

2.3 Severe Accident Systems

2.3.1 Combustible Gas Control System

1.0 Description

The combustible gas control system (CGCS) prevents damage to the containment or emergency equipment in the event of an accident with ensuing mass and energy release. In addition, for a severe accident with core degradation, the system inhibits potential damage by controlling the combustible gas concentration in containment.

The CGCS provides the following safety-related function:

- Mixing of the containment atmosphere.

The CGCS provides the following non-safety-related functions:

- Controlling combustible gas concentrations.
- Maintaining containment structural integrity by limiting the pressure to within the containment design pressure resulting from a combustible gas ignition from the most severe accident.
- Maintaining the two zone separation between accessible and equipment space.

2.0 Arrangement

2.1 The location of the CGCS equipment is as listed in Table 2.3.1-1.

3.0 Mechanical Design Features

3.1 Components identified as Seismic Category I in Table 2.3.1-1 can withstand seismic design basis loads without a loss of the function listed in Table 2.3.1-1.

4.0 Instrumentation and Controls (I&C) Design Features, Displays and Controls

4.1 Displays listed in Table 2.3.1-2—CGCS Equipment I&C and Electrical Design are retrievable in the main control room (MCR) and the remote shutdown station (RSS) as listed in Table 2.3.1-2.

4.2 The CGCS equipment controls are provided in the MCR and the RSS as listed in Table 2.3.1-2.

4.3 Equipment listed as being controlled by a priority and actuator control system (PACS) module in Table 2.3.1-2 responds to the state requested by a test signal.

5.0 Electrical Power Design Features

5.1 Hydrogen mixing dampers listed in Table 2.3.1-1 fail open on loss of power.

6.0 Environmental Qualifications

6.1 Components in Table 2.3.1-2, that are designated as harsh environment, will perform the function listed in Table 2.3.1-2 in the environments that exist during and following design basis events.

7.0 Equipment and System Performance

7.1 The hydrogen mixing dampers listed in Table 2.3.1-1 provide pressure relief for design basis events.

7.2 The convection foils listed in Table 2.3.1-1 provide pressure relief for design basis events.

7.3 The rupture foils listed in Table 2.3.1-1 provide pressure relief for design basis events.

7.4 The fusible link of the convection foils listed in Table 2.3.1-1 fails at the designed temperature.

7.5 The burst element of the convection foils listed in Table 2.3.1-1 opens at the designed pressure.

7.6 The burst element of the rupture foils listed in Table 2.3.1-1 opens at the designed pressure.

8.0 Inspections, Tests, Analyses, and Acceptance Criteria

8.1 Table 2.3.1-3 lists the Combustible Gas Control System ITAAC.

**Table 2.3.1-1—Combustible Gas Control System Equipment Mechanical Design
(4 Sheets)**

Description	Tag Number	Location	Function	Seismic Category
Recombiner	30JMT10AT001 ¹	Room 30UJA18019, surge line area	N/A	II
Recombiner	30JMT10AT002	Room 30UJA18007, SG loop 3 area	N/A	II
Recombiner	30JMT10AT003	Room 30UJA18008, SG loop 4 area	N/A	II
Recombiner	30JMT10AT004	Room 30UJA18003, SG loop 1 area	N/A	II
Recombiner	30JMT10AT005	Room 30UJA18004, SG loop 2 area	N/A	II
Recombiner	30JMT10AT006 ¹	Room 30UJA18018, spray valves area	N/A	II
Recombiner	30JMT10AT007 ¹	Room 30UJA23019, pressurizer area	N/A	II
Recombiner	30JMT10AT008	Room 30UJA23006, RCP loop 3 area	N/A	II
Recombiner	30JMT10AT009	Room 30UJA23015, annual space accumulator tank loop 3 (0°-90°) area	N/A	II
Recombiner	30JMT10AT010	Room 30UJA23006, RCP loop 3 area	N/A	II
Recombiner	30JMT10AT011	Room 30UJA23007, SG loop 3 area	N/A	II
Recombiner	30JMT10AT012	Room 30UJA23008, SG loop 4 area	N/A	II
Recombiner	30JMT10AT013	Room 30UJA23016, annual space accumulator tank loop 4 (90°-180°) area	N/A	II
Recombiner	30JMT10AT014	Room 30UJA23009, RCP loop 4 area	N/A	II
Recombiner	30JMT10AT015	Room 30UJA23009, RCP loop 4 area	N/A	II
Recombiner	30JMT10AT016 ¹	Room 30UJA15001, reactor cavity	N/A	II
Recombiner	30JMT10AT017	Room 30UJA23002, RCP loop 1 area	N/A	II
Recombiner	30JMT10AT018	Room 30UJA23002, RCP loop 1 area	N/A	II
Recombiner	30JMT10AT019	Room 30UJA23013, annual space accumulator tank loop 1 (180°-270°) area	N/A	II
Recombiner	30JMT10AT020	Room 30UJA23003, SG loop 1 area	N/A	II

**Table 2.3.1-1—Combustible Gas Control System Equipment Mechanical Design
(4 Sheets)**

Description	Tag Number	Location	Function	Seismic Category
Recombiner	30JMT10AT021	Room 30UJA23004, SG loop 2 area	N/A	II
Recombiner	30JMT10AT022	Room 30UJA23005, RCP loop 2 area	N/A	II
Recombiner	30JMT10AT023	Room 30UJA23014, annual space accumulator tank loop 2 (270°-0°) area	N/A	II
Recombiner	30JMT10AT024	Room 30UJA23005, RCP loop 2 area	N/A	II
Recombiner	30JMT10AT025 ¹	Room 30UJA29019, pressurizer area	N/A	II
Recombiner	30JMT10AT026	Room 30UJA29016, access area (equipment hatch)	N/A	II
Recombiner	30JMT10AT027	Room 30UJA29013, set down area operating floor	N/A	II
Recombiner	30JMT10AT028	Room 30UJA29018 operating floor access area	N/A	II
Recombiner	30JMT10AT029 ¹	Room 30UJA34019, pressurizer heat safety relief valves	N/A	II
Recombiner	30JMT10AT030	Room 30UJA34007, SG loop 3 area	N/A	II
Recombiner	30JMT10AT031	Room 30UJA34007, SG loop 3 area	N/A	II
Recombiner	30JMT10AT032	Room 30UJA34008, SG loop 4 area	N/A	II
Recombiner	30JMT10AT033	Room 30UJA34008, SG loop 4 area	N/A	II
Recombiner	30JMT10AT034	Room 30UJA34003, SG loop 1 area	N/A	II
Recombiner	30JMT10AT035	Room 30UJA34003, SG loop 1 area	N/A	II
Recombiner	30JMT10AT036	Room 30UJA34004, SG loop 2 area	N/A	II
Recombiner	30JMT10AT037	Room 30UJA34004, SG loop 2 area	N/A	II
Recombiner	30JMT10AT038	Room 30UJA40001, dome area	N/A	II
Recombiner	30JMT10AT039	Room 30UJA40001, dome area	N/A	II

**Table 2.3.1-1—Combustible Gas Control System Equipment Mechanical Design
(4 Sheets)**

Description	Tag Number	Location	Function	Seismic Category
Recombiner	30JMT10AT040	Room 30UJA40001, dome area	N/A	II
Recombiner	30JMT10AT041	Room 30UJA40001, dome area	N/A	II
Recombiner	30JMT10AT042	Room 30UJA40001, dome area	N/A	II
Recombiner	30JMT10AT043	Room 30UJA40001, dome area	N/A	II
Recombiner	30JMT10AT044	Room 30UJA40001, dome area	N/A	II
Recombiner	30JMT10AT045	Room 30UJA40001, dome area	N/A	II
Recombiner	30JMT10AT046	Room 30UJA40001, dome area	N/A	II
Recombiner	30JMT10AT047	Room 30UJA40001, dome area	N/A	II
Hydrogen Mixing Damper	30JMT20AA001	Room 30UJA07015, separation of IRWST air space and the lower part of the annular rooms	open	I
Hydrogen Mixing Damper	30JMT20AA002	Room 30UJA07015, separation of IRWST air space and the lower part of the annular rooms	open	I
Hydrogen Mixing Damper	30JMT20AA003	Room 30UJA07015, separation of IRWST air space and the lower part of the annular rooms	open	I
Hydrogen Mixing Damper	30JMT20AA004	Room 30UJA07015, separation of IRWST air space and the lower part of the annular rooms	open	I
Hydrogen Mixing Damper	30JMT20AA005	Room 30UJA07014, separation of IRWST air space and the lower part of the annular rooms	open	I
Hydrogen Mixing Damper	30JMT20AA006	Room 30UJA07014, separation of IRWST air space and the lower part of the annular rooms	open	I
Hydrogen Mixing Damper	30JMT20AA007	Room 30UJA07014, separation of IRWST air space and the lower part of the annular rooms	open	I
Hydrogen Mixing Damper	30JMT20AA008	Room 30UJA07014, separation of IRWST air space and the lower part of the annular rooms	open	I

**Table 2.3.1-1—Combustible Gas Control System Equipment Mechanical Design
(4 Sheets)**

Description	Tag Number	Location	Function	Seismic Category
Rupture Foils	30JMT20AB101- 30JMT20AB129	SG (Loop 1) pressure equalization ceiling	open	I
Convection Foils	30JMT20AB151- 30JMT20AB180	SG (Loop 1) pressure equalization ceiling	open	I
Rupture Foils	30JMT20AB201- 30JMT20AB229	SG (Loop 2) pressure equalization ceiling	open	I
Convection Foils	30JMT20AB251- 30JMT20AB280	SG (Loop 2) pressure equalization ceiling	open	I
Rupture Foils	30JMT20AB301- 30JMT20AB329	SG (Loop 3) pressure equalization ceiling	open	I
Convection Foils	30JMT20AB351- 30JMT20AB380	SG (Loop 3) pressure equalization ceiling	open	I
Rupture Foils	30JMT20AB401- 30JMT20AB429	SG (Loop 4) pressure equalization ceiling	open	I
Convection Foils	30JMT20AB451- 30JMT20AB480	SG (Loop 4) pressure equalization ceiling	open	I

1) Small PAR; the remaining PARs are large.

Table 2.3.1-2—CGCS Equipment I&C and Electrical Design

Description	Tag Number ⁽¹⁾	Location	IEEE Class 1E ⁽²⁾	EQ – Harsh Env.	PACS	MCR/RSS Displays	MCR/RSS Controls
Hydrogen Mixing Damper	30JMT20AA001	Reactor Containment Building	3 ^N / 4 ^A	Yes	Yes	Position / N/A	Open-Close/ N/A
Hydrogen Mixing Damper	30JMT20AA002	Reactor Containment Building	3 ^N / 4 ^A	Yes	Yes	Position / N/A	Open-Close/ N/A
Hydrogen Mixing Damper	30JMT20AA003	Reactor Containment Building	4 ^N / 3 ^A	Yes	Yes	Position / N/A	Open-Close/ N/A
Hydrogen Mixing Damper	30JMT20AA004	Reactor Containment Building	4 ^N / 3 ^A	Yes	Yes	Position / N/A	Open-Close/ N/A
Hydrogen Mixing Damper	30JMT20AA005	Reactor Containment Building	1 ^N / 2 ^A	Yes	Yes	Position / N/A	Open-Close/ N/A
Hydrogen Mixing Damper	30JMT20AA006	Reactor Containment Building	1 ^N / 2 ^A	Yes	Yes	Position / N/A	Open-Close/ N/A
Hydrogen Mixing Damper	30JMT20AA007	Reactor Containment Building	2 ^N / 1 ^A	Yes	Yes	Position / N/A	Open-Close/ N/A
Hydrogen Mixing Damper	30JMT20AA008	Reactor Containment Building	2 ^N / 1 ^A	Yes	Yes	Position / N/A	Open-Close/ N/A

- 1) Equipment tag numbers are provided for information only and are not part of the certified design.
- 2) ^N denotes the division the component is normally powered from. ^A denotes the division the component is powered from when alternate feed is implemented.

**Table 2.3.1-3—Combustible Gas Control System ITAAC
(3 Sheets)**

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
2.1	The location of the CGCS equipment is as listed in Table 2.3.1-1.	An inspection will be performed of the location of the equipment listed in Table 2.3.1-1.	The equipment listed in Table 2.3.1-1 is located as listed in Table 2.3.1-1.
3.1	Components identified as Seismic Category I in Table 2.3.1-1 can withstand seismic design basis loads without a loss of the function listed in Table 2.3.1-1.	<ul style="list-style-type: none"> a. Type tests, analyses, or a combination of type tests and analyses will be performed on the components identified as Seismic Category I in Table 2.3.1-1 using analytical assumptions, or under conditions, which bound the Seismic Category I design requirements. b. Inspections will be performed of the Seismic Category I components identified in Table 2.3.1-1 to verify that the components, including anchorage, are installed as specified on the construction drawings and deviations have been reconciled to the seismic qualification reports (SQDP, EQDP, or analyses). 	<ul style="list-style-type: none"> a. Seismic qualification reports (SQDP, EQDP, or analyses) exist and conclude that the Seismic Category I components identified in Table 2.3.1-1 can withstand seismic design basis loads without a loss of the function listed in Table 2.3.1-1. b. Inspection reports exist and conclude that the Seismic Category I components identified in Table 2.3.1-1, including anchorage, are installed as specified on the construction drawings and deviations have been reconciled to the seismic qualification reports (SQDP, EQDP, or analyses).
4.1	Displays listed in Table 2.3.1-2 are retrievable in the MCR and the RSS as listed in Table 2.3.1-2	Tests will be performed for the retrievability of the displays in the MCR or the RSS as listed in Table 2.3.1-2.	<ul style="list-style-type: none"> a. The displays listed in Table 2.3.1-2 as being retrieved in the MCR can be retrieved in the MCR. b. The displays listed in Table 2.3.1-2 as being retrieved in the RSS can be retrieved in the RSS.
4.2	Controls exist in the MCR and the RSS as identified in Table 2.3.1-2.	Tests will be performed for the existence of control signals from the MCR and the RSS to the equipment listed in Table 2.3.1-2.	<ul style="list-style-type: none"> a. The controls listed in Table 2.3.1-2 as being in the MCR exist in the MCR. b. The controls listed in Table 2.3.1-2 as being in the RSS exist in the RSS.

**Table 2.3.1-3—Combustible Gas Control System ITAAC
(3 Sheets)**

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
4.3	Equipment listed as being controlled by a PACS module in Table 2.3.1-2 responds to the state requested by a test signal.	A test will be performed using test signals.	Equipment listed as being controlled by a PACS module in Table 2.3.1-2 responds to the state requested by the test signal.
5.1	Hydrogen mixing dampers listed in Table 2.3.1-1 fail open on loss of power.	Testing will be performed for the hydrogen mixing dampers listed in Table 2.3.1-1 to fail open on loss of power.	Following loss of power, the hydrogen mixing dampers listed in Table 2.3.1-1 fail open.
6.1	Components in Table 2.3.1-2, that are designated as harsh environment, will perform the function listed in Table 2.3.1-1 in the environments that exist during and following design basis events.	<p>a. Type tests or type tests and analysis will be performed to demonstrate the ability of the components listed as harsh environment in Table 2.3.1-2 to perform the function listed in Table 2.3.1-1 for the environmental conditions that could occur during and following design basis events.</p> <p>b. Components listed as harsh environment in Table 2.3.1-2 will be inspected to verify installation in accordance with the construction drawings including the associated wiring, cables and terminations. Deviations to the construction drawings will be reconciled to the EQDP.</p>	<p>a. Environmental Qualification Data Packages (EQDP) exist and conclude that the components listed as harsh environment in Table 2.3.1-2 can perform the function listed in Table 2.3.1-1 during and following design basis events including the time required to perform the listed function.</p> <p>b. Inspection reports exist and conclude that the components listed in Table 2.3.1-2 as harsh environment have been installed per the construction drawings and any deviations have been reconciled to the EQDP.</p>
7.1	The hydrogen mixing dampers listed in Table 2.3.1-1 provide pressure relief for design basis events.	An inspection will be performed to verify that the hydrogen mixing dampers listed in Table 2.3.1-1 provide sufficient area for pressure relief.	The hydrogen mixing dampers listed in Table 2.3.1-1 provide a minimum combined total open area of 64 ft ² .

**Table 2.3.1-3—Combustible Gas Control System ITAAC
(3 Sheets)**

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
7.2	The convection foils listed in Table 2.3.1-1 provide pressure relief for design basis events.	An inspection will be performed to verify that the convection foils listed in Table 2.3.1-1 provide sufficient area for pressure relief.	The convection foils listed in Table 2.3.1-1 provide a minimum combined total open area of 450 ft ² .
7.3	The rupture foils listed in Table 2.3.1-1 provide pressure relief for design basis events.	An inspection will be performed to verify that the rupture foils listed in Table 2.3.1-1 provide sufficient area for pressure relief.	The rupture foils listed in Table 2.3.1-1 provide a minimum combined total open area of 420 ft ² .
7.4	The fusible link of the convection foils listed in Table 2.3.1-1 fails at the designed temperature.	Type tests, analyses, or a combination of type tests and analyses will be performed to demonstrate the ability of the fusible link to open	The fusible link opens at or before reaching a temperature of 185 °F.
7.5	The burst element of the convection foils listed in Table 2.3.1-1 opens at the designed pressure.	Type tests will be performed to demonstrate the ability of the burst element to open.	The burst element opens bidirectionally at a delta pressure of 0.7 psid ± 30%.
7.6	The burst element of the rupture foils listed in Table 2.3.1-1 opens at the designed pressure.	Type tests will be performed to demonstrate the ability of the burst element to open.	The burst element opens bidirectionally at a delta pressure of 0.7 psid ± 30%.