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AUTH.NAME	AUTHOR AFFILIATION
ROOT,L.D.	Iowa Electric Light & Power Co.

RECIP.NAME	RECIPIENT AFFILIATION
DENTON,H.R.	Office of Nuclear Reactor Regulation, Director

SUBJECT: Responds to NRC 830117 request for addl info re TMI Items II.F1.4,II.F.1.5 & II.F.1.6.Descriptions of containment pressure,water level & hydrogen monitoring sys encl & document compliance w/requirements of NUREG-0737.

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Iowa Electric Light and Power Company

March 21, 1983
NG-83-1020

LARRY D. ROOT
ASSISTANT VICE PRESIDENT
NUCLEAR GENERATION

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

Subject: Duane Arnold Energy Center
Docket No.: 50-331
Op. License No. DPR-49
NUREG 0737, Items II.F.1.4, II.F.1.5, II.F.1.6
Response to NRC Request for Additional Information

Dear Mr. Denton:

This letter and attachments provide the information requested in Mr. D. Vassallo's letter dated January 17, 1983 regarding NUREG-0737, Items II.F.1.4, II.F.1.5, and II.F.1.6.

Attachments 1 and 2 respond to Item (1) of the letter by providing summary descriptions of the DAEC containment pressure, water level, and hydrogen monitoring systems. Attachment 3 provides the detailed information requested by Items (2), (3), and (4) of the same letter.

We feel this information documents the DAEC compliance with the requirements of the referenced NUREG-0737 items and provides the information requested in the January 17, 1983 letter.

Very truly yours,

R. W. McGaughy
for Larry D. Root
Assistant Vice President
Nuclear Generation

A046
S
1/40

LDR/SLS/rh*
Attachments
cc: S. Swails
D. Arnold
L. Liu
S. Tuthill
F. Apicella (NRC)
NRC Resident Office
Ref: Commitment Control No. 83-0007

Duane Arnold Energy Center Response To

NRC Request for Additional Information For NUREG 0737 Items:

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

(1) Item

To date we have received no submittals which describe your proposed monitoring system or which indicate that you plan to take any exceptions to the NUREG-0737 requirements in our scope of review. Please indicate any exceptions you plan of which we are not aware. For each exception indicate (1) why you find it difficult to comply with this item, (2) how this exception will affect the monitor system accuracy, speed, dependability, availability, and utility, (3) if this exception in any way compromises the safety margin that the monitor is supposed to provide, and (4) any extenuating factors that make this exception less deleterious than it appears at face value.

Response

Although not specifically requested, the following information provides a summary description of the Duane Arnold Energy Center (DAEC) containment pressure, water level, and hydrogen monitoring systems. The information is provided in a format which addresses the requirements and recommendations contained in the Positions and Clarifications to NUREG 0737, Items II.F.1.4, 5, and 6. This information demonstrates compliance with the requirements of NUREG 0737. No exceptions to the requirements of NUREG 0737, Items II.F.1.4, II.F.1.5, and II.F.1.6 have been identified for the DAEC.

(1.1) II.F.1, ATTACHMENT 4, CONTAINMENT PRESSURE MONITOR

Position

A continuous indication of containment pressure shall be provided in the control room of each operating reactor. Measurement and indication capability shall include three times the design pressure of the containment for concrete, four times the design pressure for steel, and -5 psig for all containments.

Compliance

The Duane Arnold Energy Center (DAEC) containment (drywell) pressure monitoring system provides continuous indication of drywell pressure via two sets of redundant displays located on control room panel 1C-09. Redundant high-range displays provide measurement and indication over the range of 0 to 250 psig. This range envelopes the requirement to measure four times the design pressure of the DAEC steel containment (56 psig). Redundant low-range displays provide measurement and indication over the range of -5 to +5 psig.

Clarification (1)

Design and qualification criteria are outlined in Appendix A.

Compliance

See Attachment 2 to this submittal.

Clarification (2)

Measurement and indication capability shall extend to 5 psia for subatmospheric containments.

Compliance

The DAEC design does not incorporate a subatmospheric containment.

Clarification (3)

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

Compliance

The DAEC system utilizes two sets of instruments (high-range and low-range) to provide the required measurement and indication. Redundant control room displays provide continuous indication for the high-range (0 to 250 psig) instruments. Separate, redundant control room displays provide continuous indication for the low-range (-5 to +5 psig) instruments.

Clarification (4)

Continuous display and recording of the containment pressure over the specified range in the control room is required.

Compliance

As previously discussed, the DAEC system provides continuous control room indication of the drywell pressure. The DAEC system also provides continuous recording of drywell pressure over the specified range via redundant pressure recorders (two-pen type) located on control room panel 1C-09.

Clarification (5)

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

Compliance

As indicated in Attachment 3 to this submittal, the calculated uncertainty of the DAEC containment pressure monitoring system is approximately ±1% of full scale for both the high-range, and low-range instrumentation. ANSI/ANS 4.5 - 1980, Section 6.3.5.2 specifies an accuracy of ±10% of span for this instrumentation. The accuracy of the DAEC containment pressure monitoring system is within the guidelines of ANSI/ANS 4.5 - 1980, and is therefore considered adequate.

The response time of the DAEC pressure monitoring system (control room indicators) is approximately 180 ms for a 10 to 90% step function. ANSI/ANS 4.5 - 1980, Section 6.3.5.2 specifies a time response of less than one second for an input step change of ±10% of span. The time response of the DAEC containment pressure monitoring system is within the guidelines of ANSI/ANS 4.5 - 1980, and is therefore considered adequate.

(1.2) II.F.1, ATTACHMENT 5, CONTAINMENT WATER LEVEL MONITOR

Position

A continuous indication of containment water level shall be provided in the control room for all plants. A narrow range instrument shall be provided for PWRs and cover the range from the bottom to the top of the containment sump. A wide range instrument shall also be provided for PWRs and shall cover the range from the bottom of the containment to the elevation equivalent to a 600,000 gallon capacity. For BWRs, a wide range instrument shall be provided and cover the range from the bottom to 5 feet above the normal water level of the suppression pool.

Compliance

The DAEC containment (torus) water level monitoring system provides continuous indication of torus water level via redundant displays located on control room panel 1C-09. The DAEC design envelopes the range required by this position as described in the response to Clarification (4). The DAEC system envelopes a range from a point below the emergency core cooling system (ECCS) suction line inlets to 5 feet above the normal water level.

Clarification (1)

The containment wide-range water level indication channels shall meet the design and qualification criteria as outlined in Appendix A. The narrow-range channel shall meet the requirements of Regulatory Guide 1.89.

Compliance

See Attachment 2 to this submittal.

Clarification (2)

The measurement capability of 600,000 gallons is based on recent plant designs. For older plants with smaller water capacities, licensees may propose deviations from this requirement based on the available water supply capability at their plant.

Compliance

This requirement applies to PWRs only and is, therefore, not applicable to the DAEC.

Clarification (3)

Narrow-range water level monitors are required for all sizes of sumps but are not required in those plants that do not contain sumps inside the containment.

Compliance

The DAEC design incorporates a BWR Mark I containment consisting of a separate drywell and torus as opposed to the typical PWR containment building. Drywell sumps have no emergency function and consequently post-LOCA sump level is not monitored. In the event of a loss-of-coolant accident (LOCA), monitoring of torus level will provide the operator with indication of the inventory in the suppression pool heat sink.

Clarification (4)

For BWR pressure-suppression containments, the emergency core cooling system (ECCS) suction line inlets may be used as a starting reference point for the narrow-range and wide-range water level monitors instead of the bottom of the suppression pool.

Compliance

The starting reference point for the DAEC system is below the level of the ECCS suction line inlets.

Clarification (5)

The accuracy requirements of the water level monitors shall be provided and justified to be adequate for their intended function.

Compliance

As indicated in Attachment 3 to this submittal, the calculated uncertainty of the DAEC containment water level monitoring system is approximately ±5% of full scale. ANSI/ANS 4.5 - 1980, Section 6.3.3.4 specifies an accuracy of ± 20% of span for instrumentation monitoring the reactor coolant system (RCS) pressure boundary. Although torus water level monitors are not specifically addressed in section 6.3.3.4, the guidelines are applicable based on similarity of function. The accuracy of the DAEC torus water level monitoring system is within the guidelines of ANSI/ANS 4.5 - 1980, Section 6.3.3.4 for instrumentation monitoring the RCS pressure boundary, and is therefore considered adequate.

(1.3) II.F.1, ATTACHMENT 6, CONTAINMENT HYDROGEN MONITOR

Position

A continuous indication of hydrogen concentration in the containment atmosphere shall be provided in the control room. Measurement capability shall be provided over the range of 0 to 10% hydrogen concentration under both positive and negative ambient pressure.

Compliance

The DAEC containment hydrogen monitoring system provides continuous indication of containment atmosphere hydrogen concentration via redundant displays located on control room panel 1C-09. The DAEC system provides measurement capability over the range of 0 to 10% hydrogen concentration under both positive and negative ambient pressures (-2 to 60 psig).

Clarification (1)

Design and qualification criteria are outlined in Appendix A.

Compliance

See Attachment 2 to this submittal.

Clarification (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.

Compliance

Continuous indication of hydrogen concentration is provided during normal operation.

Clarification (3)

The accuracy and placement of the hydrogen monitors shall be provided and justified to be adequate for their intended function.

Compliance

As indicated in Attachment 3 to this submittal, the calculated uncertainty of the DAEC containment hydrogen monitoring system is approximately ±4% of span. ANSI/ANS 4.5 - 1980, Section 6.3.5.3 specifies an accuracy of ±10% of span for this instrumentation. The accuracy of the DAEC containment hydrogen monitoring system is within the guidelines of ANSI/ANS 4.5 - 1980, and is therefore considered adequate.

The location of the containment hydrogen monitoring system sample ports is discussed in Item (4d) of Attachment 3 to this submittal. These locations were chosen to provide sampling of a wide cross section of the containment, and to facilitate the detection of hydrogen escaping from the core. The location of the containment hydrogen monitoring system sample ports is considered adequate to provide the operator with information concerning hydrogen concentration in the containment.

DESIGN AND QUALIFICATION REVIEW

Attachments 4, 5, and 6 to Item II.F.1 of NUREG 0737, state, "Design and qualification criteria are outlined in Appendix A." Appendix A to NUREG 0737 does not address these criteria; however, Appendix B contains design and qualification criteria for accident monitoring instrumentation. Based on this, the following DAEC review for Item II.F.1, Attachments 4, 5, and 6 references the applicable design and qualification criteria contained in Appendix B to NUREG 0737.

Criterion (1)

The instrumentation should be environmentally qualified in accordance with Regulatory Guide 1.89 (NUREG 0588). Qualification applies to the complete instrumentation channel from sensor to display where the display is a direct-indicating meter or recording device. Where the instrumentation channel signal is to be used in a computer-based display, recording, and/or diagnostic program, qualification applies to and includes the channel isolation device. The location of the isolation device should be such that it would be accessible for maintenance during accident conditions. The seismic portion of enviroumental qualification should be in accordance with Regulatory Guide 1.100. The instrumentation should continue to read within the required accuracy following, but not necessarily during, a safe shutdown earthquake. Instrumentation, whose ranges are required to extend beyond those ranges calculated in the most severe design basis accident (DBA) event for a given variable, should be qualified using the following guidance.

The qualification environment shall be based on the DBA events, except the assumed maximum of the value of the monitored variable shall be the value equal to the maximum range for the variable. The monitored variable shall be assumed to approach this peak by extrapolating the most severe initial ramp associated with the DBA events. The decay for this variable shall be considered proportional to the decay for this variable associated with the DBA events. No additional qualification margin needs to be added to the extended range variable. All environmental envelopes except that pertaining to the variable measured by the information display channel shall be those associated with the DBA events.

The above environmental qualification requirement does not account for steady-state elevated levels that may occur in other environmental parameters associated with the extended range variables. For example, a sensor measuring containment pressure must be qualified for the measured process variable range, but the corresponding ambient temperature is not mechanistically linked to that pressure. Rather, the ambient temperature value is the bounding value for DBA events analyzed in Chapter 15 of the final safety analysis report (FSAR). The extended range requirement is to ensure that the equipment will continue to provide information should conditions degrade beyond those postulated in the safety analysis. Because variable ranges are nonmechanistically determined, extension of associated parameter levels is not justifiable and has, therefore, not been required.

Compliance

The portions of the containment pressure, water level, and hydrogen monitoring instrumentation located in a post-accident harsh environment are included in the DAEC Environmental Qualification Program (consistent with the requirements of 10 CFR 50.49). Information regarding the environmental qualification of this instrumentation is provided in Iowa Electric's second semiannual update transmitted via Letter LDR-82-191, dated July 15, 1982, and Environmental Qualification SER Response transmitted via Iowa Electric letter NG-83-0544, dated February 11, 1983.

Criterion (2)

No single failure within either the accident monitoring instrumentation, its auxiliary supporting features, or its power sources concurrent with the failure that is a condition or result of a specific accident should prevent the operator from being presented the information necessary to determine the safety status of the plant and to bring the plant to a safe condition and maintain it in a safe condition following that accident. Where failure of one accident monitoring channel results in ambiguity (i.e., the redundant displays disagree) which could lead the operator to defeat or fail to accomplish a required safety function additional information should be provided to allow the operator to deduce the actual conditions in the plant. This may be accomplished by: a) providing additional independent channels of information of the same variable (addition of an identical channel), b) providing an independent channel which monitors a different variable bearing a known relationship to the multiple channels (addition of a diverse channel), or c) providing the capability, if sufficient time is available, for the operator to perturb the measured variable and determine which channel has failed by observation of the response on each instrumentation channel. Redundant or diverse channels should be electrically independent, energized from station Class 1E power source, and physically separated in accordance with Regulatory Guide 1.75 up to the including any isolation device. At least one channel should be displayed on a direct-indicating or recording device. (Note: Within each redundant division of a safety system, redundant monitoring channels are not required.)

Compliance

The DAEC containment pressure monitoring system has redundant channels satisfying single-failure criteria in accordance with IEEE Standard 279-1971. In accordance with the intent of the recommendations contained in Criterion (2) above, additional information is available to the operator which can be utilized as a means to resolve disagreement between the redundant containment pressure monitoring system displays. Although not identical to the primary channels, the instrumentation providing this additional information measures the same variable (i.e. containment pressure).

The DAEC containment water level monitoring system has redundant channels satisfying single-failure criteria in accordance with IEEE Standard 279-1971. Where failure of one accident monitoring channel results in redundant display disagreement, additional information is provided to allow the operator to deduce the actual plant conditions. This is accomplished by providing independent channels which monitor a different variable bearing a known relationship to the multiple channels.

The DAEC containment hydrogen monitoring system has redundant channels satisfying single-failure criteria in accordance with IEEE Standard 279-1971. Where failure of one accident monitoring channel results in redundant display disagreement, additional information is provided to allow the operator to deduce the actual plant conditions by cross-checking between channels that bear a known relationship to each other and that have readouts available.

The design of the DAEC preceded Regulatory Guide 1.75; however, the subject system designs are in accordance with Regulatory Guide 1.75 within the constraints of the preexisting installation of structures, systems, and components at the DAEC. The containment pressure, water level, and hydrogen monitoring instrumentation consist of physically separated, electrically independent, redundant channels energized from station Class 1E power sources. Each of the channels provides a direct-indicating and recording device.

Criterion (3)

The instrumentation should be energized from station Class 1E power sources.

Compliance

The DAEC containment pressure, water level, and hydrogen monitoring instrumentation are energized from redundant Class 1E power sources via control room panel 1C-09.

Criterion (4)

An instrumentation channel should be available prior to an accident except as provided in Paragraph 4.11, "Exemption", as defined in IEEE Standard 279, or as specified in the technical specification.

Compliance

As previously discussed, the subject systems provide continuous monitoring; therefore, an instrument channel is available prior to an accident. The subject system designs are in accordance with IEEE Standard 279-1971.

Criterion (5)

The recommendations of the following regulatory guides pertaining to quality assurance should be followed.

1.28 Quality Assurance Program Requirements (Design and Construction)

1.30 Quality Assurance Requirements for the Installation, Inspection, and Testing of Instrumentation and Electric Equipment

1.38 Quality Assurance Requirements for Packaging, Shipping, Receiving, Storage, and Handling of Items for Water-Cooled Nuclear Power Plants

1.58 Qualification of Nuclear Power Plant Inspection, Examination, and Testing Personnel

1.64 Quality Assurance Requirements for the Design of Nuclear Power Plants

1.74 Quality Assurance Terms and Definitions

1.88 Collection, Storage, and Maintenance of Nuclear Power Plant Quality Assurance Records

1.123 Quality Assurance Requirements for Control of Procurement of Items and Services for Nuclear Power Plants

1.144 Auditing of Quality Assurance Programs for Nuclear Power Plants

Task RS 810-5 "Qualification of Quality Assurance Program Audit Personnel for Nuclear Power Plants" (Guide number to be inserted.)

Reference to the above regulatory guides (except Regulatory Guides 1.30 and 1.38) are being made pending issuance of a regulatory guide endorsing NQA-1 (Task RS 002-5) now in progress.

Compliance

The Iowa Electric Light and Power Company quality assurance program for the DAEC is described in the Iowa Electric Quality Assurance Department Manual, QADM-1300 Series. Services provided by Bechtel Power Corporation are in accordance with the Bechtel Quality Assurance Program for Nuclear Power Plants as described in Topical Report BQ-TOP-1, Revision 2A, July 1977. Equipment and services provided by General Electric are in accordance with the General Electric BWR Quality Assurance Program as described in Topical Report NEDO-11209-04A.

Criterion (6)

Continuous indication (it may be by recording) display should be provided at all times. Where two or more instruments are needed to cover a particular range, overlapping of instrument span should be provided.

Compliance

The DAEC containment pressure monitoring system provides continuous indication display. The subject system incorporates two instruments to span the required range. Overlapping instrument spans are provided.

The DAEC containment water level and hydrogen monitoring systems provide continuous indication display. Each system spans the required range with a single instrument.

Criterion (7)

Recording of instrumentation readout information should be provided. Where trend or transient information is essential for operator information or action, the recording should be analog strip chart or stored and displayed continuously on demand. Intermittent displays, such as data loggers and scanning records, may be used if no significant transient response information is likely to be lost by such devices.

Compliance

The subject systems provide continuous analog strip chart recording of the instrumentation readout information.

Criterion (8)

The instruments should be specifically identified on the control panels so the operator can easily discern that they are intended for use under accident conditions.

Compliance

Each control panel instrument associated with the subject systems is specifically identified by tag (stating the measured parameter) and located on control room panel 1C-09. Panel 1C-09 is specifically titled, Control Room Accident Monitoring.

Criterion (9)

The transmission of signals from the instrument or associated sensors for other use should be through isolation devices that are designated as part of monitoring instrumentation and that meet the provision of the document.

Compliance

The subject monitoring systems signals are not transmitted for other use and, therefore, do not require isolation devices.

Criterion (10)

Means should be provided for checking, with a high degree of confidence, the operational availability of each monitoring channel, including its input sensor, during reactor operation. This may be accomplished in various ways; for example:

(a) By perturbing the monitored variable

(b) By introducing and varying, as appropriate, a substitute input to the sensor of the same nature as the measured variable

(c) By cross-checking between channels that bear a known relationship to each other and that have readouts available.

Compliance

The design of the subject systems provides for checking, with a high degree of confidence, the operational availability of each monitoring channel, including its input sensor, during reactor operation by introducing and varying, as appropriate, a substitute input to the sensor of the same nature as the measured variable or cross-checking between channels that bear a known relationship to each other and that have readouts available.

Criterion (11)

Servicing, testing, and calibrating programs should be specified to maintain the capability of the monitoring instrumentation. For those instruments where the required interval between testing will be less than the normal time interval between generating station shutdowns, a capability for testing during power operation should be provided.

Compliance

The DAEC procedures specify servicing, testing, and calibration programs to maintain the capability of the subject monitoring systems. The programs include consideration of access requirements and provide the capability to implement the procedures according to the schedules specified.

Criterion (12)

Whenever means for removing channels from service are included in the design, the design should facilitate administrative control of the access to such removal means.

Compliance

The subject monitoring system designs provide for removing channels from service and the designs facilitate administrative control of the access to such removal means.

Criterion (13)

The design should facilitate administrative control of the access to all setpoint adjustments, module calibration adjustments, and test points.

Compliance

The subject monitoring systems are designed in accordance with the requirements of IEEE Standard 279 - 1971 to facilitate administrative control of the access to all setpoint adjustments, module calibration adjustments, and test points.

Criterion (14)

The monitoring instrumentation design should minimize the development of conditions that could cause meters, annunciators, recorders, alarms, etc. to give anomalous indications potentially confusing to the operator.

Compliance

The subject monitoring instrumentation are designed in accordance with the requirements of IEEE Standard 279 - 1971 to minimize the development of conditions that would cause meters, annunciators, recorders, alarms, etc. to give anomalous indications potentially confusing to the operator.

Criterion (15)

The instrumentation should be designed to facilitate the recognition, location, replacement, repair, or adjustment of malfunctioning components or modules.

Compliance

The subject monitoring systems instrumentation has been designed in accordance with the requirements of IEEE Standard 279 - 1971, to facilitate the recognition, location, replacement, repair, or adjustment of malfunctioning components or modules.

Criterion (16)

To the extent practical, monitoring instrumentation inputs should be from sensors that directly measure the desired variables.

Compliance

To the extent practical, the subject monitoring instrumentation receives inputs from sensors that directly measure the desired variables.

The containment pressure monitoring system instrumentation receives input from sensors which directly measure the containment pressure.

The containment water level monitoring system instrumentation derives torus level from the differential pressure across two torus instrument taps.

The containment hydrogen monitoring system instrumentation receives hydrogen concentration input derived from 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.

Criterion (17)

To the extent practical, the same instruments should be used for accident monitoring as are used for the normal operations of the plant to enable the operator to use, during accident situations, instruments with which the operator is most familiar. However, where the required range of monitoring instrumentation results in a loss of instrumentation sensitivity in the normal operating range, separate instruments should be used.

Compliance

The subject monitoring systems utilize the same instrumentation for accident and normal operations monitoring. For the containment pressure monitoring system, multiple instruments with overlapping ranges are used, permitting instrument sensitivity in the normal operating range. The containment water level and hydrogen monitoring systems cover the entire range with a single instrument. Because of the small variation in range required for accident monitoring, there is no loss of sensitivity for normal operations.

Criterion (18)

Periodic testing should be in accordance with the applicable portions of Regulatory Guide 1.118 pertaining to testing of instruments channels.

Compliance

The design basis of the DAEC predates the issuance of Regulatory Guide 1.118. Periodic testing of the subject systems will be based on the applicable portions of the DAEC Technical Specifications, and manufacturers' recommendations.

DUANE ARNOLD ENERGY CENTER
RESPONSE TO NRC REQUEST
FOR ADDITIONAL INFORMATION ON NUREG 0737 ITEMS

II.F.1.4, Containment Pressure Monitor, Accuracy and Time Response

II.F.1.5, Containment Water Level Monitor, Accuracy

II.F.1.6, Containment Hydrogen Monitor, Accuracy and Placement

1.0 INTRODUCTION

The following provides the Duane Arnold Energy Center (DAEC) response to Sections 2, 3, and 4 of the January 17, 1983, NRC request for additional information regarding NUREG 0737, Items II.F.1.4, II.F.1.5, and II.F.1.6. The DAEC response to Section 1 of the January 17, 1983, request is contained in Attachments 1 and 2 to this submittal.

(2) <u>CONTAINMENT (DRYWELL) PRESSURE MONITOR</u>

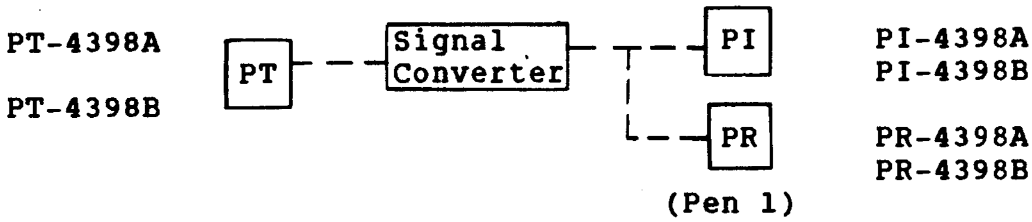
(2.1) NARROW RANGE (-5 to +5 PSIG)

(2.1a) <u>Item</u>

Provide a block diagram of the configuration of modules that make up your PMS. Provide an explanation of any details in the block diagram that might be necessary for an understanding of your PMS accuracy and time response.

<u>Response</u>

BLOCK DIAGRAM (REDUNDANT SYSTEMS APPLICABLE)



(2.1b) <u>Item</u>

For each module, provide a list of all parameters which describe the overall uncertainty in the transfer function of that module.

<u>Response</u>

UNCERTAINTY PARAMETERS

1. <u>Pressure Transmitter (Narrow Range)</u>

Model:	ITT-Barton Model 764 (Reference 2)
Specification:	GE 147D7701P764-1-1 (Reference 1)
Calibrated range (span):	-5 to +5 psig (0 psig at mid-range) (Reference 1)
Location:	Reactor building, south 757'-6" (Reference 4) Reactor building, north 786'-0" (Reference 4) Temperature range: 68 to 90F (Reference 5.a) Radiation level (30-day LOCA): <7.5 x 10^5 rads (Reference 5.a)

Parameters:

Random error (hysteresis, repeatability, and deadband):	± 0.5% of span (References 2 and 3)
Temperature:	± 1.0% of span per 100F change from +40 to +150F (Reference 3)
Power supply (see Note 1 for variation of ± 0.06 V dc):	Less than ± 0.025% of span per 1 V change (Reference 3)
Calibration:	± 0.5% of span (Note 2)

2. Signal Converter

Model:	Foxboro Type N-2AI-I2V (Reference 13)
Specification:	GE 184C5508 (Reference 13)
Span:	Same as transmitter range
Input/output signal:	4 to 20 mA dc/0 to 10 V dc (Reference 14)
Supply voltage:	+15, -15 V dc (Reference 14)
Location:	Control room (1C-09) (Reference 4) Temperature range: 75F ± 5F (Reference 5.b) Radiation level (30-day LOCA): 7.1×10^1 rads (Reference 5.b)

Parameters:

Random error:	± 0.25% of span (Reference 14)
Temperature:	± 0.5% of span for a 50F change (Reference 14)
Power supply:	± 0.2% of span within normal operating voltage limits (Reference 14)

3. Pressure Indicator

Model:	GE/Metermaster Type 180 (Reference 16)
Specification:	GE 152D8177P (see drawing codes) (Reference 15)
Scale range:	Same as transmitter range (Reference 15)
Location:	Control room (1C-09) (Reference 4) Temperature range: 75F ± 5F (Reference 5.b) Radiation level (30-day LOCA): 7.1×10^1 rads (Reference 5.b)

Parameters:	
Random error (hysteresis and repeatability):	± 0.5% of span (Reference 16)
Temperature:	Included in random error for temperature change of ± 15F (Reference 16)
Calibration:	± 0.5% of span (Note 2)

4. Pressure Recorder

Model:	Foxboro 226-S (References 17 and 18)
Specification:	GE 152D8181P226 (see drawing codes) (Reference 17)
Scale range:	Same as transmitter range (Reference 17)
Supply voltage:	30 V dc (Reference 30)
Location:	Control room (1C-09) (Reference 14) Temperature range: 75F ± 5F (Reference 5.b) Radiation level (30-day LOCA): 7.1×10^1 rads (Reference 5.b)
Parameters:	
Random error (hysteresis, repeatability, and pen positioning):	± 0.25% of span (Reference 20)
Temperature	± 0.5% of span for 50F change (Reference 20)
Power supply:	Pen positioning included in random error (Reference 20)
Calibration:	± 0.25% of span (Note 2)

(2.1c) Item

Combine parameters in 2.1b to get an overall system uncertainty. If you have both strip chart recorder and indicator output, give the overall system uncertainty for both systems. If you have systems spanning different ranges, give the overall system uncertainty for each system.

Response

OVERALL SYSTEM UNCERTAINTY

1. Pressure Transmitter (Span 10 psig)

Random	10 (.005)	.05
Temperature	10 (.01) $\frac{90°-68°}{100°}$	.022
Power supply	10 (.00025) (.06 V)	.00015
Calibration	10 (.005)	.05

$\sqrt{(.05)^2+(.022)^2+(.00015)^2+(.05)^2}$ ± 0.074 psig

2. Signal Converter (Span 10 psig)

Random	10 (.0025)	.025
Temperature	10 (.005) $\frac{10°}{50°}$	.01
Power supply	10 (.002)	.02

$\sqrt{(.025)^2 + (.01)^2 + (.02)^2}$ ± 0.034 psig

3. Pressure Indicator (Span 10 psig)

Random	10 (.005)	.05
Calibration	10 (.005)	.05

$\sqrt{(.05)^2 + (.05)^2}$ ± 0.071 psig

4. Pressure Recorder (Span 10 psig)

Random	10 (.0025)	.025
Temperature	10 (.005) $\frac{10°}{50°}$	.01
Calibration	10 (.0025)	.025

$\sqrt{(.025)^2 + (.01)^2 + (.025)^2}$ ± 0.037 psig

Overall Indicator System Uncertainty:

$\sqrt{(PT)^2 + (SC)^2 + (PI)^2}$

$\sqrt{(.074)^2 + (.034)^2 + (.071)^2}$ ± 0.100 psig

Overall Recorder System Uncertainty:

$$\sqrt{(PT)^2 + (SC)^2 + (PR)^2}$$

$$\sqrt{(.074)^2 + (.034)^2 + (.037)^2} \qquad \underline{\pm\ 0.089\ \text{psig}}$$

(21.d) Item

For each module, indicate the time response. For modules with a linear transfer function, state either the time constant, τ, or the Ramp Asymptotic Delay Time, RADT. For modules with an output that varies linearly in time, state the full scale response time. (Most likely the only module you have in this category is the strip chart recorder.)

Response

MODULE TIME RESPONSE

1. Pressure Transmitter (Reference 3)

   Less than 180 MS for 10 to 90% step function

2. Signal Converter

   Negligible

3. Pressure Indicator

   Negligible

4. Pressure Recorder (Reference 20)

   3 seconds maximum for pen travel from 10 to 90% full scale

(2.1e) Item

We will compute the overall system time response for you.

Response

No response requested.

(2) CONTAINMENT (DRYWELL) PRESSURE MONITOR (CONTINUED)

(2.2) FULL RANGE (0 to 250 PSIG)

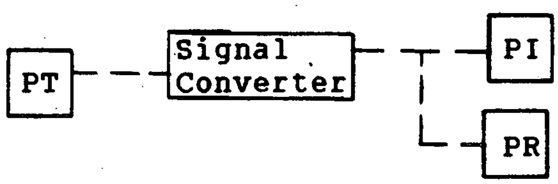
(2.2a) Item

Provide a block diagram of the configuration of modules that make up your PMS. Provide an explanation of any details in the block diagram that might be necessary for an understanding of your PMS accuracy and time response.

Response

BLOCK DIAGRAM (REDUNDANT SYSTEMS APPLICABLE)

PT-4399A
PT-4399B



PI-4399A
PI-4399B

PR-4398A
PR-4398B

(Pen 2)

(2.2b) Item

For each module provide a list of all parameters which describe the overall uncertainty in the transfer function of that module.

Response

UNCERTAINTY PARAMETERS

1. Pressure Transmitter (Full Range)

Model:	ITT-Barton Model 763 (Reference 9)
Specification:	GE 147D07706P763-1-3 (Reference 8)
Calibrated range (span):	0 to 250 psig (Reference 8)
Location:	Reactor building, south 757'-6" (Reference 4) Reactor building, north 786'-0" (Reference 4) Temperature range: 68 to 90F (Reference 5.a) Radiation level (30-day LOCA): $<7.5 \times 10^5$ rads (Reference 5.a)

Parameters:	
Random error (hysteresis, repeatability, and deadband):	± 0.5% of span (References 9 and 10)
Temperature:	± 1.0% of span per 100F change from +40 to +150F (Reference 10)
Power supply (see Note 1 for variation of ± 0.06 V dc):	Less than ± 0.025% of span per 1 V change (Reference 10)
Calibration:	± 0.5% of span (Note 2)

2. Signal Converter

Model:	Foxboro Type N-2AI-I2V (Reference 13)
Specification:	GE 184C5508 (Reference 13)
Span:	Same as transmitter range
Input/output signal:	4 to 20 mA dc/0 to 10 V dc (Reference 14)
Supply voltage:	+15, -15 V dc (Reference 14)
Location:	Control room (1C-09) (Reference 4) Temperature range: 75F ± 5F (Reference 5.b) Radiation level (30-day LOCA): 7.1×10^1 rads (Reference 5.b)
Parameters:	
Random error:	± 0.25% of span (Reference 14)
Temperature:	± 0.5% of span for a 50F change (Reference 14)
Power supply:	± 0.2% of span within normal operating voltage limits (Reference 14)

3. Pressure Indicator

Model:	GE/Metermaster Type 180 (Reference 16)
Specification:	GE 152D8177P (see drawing codes) (Reference 15)
Scale range:	Same as transmitter range (Reference 15)
Location:	Control room (1C-09) (Reference 4) Temperature range: 75F ± 5F (Reference 5.b) Radiation level (30-day LOCA): 7.1×10^1 rads (Reference 5.b)

Parameters:	
Random error (hysteresis and repeat-ability):	± 0.5% of span (Reference 16)
Temperature:	Included in random error for temperature change of ± 15F (Reference 16)
Calibration:	± 0.5% of span (Note 2)

4. Pressure Recorder

Model:	Foxboro 226-S (References 17 and 18)
Specification:	GE 152D8181P226 (see drawing codes) (Reference 17)
Scale range:	Same as transmitter range (Reference 17)
Supply voltage:	30 V dc (Reference 18)
Location:	Control room (1C-09) (Reference 4) Temperature range: 75F ± 5F (Reference 5.b) Radiation level (30-day LOCA): 7.1×10^1 rads (Reference 5.b)
Parameters:	
Random error (hysteresis, repeatability, and pen positioning)	± 0.25% of span (Reference 20)
Temperature:	± 0.5% of span for 50F change (Reference 20)
Power supply	Pen positioning included in random error (Reference 20)
Calibration:	± 0.25% of span (Note 2)

(2.2c) Item

Combine parameters in 2.2b to get an overall system uncertainty. If you have both strip chart recorder and indicator output, give the overall system uncertainty for both systems. If you have systems spanning different ranges, give the overall system uncertainty for each system.

Response

OVERALL SYSTEM UNCERTAINTY

1. Pressure Transmitter (Span 250 psig)

Random	250 (.005)	1.25
Temperature	250 (.01) $\frac{90°-68°}{100°}$	0.55
Power supply	250 (.00025) (.06 V)	0.0038
Calibration	250 (.005)	1.25

$\sqrt{(1.25)^2+(0.55)^2+(0.0038)^2+(1.25)^2}$ ± 1.85 psig

2. Signal Converter (Span 250 psig)

Random	250 (.0025)	.625
Temperature	250 (.005) $\frac{10°}{50°}$	.25
Power supply	250 (.002)	.50

$\sqrt{(.625)^2 + (.25)^2 + (.50)^2}$ ± 0.84 psig

3. Pressure Indicator (Span 250 psig)

Random	250 (.005)	1.25
Calibration	250 (.005)	1.25

$\sqrt{(1.25)^2 + (1.25)^2}$ ± 1.77 psig

4. Pressure Recorder (Span 250 psig)

Random	250 (.0025)	.625
Temperature	250 (.005) $\frac{10°}{50°}$	.25
Calibration	250 (.0025)	.625

$\sqrt{(.625)^2 + (.25)^2 + (.625)^2}$ ± 0.92 psig

Overall Indicator System Uncertainty:

$$\sqrt{(PT)^2 + (SC)^2 + (PI)^2}$$

$\sqrt{(1.85)^2 + (.84)^2 + (1.77)^2}$ ± 2.70 psig

Overall Recorder System Uncertainty:

$$\sqrt{(PT)^2 + (SC)^2 + (PR)^2}$$

$$\sqrt{(1.85)^2 + (.84)^2 + (.92)^2} \qquad \underline{\pm\ 2.23 \text{ psig}}$$

(2.2d) Item

For each module indicate the time response. For modules with a linear transfer function, state either the time constant, τ, or the Ramp Asymptotic Delay Time, RADT. For modules with an output that varies linearly in time, state the full scale response time. (Most likely the only module you have in this category is the strip chart recorder.)

Response

MODULE TIME RESPONSE

1. Pressure Transmitter (Reference 10)

Less than 180 MS for 10 to 90% step function

2. Signal Converter

Negligible

3. Pressure Indicator

Negligible

4. Pressure Recorder (Reference 20)

3 seconds maximum for pen travel from 10 to 90% full scale

(2.2e) Item

We will compute the overall system time response for you.

Response

No response requested.

(3) <u>CONTAINMENT (TORUS) WATER LEVEL MONITOR</u>

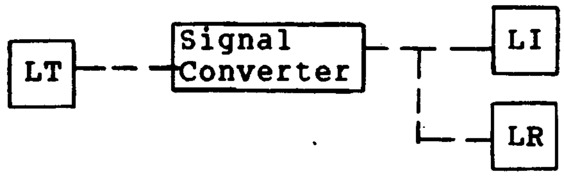
(3a) <u>Item</u>

Provide a block diagram of the configuration of modules that make up your WLMS. Provide an explanation of any details in the block diagram that might be necessary for an understanding of your WLMS accuracy.

<u>Response</u>

BLOCK DIAGRAM (REDUNDANT SYSTEMS APPLICABLE)

LT-4397A
LT-4397B



LI-4397A
LI-4397B

LR-4396A
LR-4396B

(Pen 1)

(3b) <u>Item</u>

For each module provide a list of all parameters which describe the overall uncertainty in the transfer function of that module.

<u>Response</u>

UNCERTAINTY PARAMETERS

1. <u>Level Transmitter</u>

Model:	ITT-Barton Model 764 with two Model 352 sealed sensors and capillaries with DC 702 fill (Reference 12)
Specification:	GE 152D8193P352010101B (Reference 11)
Calibrated range (span):	0 to 30 feet at 68F process water density (Reference 11)
Location:	Torus room, north 716'-9" (Reference 4) Temperature range: 68 to 104F (normal); 140F (30-day LOCA) Radiation level (30-day LOCA): 12×10^6 rads (Reference 5.c)
Parameters:	
Random error (hysteresis, repeatability, and deadband):	± 0.5% of span (References 2 and 3)

Temperature:	± 1.0% of span per 100F change from +40 to +150F (Reference 3)
Power supply (see Note 1 for variation of ± 0.06 V dc):	Less than ± 0.025% of span per 1 V change (Reference 3)
Radiation exposure during LOCA based on 50 x 10^6 rads test exposure	± 5.0% of span (Reference 3)
Calibration:	± 0.5% of span (Note 2)

Measurement is not temperature-compensated to correct level indication for variations in density due to transient temperature conditions. Maximum density error is 3.6% at transient temperature of 200F which exists for only 25 hours. Actual level would be slightly higher than indicated.

2. Signal Converter

Model:	Foxboro Type N-2AI-I2V (Reference 13)
Specification:	GE 184C5508 (Reference 13)
Span:	Same as transmitter range
Input/output signal:	4 to 20 mA dc/0 to 10 V dc (Reference 14)
Supply voltage:	+15, -15 V dc (Reference 14)
Location:	Control room (1C-09) (Reference 4) Temperature range: 75F ± 5F (Reference 5.b) Radiation level (30-day LOCA): 7.1 x 10^1 rads (Reference 5.b)
Parameters:	
Random error:	± 0.25% of span (Reference 14)
Temperature:	± 0.5% of span for a 50F change (Reference 14)
Power supply:	± 0.2% of span within normal operating voltage limits (Reference 14)

3. Level Indicator

Model:	GE/Metermaster Type 180 (Reference 16)
Specification:	GE 152D8177P (see drawing codes) (Reference 15)
Scale range:	Same as transmitter range (Reference 15)

Location:	Control room (1C-09) (Reference 4) Temperature range: 75F ± 5F (Reference 5.b) Radiation level (30-day LOCA): 7.1×10^1 rads (Reference 5.b)
Parameters:	
Random error (hysteresis and repeatability)	± 0.5% of span (Reference 16)
Temperature:	Included in random error for temperature change of ± 15F (Reference 16)
Calibration:	± 0.5% of span (Note 2)

4. Level Recorder

Model:	Foxboro 226-S (References 17 and 18)
Specification:	GE 152D8181P226 (see drawing codes) (Reference 17)
Scale range:	Same as transmitter range (Reference 17)
Supply voltage:	30 V dc (Reference 18)
Location:	Control room (1C-09) (Reference 4) Temperature range: 75F ± 5F (Reference 5.b) Radiation level (30-day LOCA): 7.1×10^1 rads (Reference 5.b)
Parameters:	
Random error (hysteresis, repeatability, and pen positioning)	± 0.25% of span (Reference 20)
Temperature:	± 0.5% of span for 50F change (Reference 20)
Power supply:	Pen positioning included in random error (Reference 20)
Calibration:	± 0.25% of span (Note 2)

(3c) Item

Combine parameters in 3b to get an overall system uncertainty. If you have both strip chart recorder and indicator output, give the overall system uncertainty for both systems. If you have systems spanning different ranges, give the overall system uncertainty for each system.

Response

OVERALL SYSTEM UNCERTAINTY

1. Level Transmitter (Span 30 feet)

Random	30 (.005)	0.15
Temperature	30 (.01) $\frac{140°-68°}{100°}$	0.216
	(140F is LOCA temperature)	
Power supply	30 (.0025) (.06 V)	0.0045
Radiation	30 (.05)	1.5
Calibration	30 (.005)	0.15

$\sqrt{(.15)^2+(.216)^2+(.0045)^2+(1.5)^2+(.15)^2}$ ± 1.53 feet

2. Signal Converter (Span 30 feet)

Random	30 (.0025)	.075
Temperature	30 (.005) $\frac{10°}{50°}$	.03
Power supply	30 (.002)	.06

$\sqrt{(.075)^2 + (.03)^2 + (.06)^2}$ ± 0.10 feet

3. Level Indicator (Span 30 feet)

Random	30 (.005)	.05
Calibration	30 (.005)	.05

$\sqrt{(.05)^2 + (.05)^2}$ ± 0.07 feet

4. Level Recorder (Span 30 feet)

Random	30 (.0025)	.075
Temperature	30 (.005) $\frac{10°}{50°}$	.03
Calibration	30 (.0025)	.075

$\sqrt{(.075)^2 + (.03)^2 + (.075)^2}$ ± 0.11 feet

Overall Indicator System Uncertainty:

$$\sqrt{(LT)^2 + (SC)^2 + (LI)^2}$$

$$\sqrt{(1.53)^2 + (.10)^2 + (.07)^2}$$ $\underline{\pm 1.5 \text{ feet}}$

Overall Recorder System Uncertainty:

$$\sqrt{(LT)^2 + (SC)^2 + (LR)^2}$$

$$\sqrt{(1.53)^2 + (.10)^2 + (.11)^2}$$ $\underline{\pm 1.5 \text{ feet}}$

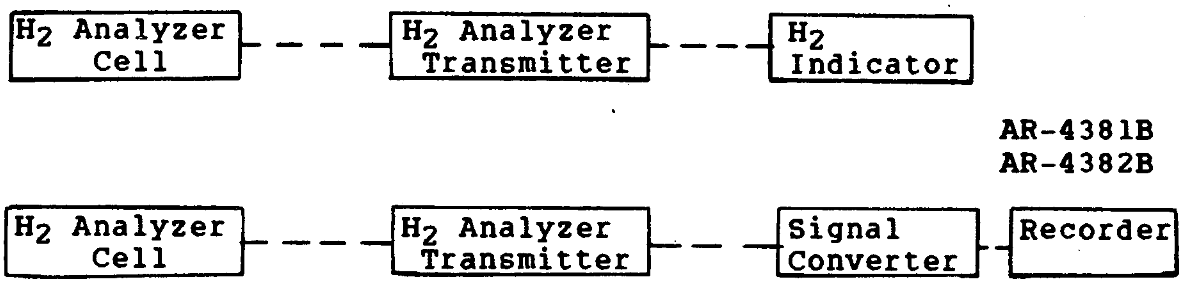
(4) CONTAINMENT HYDROGEN MONITOR

(4a) Item

Provide a block diagram of the configuration of modules that make up your HMS. Provide an explanation of any details in the block diagram that might be necessary for an understanding of your HMS accuracy. If you have different types of HMSs give this information for each type.

Response

BLOCK DIAGRAM (REDUNDANT SYSTEMS APPLICABLE)



(Pen 2)

(4b) Item

For each module provide a list of all parameters which describe the overall uncertainty in the transfer function of that module.

Response

UNCERTAINTY PARAMETERS

1. Hydrogen Analyzer System

Model:	Comsip, Inc K-IV Containment Monitor. The monitor system consists of a local panel containing the analyzer cell with required piping components and a control room panel insert containing the analyzer transmitter, indicator, and the recorder signal converter. The analyzing system combined accuracy includes the cell and transmitter (References 21, 22, and 23)

Scale range:	0 to 10% (Reference 24)
Location:	1) Analyzer panels 1C-218A and 1C-218B (Reference 25) Reactor building, 757'-6" (Reference 25) Temperature range: 68 to 90F (Reference 5.a) Radiation level (30-day LOCA): 4.7×10^5 rads (Reference 5.a) 2) Control room panels 1C-09 Temperature range: 75F ± 5F (Reference 5.b) Radiation level (30-day LOCA): 7.1×10^1 rads (Reference 5.b)
Parameters:	
Analyzer cell and transmitter accuracy:	± 1% of full scale (Reference 26)
Calibration gas error:	± 2% of full scale (Reference 26)
Flow variation:	± 1% of full scale
Temperature:	The sample line is heat traced to maintain a temperature of 280F. The cell is located in a "hot box" enclosure to maintain a constant temperature (Reference 27). The transmitter is located in the control room which is controlled at 75F ± 5F. This temperature change is included in the cell transmitter accuracy.
Calibration:	± 1% of full scale (Note 2)
Power supply:	Negligible
Indicator:	± 2.0% of full scale (Reference 26)
Signal converter for recorder signal:	± 0.5% of full scale (Reference 26)
Indicator calibration:	± 2% of full scale (Note 2)

2. Hydrogen Recorder

Model:	Honeywell Type Vutronik, Model Y37303-6020-0222-000-610 (Reference 24)
Scale range:	0 to 10% (Reference 24)
Location:	Control room (1C-09) Temperature range: 75F ± 5F (Reference 5.b) Radiation level (30-day LOCA): 7.1×10^1 rads (Reference 5.b)

Parameters:

Random error (hysteresis and repeatability):	± 0.5% of span (Reference 14)
Temperature:	± 0.036% of span per 1C (1.8F) change for conditions of 25C ± 1C (77F ± 2F) (Reference 31)
Power supply:	Included in random error for power supply of 120 V ac ± 6% (± 7.2 V ac)
Calibration:	± 0.5% of full scale (Note 2)

3. <u>Indicator and Signal Converter</u>

See Item 1, Hydrogen Analyzer System, for parameter data.

(4c) <u>Item</u>

Combine the parameters in 4b to get an overall system uncertainty. If you have both strip chart recorder and indicator output, give the overall system uncertainty for both systems.

<u>Response</u>

OVERALL SYSTEM UNCERTAINTY

1. <u>Hydrogen Analyzer System (Scale 10%)</u>

Cell and transmitter	10 (.01)	.1
Calibration gas error	10 (.02)	.2
Variation due to flow	10 (.01)	.1
Calibration	10 (.01)	.1

$$\sqrt{(.1)^2 + (.2)^2 + (.1)^2 + (.1)^2} \qquad \pm 0.27\%$$

2. <u>Hydrogen Indicator (Scale 10%)</u>

Random	10 (.02)	.2
Calibration	10 (.02)	.2

$$\sqrt{(.2)^2 + (.2)^2} \qquad \pm 0.28\%$$

3. <u>Signal Converter for Recorder Signal</u>

Random	10 (.005)		.05

$\sqrt{(.05)^2}$ $\pm$ 0.05%

4. <u>Hydrogen Recorder (Scale 10%)</u>

Random	10 (.005)		.05
Temperature	10 (.00036)	$\frac{10F}{1.8F}$	.02
Calibration	10 (.005)		.05

$\sqrt{(.05)^2 + (.02)^2 + (.05)^2}$ $\pm$ 0.074%

Overall Indicator System Uncertainty:

$$\sqrt{(\text{Analyzer})^2 + (\text{Indicator})^2}$$

$\sqrt{(.27)^2 + (.28)^2}$ $\pm$ 0.39%

Overall Recorder System Uncertainty:

$$\sqrt{(\text{Analyzer})^2 + (\text{SC})^2 + (\text{Recorder})^2}$$

$\sqrt{(.27)^2 + (.05)^2 + (.074)^2}$ $\pm$ 0.28%

(4d) <u>Item</u>

Indicate the placement and number of hydrogen monitor intake ports in containment. Indicate any special sampling techniques that are used either to examine one region of containment or to assure that a good cross section of containment is being monitored.

Response

CONTAINMENT SAMPLING METHOD AND LOCATIONS

1. Sampling Method

Hydrogen monitoring consists of two redundant systems consisting of a local analyzer panel containing the sample extraction pump, analyzer cell with required piping components, and a control room panel insert containing the analyzer transmitter and associated electronics (References 21, 22, and 23).

Each local analyzer panel has a single sample supply and sample return. The single sample supply is manifold to two drywell samples and one torus sample. Any one of these samples is operator-selected by handswitches located on the local analyzer panel or a control room panel to open the applicable sample solenoid valve (Reference 28).

2. Sampling Locations

The drywell samples are obtained from the containment through 1 inch stainless piping routed from the specified penetration to the following locations. Two samples, 180 degrees apart and at the same elevation, are provided at an upper elevation of 817'-0" and at a lower elevation of 764'-0" which is 2 feet below the eguator elevation. One each of the upper and lower connections is routed to each analyzer rack. The sample returns are not 180 degrees apart and extend inside and flow directed down (Reference 29).

Analyzer Rack 1C-218A

Penetration	Sample Location
X50-B supply	Elevation 817'-0" at 160 degree azimuth halfway between drywell inner wall and bioshield
X50-E supply	Elevation 764'-0" at 70 degree azimuth and 10'-0" from inner wall of drywell
X50-D return	Elevation 773'-9" at 130 degree azimuth inside drywell facing down at inside penetration

Analyzer Rack 1C-218B

Penetration	Sample Location
X56-C supply	Elevation 817'-0" at 340 degree azimuth halfway between drywell inner wall and bioshield
X56-D supply	Elevation 764'-0" at 250 degree azimuth and 10'-0" from inner wall of drywell
X46-E return	Elevation 781'-5" at 245 degree azimuth inside drywell facing down at inside penetration

The torus (suppression chamber) samples are obtained from the containment through a 1-inch nipple extended 6 inches from the inner wall 1 foot above the torus centerline, elevation 732'-3-1/4" at the following locations. Review of this location data will denote that the sample supply to the two local analyzer racks are 180 degrees apart (Reference 30).

Analyzer Rack	Penetration	Sample Location
1C-218A	N229B	Azimuth 337°-30"
1C-218B	N229G	Azimuth 157°-30"

(4e) Item

Are there any obstructions which would prevent hydrogen escaping from the core from reaching the hydrogen sample ports quickly?

Response

No, the location of the hydrogen sample ports was selected to facilitate the detection of hydrogen escaping from the core into the primary containment atmosphere.

NOTES

1. INSTRUMENT POWER SUPPLY VARIATIONS

Model:	Foxboro 2ARPS multinest power supply, +15, -15 V dc supply (Reference 6)
Location:	Control room (1C-09) Temperature range: 75F ± 5F (Reference 5.b)
Parameters:	
Input voltage variation (References 6 and 19):	120 V ac, +10%, -15%
Output regulation (Reference 19):	8 ± 0.2% for +10%, -15% change from nominal input voltage
For +15, -15 V dc Spec 200 system: (0.002)(15 V dc)	± 0.03 V dc
For 24 V dc transmitter supply (30 to 24 V dc converter): (.002)(30 V dc)	± 0.06 V dc

2. Calibration instrumentation accuracies are greaer than or equal to the accuracy of the basic component being calibrated. Therefore, calibration uncertainty is conservatively assumed to be egual to the basic component uncertainty (random error).

REFERENCES

1. GE Drawing 147D7701, Purchase Part, Differential Pressure Electrical Transmitter, Supplier Document 11186-223-37531-2-1

2. GE Performance Specification 22A7885, Differential Pressure Electrical Transmitter

3. ITT-Barton Model 764 Differential Pressure Electronic Transmitter Qualification Test Report R3-764-9, dated October 5, 1982

4. Environmental Qualification Program, July 15, 1982

5. Specification 7884-M-411A, Environment Service Conditions for Safety-Related Equipment, Revision 2

5.a Parameter Sheets 12A and 16B
5.b Parameter Sheet 37
5.c Parameter Sheet 1A

6. GE Drawing 147D7861 Power Supply, Supplier Document 11186-223-37531-6-1

7. GE Performance Specification 22A7725, Power Supply

8. GE Drawing 147D7706, Purchase Part, Gage Pressure Electrical Transmitter, Supplier Document 11186-223-37531-3-1

9. GE Performance Specification 22A7898, Gage Pressure Electrical Transmitter

10. ITT-Barton Model 763 Gage Pressure Electronic Transmitter Qualification Test Report R3-763-6, dated September 30, 1982

11. GE Drawing 152D8193, Purchase Part, Pressure Transmitter 500 psi (With Sealed Sensor Used for Level Sensing), Supplier Document 11186-223-J-37351-16-1

12. GE Performance Specification 22A7726, Differential Pressure Electrical Transmitter with Sealed Sensors

13. GE Drawing 184C5508, Purchase Part, Current-to-Voltage Converter, Supplier Document 11186-223-J-37351-12-1

14. Foxboro Spec 200, Current-to-Voltage Converters, Technical Information Sheet TI 2A1-130

15. GE Drawing 152D8177, Selected Item, Meter, Supplier Document 1118[illegible]23-37351-9-1

16. GE Performance Specification 22A7722, Panel Meter

17. GE Drawing 152D8181, Purchased Part, Recorder, Supplier Document 11186-223-J-37351-17-1

18. GE Performance Specification 22A7724, Recorder and Recorder Shelf Performance Specification

19. Foxboro Spec 200, Multinest Power Supply, Technical Information Sheet TI 2AR-120

20. Foxboro 226S Series Spec 200 Electronic Recording Display Station (Recorder), Product Specification PSS 2E-2A1A

21. Comsip Drawing 06720 K-IV, Piping and Instrumentation Diagram, Supplier Document 11186-204-MRS-M193A-3-2

22. Comsip Drawing 06702 K-IV, Analyzer Panel Layout, Supplier Document 11186-204-MRS-M193A-2-2

23. Comsip Drawing 06701 K-IV, Remote Control Panel Layout, Supplier Document 11186-204-MRS-M193A-1-2

24. Telephone Memorandum, Charles Deahl (Jobsite) to J. Burns (Ann Arbor), dated February 18, 1983, Subject: Requested Data for Containment Hydrogen Monitor and Recorder, Chron 0010712

25. Drawing M-2, Equipment Location Plan at Elevation 757'-6"

26. Comsip Letter dated February 18, 1983, to Bechtel Power Corporation, Subject: System Accuracies Post-LOCA Containment Hydrogen Monitoring System, Chron 0010621

27. Comsip Operational Manual for K-IV Monitor, Supplier Document 11186-204-MRS-M193A-22-1

28. Drawing M-181, P&ID Containment Atmosphere Monitoring System

29. Drawing FSK 5000, Schedule of Penetration Usage, Sheets C-2, C-3, and C-5

30. Drawing M-43, Suppression Chamber; Plan, Sections, and Penetrations

31. Honeywell Type Vutronik Recorders and Trend Panel Specification Data S373-1C