the bridge will become unbalanced, and the electrical output will amplify with increasing differences in thermal conductivity of the gases used.

Although this technique is non-specific, it is an extremely reliable technique when the gases or gas mixtures are known, and the variation in composite thermal conductivity can be accurately determined.

Hydrogen Measurement

The measurement of hydrogen in the presence of nitrogen, oxygen and water vapor is possible because the thermal conductivity of the hydrogen is approximately seven times higher than nitrogen, oxygen or water vapor, which have nearly the same thermal conductivities (at the filament operational temperature of approximately 500°K). The measurement is accomplished by using a thermal conductivity measurement cell and a catalytic reactor. The sample first flows through the reference section of the cell, then passes through the sample section of the measuring cell that includes the catalyst. The change is sample composition, due to the catalytic reaction is therefore indicated by the difference in thermal conductivity of the sample hydrogen content, as measured in the sample and reference sides of the cell.

If an excess amount of oxygen does not exist in the sample for recombining all the hydrogen, oxygen can be provided ahead of the hydrogen analyzer. The amount of oxygen added is determined by the highest range of the analyzer.

Span calibration is accomplished by introducing a known amount of oxygen and gas mixture of hydrogen in nitrogen to the cell; this will give a specific output for a readout calibration.

Zero calibration may be accomplished by shutting off the oxygen supply of the span gas mixture.

This will result in the gas flowing unchanged through both sides of the cell the thermal conductivity will also remain unchanged, the cell will be balanced, and the electrical output will be zero.

Oxygen Measurement

The same technique and equipment used for measuring hydrogen is also used for measuring oxygen, except that an excess of hydrogen must be supplied to complete reaction of all available oxygen.

Functional Description

Controls

Calibration, zero and span controls and lights are located on the analyzer cabinet. A master off, stand-by power on, and analysis mode selector switch is located on either the analyzer cabinet or a remote module.

Outputs

In addition to the high hydrogen, high oxygen, and instrument failure alarms, a 4-20ma or 10-50ma current output from each analyzer is provided for customer's remote monitor.

Utility Requirements

120VAC, 10 amps, 60Hz.

460VAC, 30, 2.5 amps, 60Hz.

Hydrogen Span Gas, B-size cylinder, approximately 5% Hydrogen (or 50% of full scale) in Nitrogen, analyzed.

Reagent Gas, B-size cylinder, Oxygen, 99.6 purity.

Oxygen Span Gas, B-size cylinder, approximately 5% Oxygen (or 50% of full scale) in Nitrogen, analyzed.

Reagent Gas, B-size cylinder, 99.8 minimum purity hydrogen.

Seismic Qualifications

The system has been designed to withstand the vibrational stresses suggested by Continental U.S. Power Plant Site Generic response spectrum, with acceleration peaks in excess of 10G's. Test documentation will be presented qualifying the system to the Generic requirements. Testing is done in accordance with IEEE 344-1975.

Environmental Qualification

The system is designed to meet the requirements of IEEE 323-1974 and a program for qualification has been established.

Material Certification and Documentation

Instrumentation is specifically excluded from material requirements, listed in the ANSI B31.1.0 and ASME power piping codes. However, every attempt is made to provide components which materially comply with these codes.

Chemical certification and test reports from the producing mill will be supplied for all sample tubing.