E. Emergency Air Treatment Systems

1. Except as specified in Specification 3.6.E.3 below, all trains of the Shield Building Ventilation System, the Auxiliary Building Special Ventilation System, and the diesel generation required for their operation shall be operable at all times.

2. a. The results of in-place DOP and halogenated hydrocarbon tests at design flows on HEPA filters and charcoal adsorber banks respectively shall show 99% DOP removal for particles having a mean diameter of 0.7 microns and 99% halogenated hydrocarbon removal.

   b. The results of laboratory carbon sample analysis shall show 90% radioactive methyl iodide removal efficiency (130°C, 95% RH).

3. From and after the date that one train of the Shield Building Ventilation System or one train of the Auxiliary Building Special Ventilation System is made or found to be inoperable for any reason, reactor operation is permissible only during the succeeding seven days (unless such train is made operable) provided that during such seven days the redundant train is verified to be operable daily.

4. If the conditions for operability of the Shield Building Ventilation System cannot be met, procedures shall be initiated immediately to establish reactor conditions for which containment integrity is not required for the affected unit.

5. If the conditions for operability of the Auxiliary Building Special Ventilation System cannot be met, procedures shall be initiated immediately to establish reactor conditions for which containment integrity is not required in either unit.

F. Electric Hydrogen Recombiners

Both containment hydrogen recombiner systems shall be operable whenever the reactor is above hot shutdown. If one hydrogen recombiner system becomes inoperable, restore the inoperable system to operable status within 30 days or be in at least hot shutdown within the next 6 hours.

periodic tests combined with the qualification testing conducted on new filters and adsorber provide a high level of assurance that the emergency air treatment systems will perform as predicted in the accident analyses.

In-place testing procedures will be established utilizing applicable sections of ANSI N510 - 1975 standard as a procedural guideline only.

The operability of the equipment and systems required for the control of hydrogen gas ensures that this equipment will be available to maintain the hydrogen concentration within containment below its flammable limit during post-LOCA conditions. Either recombiner unit is capable of controlling the expected hydrogen generation associated with (1) zirconium-water reactions, (2) radiolytic decomposition of water, and (3) corrosion of metals within containment. These hydrogen control systems are consistent with the recommendations of Regulatory Guide 1.7, "Control of Combustible Gas Concentrations in Containment Following a LOCA," March 1971.

References

(1) FSAR, Table 3.2.1-1
(2) FSAR, Section 5
(3) FSAR, Section 9.6.5 and Appendix G
(4) Safety Evaluation Report, dated September 28, 1972
Section 15 and Supplement No. 2 dated April 30, 1973
(5) Letter to NSP dated November 29, 1973
(6) Letter to NSP dated September 16, 1974

mechanical properties to within assumed design criteria. In addition, limiting the peak linear power density during Condition I events provides assurance that the initial conditions assumed for the LOCA analyses are met and the ECCS acceptance criteria limit of 2200°F is not exceeded.

During operation, the plant staff compares the measured hot channel factors, F_Q^N and $F_{\Delta H}^N$, (described later) to the limit determined in the transient and LOCA analyses. The limiting $F_Q(Z)$ includes measurement, engineering, and calculational uncertainties. The terms on the right side of the equations in section 3.10.B.1 represent the analytical limits. Those terms on the left side represent the measured hot channel factors corrected for engineering, calculational and measurement uncertainties.

$F_Q(Z)$, Height Dependent Heat Flux Hot Channel Factor, is defined as the maximum local heat flux on the surface of a fuel rod at core elevation Z divided by the average fuel rod heat flux, allowing for manufacturing tolerances on fuel pellets and rods. The maximum value of $F_Q(Z)$ is 2.21/P for the Prairie Island reactors. This value is restricted further by the K(Z) and $BU(E_j)$ functions described below. The product of these three factors is $F_Q(Z)$.

The K(Z) function shown in Figure TS.3.10-5 is a normalized function that limits $F_Q(Z)$ axially for three reasons. The K(Z) specified for the lowest six (6) feet of the core is arbitrarily flat since the lower part of the core is generally not limiting. Above that region, the K(Z) value is based on large and small break LOCA analyses. $F_Q(Z)$ in the uppermost region is limited to reduce the PCT expected during a small break LOCA since this region of the core is expected to uncover temporarily for some small break LOCA's.

The $BU(E_j)$ function shown in Figure TS.3.10-7 is a normalized function that limits $F_Q(Z)$ based on exposure dependent analyses for the ENC fuel. These analyses consider pin internal pressure uncertainties, fuel swelling, rupture pressures and flow blockage.

F_Q^N is the measured Nuclear Hot Channel Factor, defined as the maximum local neutron flux in the core divided by the average neutron flux in the core.

V(Z) is an axially dependent function applied to the equilibrium measured F_Q^N to bound F_Q^N's that could be measured at non-equilibrium conditions. This function is based on power distribution control analyses that evaluated the effect of burnable poisons, rod position, axial effects and xenon worth.

F_Q^E, Engineering Heat Flux Hot Channel Factor, is defined as the allowance on heat flux required for manufacturing tolerances. The engineering factor allows for local variations in enrichment, pellet density and diameter, surface area of the fuel rod and eccentricity of the gap between pellet and clad. Combined statistically the net effect is a factor of 1.03 to be applied to fuel rod surface heat flux.

SAFETY RELATED SNUBBERS

Snubber No.	Location	Elevation	Accessible or Inaccessible (A or I)	Snubbers Especially Difficult to Remove	In High Radiation Area During Shutdown
	UNIT II				
RCVCH-1396	Chemical & Vol	702'-10"	I		
RCVCH-1505	Control	708'-6"	I		
RCVCH-1513		710'-1"	I		
RCVCH-1524		719'-1"	I		
RCVCH-1574		721'-0"	I		
RCVCH-1668		705'-5"	I		
RCVCH-1373		722'-11"	I		
RCVCH-1389		706'-1"	I		
RRCH-253		704'-4"	I		
RRCH-255		704'-8"	I		
RRCH-261		707'-2"	I		
RRCH-288		707'-2"	I		
RRCH-291		704'-6"	I		
RRCH-292		704'-7"	I		
CVCH-166		708'-0"	A		
	UNIT I				
CCH-304	Comp Cooling	717'-7"	A		
CCH-373		712'-4"	A		
CCH-376 A&B		700'-5"	A		
CCH-377		703'-0"	A		
CCH-378		708'-4"	A		
CCH-380		670'-8"	A		
CCH-381 A&B		671'-4"	A		
CCH-397		699'-3"	A		
CCH-398 A&B		671'-4"	A		
	UNIT II				
CCH-161	Comp Cooling	717'-7"	A		
CCH-166		719'-11"	A		
CCH-167		720'-0"	A		
CCH-172		720'-0"	A		
CCH-173		708'-5"	A		
CCH-176		705'-3"	A		
CCH-179 A&B		671'-4"	A		
CCH-180		670'-8"	A		
CCH-181		708'-4"	A		
CCH-182		704'-2"	A		
CCH-185 A&B		671'-4"	A		
CCH-186		670'-10"	A		
	UNIT I				
RCSH-81	Containment Spray	760'-9"	I		
RCSH-82		760'-8"	I		
RCSH-83 A&B		732'-1"	I		
	UNIT II				
CSH-75 A&B	Containment Spray	731'-10"	I		
CSH-76		752'-7"	I		
CSH-79		751'-9"	I		
CSH-82 A&B		731'-11"	I		
CSH-83		767'-2"	I		
CSH-84		767'-2"	I		
CSH-210		698'-0"	I		
CSH-215		698'-0"	A		
CSH-224		710'-6"	A		

3.13 CONTROL ROOM AIR TREATMENT SYSTEM

Applicability

Applies to the operability of the Control Room Special Ventilation System.

Objective

To specify operability requirements for the Control Room Special Ventilation System.

Specification

A. Except as specified in Specification 3.13.C below, both trains of the Control Room Special Ventilation System required for their operation shall be operable at all times when containment integrity is required.

B. Each Control Room Special Ventilation System train shall safisfy the following operability requirements:

1. The results of in-place DOP and halogenated hydrocarbon tests at design flows on HEPA filters and charcoal adsorber banks respectively shall show $\geq$ 99% DOP removal for particles having a mean diameter of 0.7 microns and $\geq$ 99% halogenated hydrocarbon removal.

2. The results of laboratory carbon sample analysis shall show $\geq$ 90% radioactive methyl iodide removal efficiency (130°C, 95% RH).

3. Fans shall be shown to operate within $\pm$10% of 4000 cfm.

C. From and after the date that one train of the Control Room Special Ventilation System is made or found to be inoperable for any reason, reactor operation or refueling operations are permissible only during the succeeding seven days (unless such train is made operable) provided that during such seven days the redundant train is verified to be operable daily.

D. If conditions A, B & C cannot be met, reactor shutdown shall be initiated and the reactors shall be in cold shutdown within 36 hours and refueling operations shall be terminated within two hours.

E. Two chlorine detection systems, each consisting of two channels of instrumentation shall be operable at all times except as specified below. The alarm/trip setpoint shall be adjusted to actuate at a chlorine concentration of less than or equal to 5 ppm.

1. With one chlorine detection channel for one train of Control Room Special Ventilation inoperable, restore the inoperable detection channel to Operable status within 7 days or initiate and maintain operation of the Control Room Special Ventilation train associated with the inoperable chlorine detection channel in the recirculation mode of operation or initiate operation of the Control Room Special Ventilation redundant train.

2. With both chlorine detection channels inoperable for one train of Control Room Special Ventilation, initiate and maintain operation of the Control Room Special Ventilation train associated with the inoperable chlorine detection channels in the recirculation mode of operation or initiate operation of Control Room Special Ventilation system redundant train.

3. If both trains of Control Room Special Ventilation have one or more inoperable chlorine detection channels, initiate and maintain Control Room Special Ventilation system in the recirculation mode of operation within the time allowed for the limiting condition of operation applicable to the train in operation.

3.13 CONTROL ROOM AIR TREATMENT SYSTEM

Basis

The Control Room Special Ventilation System is designed to filter the Control Room atmosphere during accident conditions. The system is designed to automatically start on a high radiation signal in the ventilation air or when a Safety Injection signal is received from either unit. Two completely redundant trains are provided.

Each train has a filter unit consisting of a prefilter, HEPA filters, and charcoal adsorbers. The HEPA filters remove particulates from the Control Room atmosphere and prevent clogging of the iodine adsorbers. The charcoal adsorbers are installed to remove any radioiodines from the Control Room atmosphere. The in-place test results should indicate a HEPA filter leakage of less than 1% through DOP testing and a charcoal adsorber leakage of less than 1% through halogenated hydrocarbon testing. The laboratory carbon sample test results should indicate a radioactive methyl iodide removal efficiency of at least 90% under test conditions more severe than expected accident conditions. System flows should be near their design values. The verification of these performance parameters combined with the qualification testing conducted on new filters and adsorber provide a high level of assurance that the Control Room Special Ventilation System will perform as predicted in reducing potential doses to plant personnel below those levels stated in Criterion 19 of Appendix A to 10 CFR 50.

In-place testing procedures will be established utilizing applicable section of ANSI N510 - 1975 standard as a procedural guideline only.

The operability of the chlorine detection system ensures that sufficient capability is available to promptly detect and initiate protective action in the event of an accidental chlorine release. This capability is required to protect the control room personnel and is consistent with the recommendations of Regulatory Guide 1.95 "Protection of Nuclear Power Plant Control Room Operators Against an Accidental Chlorine Release," February 1975.

The Control Room Special Ventilation System remains operable if the ventilation system can be operated in the recirculation mode.

	Channel Description	Check	Calibrate	Functional Test	Response Test	Remarks
16.	Refueling Water Storage Tank Level	W	R	M(1)	NA	1) Functional test can be performed by bleeding transmitter
17.	Volume Control Tank	S	R	NA	NA	
18a.	Containment Pressure SI Signal	S	R	M	NA	
18b.	Containment Pressure Steam Line Isolation	S	R	M	NA	
18c.	Containment Pressure Containment Spray	S	R	M	NA	
18d.	Annulus Pressure (Vacuum Breaker)	NA	R	R	NA	
19.	Deleted					
20.	Boric Acid Make-up Flow Channel	NA	R	NA	NA	
21.	Containment Sump Level	NA	R	R	NA	Includes Sumps A, B and C
22.	Accumulator Level and Pressure	S	R	R	NA	
23.	Steam Generator Pressure	S	R	M	NA	
24.	Turbine First Stage Pressure	S	R	M	NA	
25.	Emergency Plan Radiation Instruments	*M	R	M	NA	Includes those named in the emergency procedure (referenced in Spec. 6.5 A.6)
26.	Protection Systems Logic Channel Testing	NA	NA	M	NA	Includes auto load sequencers

TABLE TS.4.1-1
(Page 4 of 5)

	Channel Description	Check	Calibrate	Functional Test	Response Test	Remarks
27.	Turbine Overspeed Protection Trip Channel	NA	R	M	NA	
28.	Deleted					
29.	Deleted					
30.	Deleted					
31.	Seismic Monitors	R	R	NA	NA	
32.	Coolant Flow-RTD Bypass Flowmeter	S	R	M	NA	
33.	CRDM Cooling Shroud Exhaust Air Temperature	S	NA	R	NA	
34.	Reactor Gap Exhaust Air Temperature	S	NA	R	NA	
35a.	Post-Accident Monitoring Instruments	M	R	NA	NA	Includes all those in Table TS.3.15-1
b.	Post-Accident Monitoring Radiation Instruments	D	R	M	NA	Includes all those in Table TS.3.15-2
36.	Steam Exclusion Actuation System	W	Y	M	NA	
37.	Overpressure Mitigation System	NA	R	R	NA	Instrument Channels for PORV Control Including Overpressure Mitigation System
38.	Degraded Voltage 4KV Safeguard Busses	NA	R	M	NA	
39.	Loss of Voltage 4KV Safeguard Busses	NA	R	M	NA	

TABLE TS.4.1-1
(Page 5 of 5)

	Channel Description	Check	Calibrate	Functional Test	Response Test	Remarks
40.	Auxiliary Feedwater Pump Suction Pressure	NA	R	R	NA	
41.	Auxiliary Feedwater Pump Discharge Pressure	NA	R	R	NA	
42.	Control Room Ventilation System Chlorine Monitors	W	R	R	NA	
43.	Containment Recombiner Instrumentation	NA	R	NA	NA	

S - Shift
D - Daily
W - Weekly
M - Monthly
Q - Quarterly
P - Prior to each startup if not done previous week
T - Prior to each startup following shutdown in excess of 2 days if not done in the previous 30 days.

Y - Yearly
R - Each refueling Shutdown
NA - Not applicable
* - See Specification 4.1.D.

E. Containment Isolation Valves

During each refueling shutdown, the containment isolation valves, shield building ventilation valves, and the auxiliary building normal ventilation system isolation valves shall be tested for operability by applying a simulated accident signal to them.

F. Post Accident Containment Ventilation System

During each refueling shutdown, the operability of system recirculating fans and valves, including actuation and indication, shall be demonstrated.

G. Containment and Shield Building Air Temperature

Prior to establishing reactor conditions requiring containment integrity, the average air temperature difference between the containment and its associated Shield Building shall be verified to be within acceptable limits.

H. Containment Shell Temperature

Prior to establishing reactor conditions requiring containment integrity, the temperature of the containment vessel wall shall be verified to be within acceptable limits.

I. Electric Hydrogen Recombiners

1. Each hydrogen recombiner train shall be demonstrated Operable:

   a. At least once per 6 months by energizing the recombiner system to 10 KW for 5 minutes to check the electronics and voltage applied to the SCR's and other electrical components.

   b. At least once per 18 months by:

      1. Perform a heatup test to insure an operating temperature of greater than or equal to 1225°F can be obtained at a power level less than or equal to 58 KW.

Basis

The containment system consists of a steel containment vessel, a concrete shield building, the auxiliary building special ventilation zone (ABSVZ), a shield building ventilation system, and an auxiliary building special ventilation system. In the event of a loss-of-coolant accident, a vacuum in the shield building annulus will cause most leakage from the containment vessel to be mixed in the annulus volume and recirculated through a filter system before its deferred release to the environment through the exhaust fan that maintains vacuum. Some of the leakage goes to the ABSVZ from which it is exhausted through a filter. A small fraction bypasses both filter systems.

The freestanding containment vessel is designed to accommodate the maximum internal pressure that would result from the Design Basis Accident.[1] For initial conditions typical of normal operation, 120°F and 15 psia, an instantaneous double-ended break with minimum safeguards results in a peak pressure of less than 46 psig at 268°F.

The containment will be strength-tested at 51.8 psig and leak-tested at 46.0 psig to meet acceptance specifications.

The safety analysis [2][3] is based on a conservatively chosen reference set of assumptions regarding the sequence of events relating to activity release and attainment and maintenance of vacuum in the shield building annulus and the auxiliary building special ventilation zone, the effectiveness of filtering, and the leak rate of the containment vessel as a function of time. The effects of variation in these assumptions, including that for leak rate, has been investigated thoroughly. A summary of the items of conservatism involved in the reference calculation and the magnitude of their effect upon off-site dose demonstrates the collective effectiveness of conservatism in these assumptions.

C. Steam Exclusion System

Isolation dampers in each duct that penetrates rooms containing equipment required for a high energy line rupture outside of containment shall be tested for operability once each month.

In addition, damper mating surfaces shall be examined visually once each year to assure that no physical change has occurred that could affect leakage.

Basis

Monthly testing of the auxiliary feedwater pumps, monthly valve inspections, and startup flow verification provide assurance that the AFW system will meet emergency demand requirements. The discharge valves of the pumps are normally open, as are the suction valves from the condensate storage tanks. Proper opening of the steam admission valve on each turbine-driven pump will be demonstrated each time a turbine-driven pump is tested. Ventilation system isolation dampers required to function for the postulated rupture of a high energy line will also be tested.

At 18-month intervals, pump starting and valve positioning is verified using test signals to simulate each of the automatic actuation parameters.

Reference

FSAR, Sections 6.6, 14, and Appendix I.

Exhibit C

Cross Reference - FSAR Table 7.7-2 to TS 4.1-1

No.	FSAR Table 7.7-2 Instruments	Corresponding Item in TS 4.1-1 or as noted
1.	Nuclear Instrumentation	1
2.	RCCA Position Indication	9, 10
3.	ECCS Flow, Pressure Temperature	13, 14
4.	Accumulator Tank, Boric Acid Tanks Level & Pressure Indication	15, 22
5.	Refueling Water Storage Tank Level	16
6.	Pressurizer Pressure	6
7.	Pressurizer Lever	5
8.	Reactor Coolant Temperature	4
9.	Sump Levels	21
10.	Containment & Annulus Pressure	18a, 18d
11.	Containment Temperature	*
12.	Containment Isolation Valve Position	TS 4.4-E
13.	Personnel Air Lock Status	TS 4.4-A.2
14.	Fan Coil Units Operation	TS 4.4-F & TS 4.5-A.3
15.	Spray System Pressure	18c
16.	Steam Pressure & Flow	12, 23
17.	Feedwater Flow	12
18.	Steam Generator Level	11
19.	Containment Atmosphere Radiation Monitor	Table TS 3.15-2
20.	Containment Area Radiation Monitor	Table TS 3.15-2
21.	Auxiliary Building Ventilation Radiation Monitor	Table TS 4.17-2
22.	Shield Building Ventilation Radiation Monitor	Table TS 4.17-2
23.	Reactor Plant Sampling	TS 4.17
24.	Containment Atmosphere Sample Lines	TS 4.17

* Being reviewed as part of NuReg 1.97 requirements.