

2.4.14 Hydrogen Monitoring System

Design Description

1.0 System Description

The hydrogen monitoring system (HMS) provides for the monitoring of hydrogen concentration in the containment atmosphere.

The HMS has the following non-safety-related function:

- Provides containment hydrogen concentration signals to SCDS.

2.0 Arrangement

2.1 The location of the HMS equipment is as listed in Table 2.4.14-1—Hydrogen Monitoring System Equipment.

3.0 Mechanical Design Features

3.1 Equipment identified as Seismic Category I in Table 2.4.14-1 can withstand seismic design basis loads without a loss of safety function(s).

4.0 I&C Design Features, Displays, and Controls

4.1 Class 1E HMS equipment listed in Table 2.4.14-1 can perform its safety function when subjected to electromagnetic interference (EMI), radio-frequency interference (RFI), electrostatic discharges (ESD), and power surges.

4.2 The HMS provides output signals to the recipients listed in Table 2.4.14-2—Hydrogen Monitoring System Output Signals.

5.0 Electrical Power Design Features

5.1 Equipment designated as Class 1E in Table 2.4.14-1 are powered from the Class 1E division as listed in Table 2.4.14-1 in a normal or alternate feed condition.

6.0 Environmental Qualifications

6.1 Equipment designated as harsh environment in Table 2.4.14-1 can perform their function under normal environmental conditions, containment test conditions, anticipated operational occurrences, and accident and post-accident environmental conditions.

6.2 Equipment designated as mild environment in Table 2.4.14-1 can perform their function under normal environmental conditions, anticipated operational occurrences, and accident and post-accident environmental conditions.

Inspections, Tests, Analyses, and Acceptance Criteria

Table 2.4.14-3 lists the HMS ITAAC.

**Table 2.4.14-1—Hydrogen Monitoring System Equipment
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Description	Tag Number⁽¹⁾	Location	Seismic Category	IEEE Class 1E⁽²⁾	Environment
Hydrogen Sensor	30JMU10CQ001	Reactor Building	I	Note 3 1 ^N 2 ^A	Harsh
Hydrogen Sensor	30JMU10CQ002	Reactor Building	I	Note 3 4 ^N 3 ^A	Harsh
Hydrogen Sensor	30JMU10CQ003	Reactor Building	I	Note 3 1 ^N 2 ^A	Harsh
Hydrogen Sensor	30JMU10CQ004	Reactor Building	I	Note 3 4 ^N 3 ^A	Harsh
Hydrogen Sensor	30JMU10CQ005	Reactor Building	I	Note 3 1 ^N 2 ^A	Harsh
Hydrogen Sensor	30JMU10CQ006	Reactor Building	I	Note 3 4 ^N 3 ^A	Harsh
Hydrogen Sensor	30JMU10CQ007	Reactor Building	I	Note 3 1 ^N 2 ^A	Harsh
Hydrogen Sensor	30JMU10CQ008	Reactor Building	I	Note 3 4 ^N 3 ^A	Harsh
Hydrogen Sensor	30JMU10CQ009	Reactor Building	I	Note 3 1 ^N 2 ^A	Harsh
Hydrogen Sensor	30JMU10CQ010	Reactor Building	I	Note 3 4 ^N 3 ^A	Harsh
Hydrogen Sensor	30JMU10CQ011	Reactor Building	I	Note 3 1 ^N 2 ^A	Harsh

**Table 2.4.14-1—Hydrogen Monitoring System Equipment
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Description	Tag Number⁽¹⁾	Location	Seismic Category	IEEE Class 1E⁽²⁾	Environment
Hydrogen Sensor	30JMU10CQ012	Reactor Building	I	Note 3 4 ^N 3 ^A	Harsh
Hydrogen Monitoring Signal Processing Unit	30JMU10GH001	Safeguard Building	I	Note 3 1 ^N 2 ^A	Mild
Hydrogen Monitoring Signal Processing Unit	30JMU10GH002	Safeguards Building	I	Note 3 4 ^N 3 ^A	Mild

1. Equipment tag numbers are provided for information and are not part of the design certification.
2. ^N denotes the division the equipment is normally powered from. ^A denotes the division the equipment is powered from when alternate feed is implemented.
3. The operation of the equipment is non-safety-related and not-Class 1E. It is powered from a Class 1E source.

Table 2.4.14-2—Hydrogen Monitoring System Output Signals

Item #	Output Signal	Recipient	# Divisions
1	Containment Hydrogen Concentration	SCDS	2 (Divisions 1 & 4)

**Table 2.4.14-3—Hydrogen Monitoring System ITAAC
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Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
2.1	The location of the HMS equipment is as listed in Table 2.4.14-1.	An inspection of the location of the as-built HMS equipment will be performed.	The HMS equipment listed in Table 2.4.14-1 is located as listed in Table 2.4.14-1.
3.1	Equipment identified as Seismic Category I in Table 2.4.14-1 can withstand seismic design basis loads without a loss of safety function(s).	<p>a. Type tests, analyses, or a combination of type tests and analyses will be performed on the equipment identified as Seismic Category I in Table 2.4.14-1 using analytical assumptions, or under conditions, which bound the Seismic Category I design requirements.</p> <p>b. An inspection will be performed of the as-built equipment identified as Seismic Category I in Table 2.4.14-1 to verify that the equipment, including anchorage, are installed in a condition bounded by the tested or analyzed condition.</p>	<p>a. Test/analysis reports conclude that the equipment identified as Seismic Category I in Table 2.4.14-1 can withstand seismic design basis loads without a loss of safety function(s).</p> <p>b. Inspection reports conclude that the equipment identified as Seismic Category I in Table 2.4.14-1, including anchorage, are installed in a condition bounded by the tested or analyzed condition.</p>
4.1	Class 1E HMS equipment listed in Table 2.4.14-1 can perform its safety function when subjected to EMI, RFI, ESD, and power surges.	Type tests or type tests and analyses will be performed to demonstrate that the Class 1E HMS equipment listed in Table 2.4.14-1 can perform its safety function when subjected to EMI, RFI, ESD, and power surges.	Equipment identified as Class 1E in Table 2.4.14-1 can perform its safety function when subjected to EMI, RFI, ESD, and power surges.
4.2	The HMS provides output signals to the recipients listed in Table 2.4.14-2.	A test will be performed to verify that the HMS provides output signals to the recipients listed in Table 2.4.14-2.	The HMS provides output signals to the recipients listed in Table 2.4.14-2.

**Table 2.4.14-3—Hydrogen Monitoring System ITAAC
Sheet 2 of 3**

	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
5.1	Equipment designated as Class 1E in Table 2.4.14-1 are powered from the Class 1E division as listed in Table 2.4.14-1 in a normal or alternate feed condition.	<ul style="list-style-type: none"> a. Testing will be performed by providing a test input signal in each normally aligned division. b. Testing will be performed by providing a test input signal in each division with the alternate feed aligned to the divisional pair. 	<ul style="list-style-type: none"> a. The test input signal provided in the normally aligned division is present at the respective Class 1E equipment identified in Table 2.4.14-1. b. The test input signal provided in each division with the alternate feed aligned to the divisional pair is present at the respective Class 1E equipment identified in Table 2.4.14-1.
6.1	Equipment designated as harsh environment in Table 2.4.14-1 can perform their function under normal environmental conditions, containment test conditions, anticipated operational occurrences, and accident and post-accident environmental conditions.	<ul style="list-style-type: none"> a. Type tests or type tests and analysis will be performed to demonstrate the ability of the equipment designated as harsh environment in Table 2.4.14-1 to perform their function under normal environmental conditions, containment test conditions, anticipated operational occurrences, and accident and post-accident environmental conditions. b. An inspection will be performed of the as-built equipment designated as harsh environment in Table 2.4.14-1 to verify that the equipment, including the associated cables, wiring, and terminations located in a harsh environment, are bounded by the type test or combination of type tests and analyses. 	<ul style="list-style-type: none"> a. EQDPs conclude that the equipment designated as harsh environment in Table 2.4.14-1 can perform their function under normal environmental conditions, containment test conditions, anticipated operational occurrences, and accident and post-accident environmental conditions, including the time required to perform the listed function. b. A report exists and concludes that the equipment designated as harsh environment in Table 2.4.14-1, including the associated cables, wiring, and terminations located in a harsh environment, are bounded by the type test or combination of type tests and analyses.

**Table 2.4.14-3—Hydrogen Monitoring System ITAAC
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	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
6.2	<p>Equipment designated as mild environment in Table 2.4.14-1 can perform their function under normal environmental conditions, anticipated operational occurrences, and accident and post-accident environmental conditions.</p>	<p>a. Type tests or type tests and analysis will be performed to demonstrate the ability of the equipment designated as mild environment in Table 2.4.14-1 to perform their function under normal environmental conditions, anticipated operational occurrences, and accident and post-accident environmental conditions.</p> <p>b. An inspection will be performed of the as-built equipment designated as mild environment in Table 2.4.14-1 to verify that the equipment, including the associated cables, wiring, and terminations located in a mild environment, are bounded by the type test or combination of type tests and analyses.</p>	<p>a. EQDPs conclude that the equipment designated as mild environment in Table 2.4.14-1 can perform their function under normal environmental conditions, anticipated operational occurrences, and accident and post-accident environmental conditions, including the time required to perform the listed function.</p> <p>b. A report exists and concludes that the equipment designated as mild environment in Table 2.4.14-1, including the associated cables, wiring, and terminations located in a mild environment, are bounded by the type test or combination of type tests and analyses.</p>