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November 28, 1983
5211-83-323

Office of Nuclear Reactor Regulation
Attn: J. F. Stolz, Chief
Operating Reactors Branch No. 4
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Sir:

Three Mile Island Nuclear Station, Unit 1 (TMI-1)
Operating License No. DPR-50
Docket No. 50-289
NUREG 0737 Post Accident Monitoring (II.F.1)

In order to assist in the post implementation review of the Containment Pressure Monitor (II.F.1.4) and the Containment Hydrogen Monitor (II.F.1.6), enclosed please find the required design information. Instrument accuracy and response times are also provided in response to your request of July 19, 1983.

Sincerely,

H. D. Hukill
Director, TMI-1

HDH:RAS:vjf

Enclosure

cc: T. E. Murley
J. Van Vliet

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CONTAINMENT PRESSURE MONITOR

Item (1) Design and qualification criteria are outlined in Appendix A.

Response See Attachment A.

Item (2) Measurement and indication capability shall extend to 5 psia for subatmospheric containments.

Response Each redundant channel is comprised of a narrow range (-5 psig to +5 psig) and a wide range (0-175 psig) transmitter, associated signal conditioning equipment and a 2 pen strip chart recorder.

Item (3) Two or more instruments may be used to meet requirements. However, instruments that need to be switched from one scale to another to meet the range requirements are not acceptable.

Response See response to Item (2).

Item (4) Continuous display and recording of the containment pressure over the specified range in the Control Room is required.

Response A dual channel strip chart recorder provides continuous display of containment pressure and a permanent record of the display on a strip of recording chart paper in the Control Room. An output signal from each containment pressure monitoring system is inputted to the plant computer.

Item (5) The accuracy and response time specifications of the pressure monitor shall be provided and justified to be adequate for their intended function.

Response See Attachment B.

Ref: Restart Report Sect. 2.1.2.1
FSAR Update Section 7.3.2.2.c 11) a)

CONTAINMENT HYDROGEN MONITOR

Item (1) Design and qualification criteria are outlined in Appendix A.

Response See Attachment A.

Item (2) The continuous indication of hydrogen concentration is not required during normal operation. (If an indication is not available at all times, continuous indication and recording shall be functioning within 30 minutes of the initiation of safety injection.)

Response The Containment Hydrogen Monitor recorder and analyzer is on-line continuously. The sampler is on "Standby" and placed in the "Analyze" mode in the event of a LOCA.

Item (3) The accuracy and placement of the Hydrogen Monitors shall be provided and justified to be adequate for their intended function.

Response The Hydrogen Monitor measurement capability is over a range of 0-10 volume percent within an accuracy of $\pm$ 1.94% of full scale under both positive and negative containment pressure. The sample points are located near the dome. Since Hydrogen is lighter than air it will accumulate at the top of the reactor building. The analyzer alarms in the Control Room at 2% hydrogen by volume.

Ref: Restart Report Section 2.1.2.1

ATTACHMENT A

DESIGN AND QUALIFICATION OF THE CONTAINMENT PRESSURE MONITOR

(1) Seismic/Environmental Qualification - The seismic qualification of the pressure transmitter and signal conditioning equipment is in accordance with RC 1.100 and IEEE-344 1975. Each channel recorder and associated power supply has a steel protective shield surrounding them to serve as a seismic barrier from other non seismic qualified components. Environmental qualification of the containment pressure monitor was included in licensee letter 5211-83-076, May 16, 1983.

(2) Single Failure - The containment pressure monitor is composed of redundant safety grade, Class 1E equipment channels and power sources which have both narrow and wide range recorder indication and are therefore single failure proof.

(3) Power Sources - The containment pressure monitor is energized by separate power supplies from Class 1E uninterruptible power. The signal conditioning cabinets provide additional isolation of the non 1E computer signal from the 1E recorder signal in each channel.

(4) Availability - The containment pressure indicator is in constant operation during all plant operating modes, infrequent operation, accident conditions and post accident conditions. Operability requirements have been addressed in Technical Specification Change Request No. 114.

(5) QA Requirements - The portion of the containment pressure indication external to the Control Room panel has been designated nuclear safety related under the applicable section of the GPUN OQA Plan.

(6) Continuous Indication - See response to Item (4). Any component malfunction or loss of power leaves intact a redundant channel for indication.

(7) Recording Instrumentation - The 0-10 VDC output signal of each channel is routed to 1 of 2 Bailey Controls 2 pen recorders in the Control Room with strip chart output for trending.

(8) Display Instrumentation - The recorders are mounted on the front of the PLF vertical panel, behind the control console. This will be a normal CRO work area for post-accident conditions.

(9) Isolation - See (3)

(10) Testing - The containment pressure monitors will be checked shiftly, tested monthly and calibrated each refueling. Surveillance requirements have been addressed in Technical Specification Change Request No. 114.

(11) Surveillance - See (10)

(12) Removal From Service - The containment pressure monitor is designed such that all functional tests can be performed on line without affecting other reactor systems. Any testing that is required to be performed offline shall not be required to be performed at less than 18 month intervals.

(13) Access for Adjustment - The transmitters for containment pressure monitoring are located in the Auxiliary Building at elevation 305' near containment penetration 340 and 350. The signal condition cabinets are located in the Control Building at elevation 322' and the recorders are located in the Control Room. All equipment is accessible for adjustment.

(14) Anomalous Reading - Anomalous readings are reduced to a minimum by (2) and (3).

(15) Ease of Repair - See (13)

(16) Directly Measured Variable Sensors - Containment Pressure is a directly measured variable.

(17) Normal/Accident Ranges - See response to Item (2).

(18) Periodic Testing - See (10)

DESIGN AND QUALIFICATION OF THE CONTAINMENT HYDROGEN MONITOR (CHM)

(1) Seismic/Environmental Qualification - The sample lines are supported seismically as is all other equipment in accordance with Reg. Guide 1.100 and IEEE 344-1975. The environment qualification of the Containment Hydrogen Monitor has been reviewed against the DOR Guidelines. The results of this evaluation have been included in licensee letter 5211-83-076, May 16, 1983.

(2) Single Failure - The Containment Hydrogen Monitor has redundant safety grade channels and is powered by a class 1E power source and therefore, single failure proof. The alarms and computer inputs are not safety related.

(3) Power Sources - The power supplies for the Hydrogen Monitor are provided from redundant 1E power supplies (vital bus).

(4) Availability - The CHM is on-line continuously during normal operations. Samples are drawn continuously during accident and post accident conditions. Operability requirements have been addressed in a Tech Spec. Change Request No. 114.

(5) QA Requirements - The CHM with the exception of the alarms and computer inputs are nuclear safety related and the applicable sections of the GPU Nuclear QQA Plan are invoked.

(6) Continuous Operation - See (4)

(7) Recording Instrumentation - A recorder for each channel is located in the Control Room and will provide continuous recording.

(8) Identification - The Containment Hydrogen Monitoring instrumentation has been "human factored" and the recorders are located on the left front panel in the Control Room.

(9) Isolation Devices - The CHM System is self contained and does not interface with other systems. Therefore no isolation devices are provided.

(10) Testing - The Containment Hydrogen Monitor will be checked shiftly, tested monthly and calibrated each refueling per Technical Specification Change Request No. 114.

(11) Surveillance - See (10)

(12) Removal From Service - Testing shall be performed in accordance with the applicable portions of Reg. Guide 1.118 for testing of instrument channels.

(13) Access for Adjustment - The hydrogen analyzers are located in the Intermediate Building El. 295'-0" and 322'-0" and are accessible for adjustment, calibration and testing.

(14) Anomalous Reading - Anomalous indications are prevented by (2) and (3).

(15) Ease of Repair - See (13)

(16) Directly Measured Variable Sensors - Separate sampling lines run to each analyzing unit allow direct monitoring at containment atmosphere for hydrogen concentration.

(17) Normal/Accident Ranges - See response to Item (3).

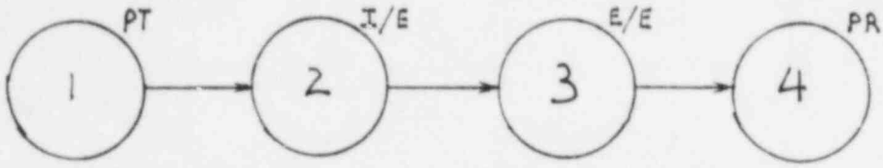
(18) Periodic Testing - See (10) and (12).

ATTACHMENT B

INSTRUMENT ACCURACY AND RESPONSE TIMES

Pressure Monitoring System (II.F.1.4)

(a) Instrument Block Diagram



(b) Module Parameters

Module 1 PT 981A
Wide Range Contain. Pres. Transmitter
Rosemount Model 1153D
Ref: Ros. Prod. Spec. Sheet 2302
Range: 0-300 psi
Span: 0-175 psi
Accuracy (incls linearity, hysteresis, & repeat.): ± .25% span
Stability: ± .25% of Upper Range Limit (URL)
Temp Effect: ± .50% of span/100 degrees F
Response Time: (63% at 100°F) 0.2 seconds

Module 2 PY 981AA
Current to voltage converter
Foxboro N2 AI-I2V
Ref: Fox Spec. Sheet TI 2AI-130
Output Span: 0-10V
Accuracy: ± 0.25% of output span
Supply V Effect: ± 0.2% span for ± 5% change
Ambient temp. effect: ± .5% span max. for 50°F change

Module 3 PY 981AC
V to V Isolator Converter
Foxboro N2AO-V2I
Ref: Fox Spec Sheet 2AO-130
Output span: 0-10V
Accuracy: ± 0.5% of output span
Repeatability: Less than 0.1% of output span
Supply V effect: ± 0.5% of output span for 5%
Ambient temp effect: Less than ± 0.5% span for 50° change

Module 4 PR 981

Containment Monitor Recorder

Bailey 771 Recorder

Ref: Bailey Prod. Spec E12-771

Input span: 0-10V/0-175 psi

Accuracy: ± 0.5% of span

Linearity: ± 0.3% of span

Hysteresis: ± 0.3% of span

Deadband: ± 0.2% of span

Response: less than 1 sec. for 100% pen travel to 100% input sig. change

(c) Overall System Uncertainty

One Sigma at normal operating conditions

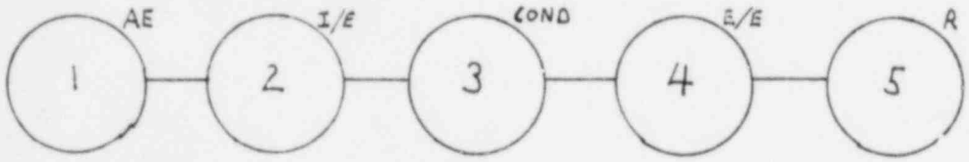
S = ± .555% of span
= ± .971 psi

(d) Time Constants

See data for modules 1 & 4.

Hydrogen Monitoring System (II.F.1.6)

(a) Instrument Block Diagram



(b) Module Parameters

Module 1 AE 42B

Hydrogen Analyzer

Consip Inc. Model K1 11

Ref: Consip Instr. Manual GPU #990-622

Output Span: 4-20 ma (0-10% or 0-20% Hydrogen)

Accuracy: ± 5% full scale

Repeatability: ± 2% one week

Response Time: 90% full scale less than 60 sec.

Module 2 AY 42B

Current to Voltage Converter

Fox Spec. Sheet TI 2ALI-130

Output Span: 0-10V

Accuracy: ± .25% of output span

Supply V Effect: ± 0.2% span for ± 5% change

Ambient Temp Effect: ± 0.5% Span Max for 50°F change

Module 3 AY 42BB
Signal Conditioner
Foxboro N2 AP + SGC
Ref: Fox Spec Sheet T1 2AP-140
Output Span: 0-10V
Accuracy: ± 0.5% Output Span
Repeatability: less than 0.1%
Supply V Effect: less than 0.5% for 5% variation
Ambient T Effect: less than 0.5% for 50°F change

Module 4 AY 42BC
V to V Isolator Converter
Foxboro N2AO-V2I
Ref: Fox Spec Sheet 2AO-130
Output Span: 0-10V
Accuracy: ± 0.5% of output span
Repeatability: less than 0.1%
Supply V Effect: ± 0.5% of output span for 5% change
Ambient T Effect: less than 0.5% span for 50°F change

Module 5 AR 42B
Hydrogen Monitor Recorder
Bailey 771 Recorder
Ref: Bailey Prod Spec E12-771
Input Span: 0-10V
Accuracy: ± 0.5% span
Linearity: ± 0.3% span
Hysteresis: ± 0.3% span
Deadband: ± 0.2% span
Response: less than 1 sec. for 100% pen travel to 100% input change

(c) Overall System Uncertainty

One sigma at normal operating conditions.

S = ± 1.94% of span
= ± .388% Hydrogen (0-20% H Scale)
= ± .194% Hydrogen (0-10% H Scale)

(d) Location of hydrogen monitor intake ports

There is one sample port for each of the HMS system. Both sample points are located high in the RB containment at approximately 460'-0" elevation.

(e) There are no obstructions that would prevent the Hydrogen escaping from the core from reaching the sample point quickly.