SNUPPS

Standardized Nuclear Unit
Power Plant System

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Executive Director

February 19, 1985

SLNRC 85-8 FILE: 0543.1.1
SUBJ: Wolf Creek Technical Specifications

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

Docket No. STN 50-482

Refs: 1) KGE (G. L. Koester) letter to NRC (H. R. Denton), dated 12/10/84, Same Subject
2) NRC (D. G. Eisenhut) letter to KGE (G. L. Koester), dated 11/7/84, Same Subject
3) SLNRC 85-2, 1/18/85, Same Subject
4) SLNRC 85-04, 1/25/85, Same Subject
5) SLNRC 85-5, 2/1/85, Same Subject

Dear Mr. Denton:

Reference 1 forwarded KGE's comments on the Final Draft version of Wolf Creek's Technical Specifications as issued by reference 2. Since reference 1, several other changes have been identified which were forwarded with references 3, 4, 5, and this letter. Note that this letter contains a request for deletion of the hydrogen mixing fan specification provided in reference 4. The deletion is based on an evaluation (attached) performed by the SNUPPS AE showing that the fans are unnecessary for adequate hydrogen mixing in the post LOCA containment environment.

Very truly yours,

N A Petrick

Nicholas A. Petrick

JHR/bds/6a10
Attachments

cc:	G. L. Koester	KGE
	J. M. Evans	KCPL
	D. F. Schnell	UE
	J. Neisler/B. Little	USNRC/CAL
	H. Bundy	USNRC/WC
	W. L. Forney	USNRC/RIII
	D. R. Hunter	USNRC/RIV

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verify 869-2010 SNUPPS Jim Riley

SURVEILLANCE REQUIREMENTS (Continued)

c. At least once per 18 months or (1) after any structural maintenance on the HEPA filter or charcoal adsorber housings, or (2) following painting, fire, or chemical release in any ventilation zone communicating with the system by:

1) Verifying that the Control Room Emergency Ventilation System satisfies the in-place penetration and bypass leakage testing acceptance criteria; of less than 1% for HEPA filters and 0.05% for charcoal adsorbers and uses the test procedure guidance in Regulatory Positions C.5.a, C.5.c, and C.5.d of Regulatory Guide 1.52, Revision 2, March 1978, and the system flow rate is 2000 cfm ~~+3, -0%~~ ±10% at greater than or equal to 6.6 inches Water Gauge (W.G.) (dirty filter) for the Filtration System and 2200 cfm ~~+3, -0%~~ ±10% at greater than or equal to 3.8 inches W.G. (dirty filter) for the Pressurization System with 500 cfm ~~+3, -0%~~ ±10% going through the Pressurization System filter adsorber unit;

2) Verifying, within 31 days after removal, that a laboratory analysis of a representative carbon sample obtained in accordance with Regulatory Position C.6.b of Regulatory Guide 1.52, Revision 2, March 1978, meets the laboratory testing criteria of Regulatory Position C.6.a of Regulatory Guide 1.52, Revision 2, March 1978, for a methyl iodide penetration of less than ~~0.05%~~ 1%; and

3) Verifying system flow rate of 2000 cfm ~~+3, -0%~~ ±10% at greater than or equal to 6.6 inches W.G. (dirty filter) for the Filtration System and 2200 cfm ~~+3, -0%~~ ±10% at greater than or equal to 3.8 inches W.G. (dirty filter) for the Pressurization System with 500 cfm ~~+3, -0%~~ ±10% going through the Pressurization System filter adsorber unit during system operation when tested in accordance with ANSI N510-1980.

d. After every 720 hours of charcoal adsorber operation by verifying within 31 days after removal, that a laboratory analysis of a representative carbon sample obtained in accordance with Regulatory Position C.6.b of Regulatory Guide 1.52, Revision 2, March 1978, meets the laboratory testing criteria of Regulatory Position C.6.a of Regulatory Guide 1.52, Revision 2, March 1978, for a methyl iodide penetration of less than ~~0.05%~~ 1%;

e. At least once per 18 months by:

1) Verifying that the pressure drop across the combined HEPA filters and charcoal adsorber banks is less than 6.6 inches Water Gauge while operating the system at a flow rate of 2000 cfm ~~+3, -0%~~ ±10% for the Filtration System and 500 cfm ~~+3, -0%~~ ±10% for the Pressurization System filter adsorber unit,

2) Verifying that on a Control Room Ventilation Isolation or High Gaseous Radioactivity test signal, the system automatically switches into a recirculation mode of operation with flow through the HEPA filters and charcoal adsorber banks,

3) Verifying that the system maintains the control room at a positive pressure of greater than or equal to 1/4 inch Water Gauge relative to the outside atmosphere during system operation,

4) Verifying that the Pressurization System filter adsorber unit heaters dissipate 15 ± 2 kW at a nominal voltage of 460 Volts in the Pressurization System when tested in accordance with ANSI N510-1975, and

5) Verifying that on a High Chlorine test signal, the system automatically switches into a recirculation mode of operation with flow through the HEPA filters and charcoal adsorber banks within 15 seconds.

f. After each complete or partial replacement of a HEPA filter bank, by verifying that the cleanup system satisfies the in-place penetration and bypass leakage testing criteria of less than 1% for HEPA filters and 0.05% for charcoal adsorbers in accordance with ANSI N510-1975 (however Prerequisite Testing, Sections 8 and 9 shall be in accordance with ANSI N510-1980) for a DOP test aerosol while operating the system at a flow rate of 2000 cfm ~~+3, -0%~~ ±10% for the Filtration System and 500 cfm ~~+3, -0%~~ ±10% for the Pressurization System filter adsorber unit; and

g. After each complete or partial replacement of a charcoal adsorber bank, by verifying that the cleanup system satisfies the in-place penetration and bypass leakage testing criteria of less than 1% for HEPA filters and 0.05% for charcoal adsorbers in accordance with ANSI N510-1975 (however Prerequisite Testing, Sections 8 and 9 shall be in accordance with ANSI N510-1980) for a halogenated hydrocarbon refrigerant test gas while operating the system at a flow rate of 2000 cfm ~~+3, -0%~~ ±10% for the Filtration System and 500 cfm ~~+3, -0%~~ ±10% for the Pressurization System filter adsorber unit.

3/4.7.7 EMERGENCY EXHAUST SYSTEM

LIMITING CONDITION FOR OPERATION

3.7.7 Two independent Emergency Exhaust Systems shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTION:

With one Emergency Exhaust System inoperable, restore the inoperable Emergency Exhaust System to OPERABLE status within 7 days or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

SURVEILLANCE REQUIREMENTS

4.7.7 Each Emergency Exhaust System shall be demonstrated OPERABLE:

a. At least once per 31 days on a STAGGERED TEST BASIS by initiating, from the control room, flow through the HEPA filters and charcoal adsorbers and verifying that the system operates for at least 10 continuous hours with the heaters operating;

b. At least once per 18 months, or (1) after any structural maintenance on the HEPA filter or charcoal adsorber housings, or (2) following painting, fire, or chemical release in any ventilation zone communicating with the system, by:

1) Verifying that the Emergency Exhaust System satisfies the in-place penetration and bypass leakage testing acceptance criteria of less than 1% for HEPA filters and 0.05% for charcoal adsorbers and uses the test procedure guidance in Regulatory Positions C.5.a, C.5.c, and C.5.d of Regulatory Guide 1.52, Revision 2, March 1978, and the system flow rate is 9000 cfm ±10% ~~+3, -0%~~ at ≥ 7.2 inches W.G. (dirty filter);

2) Verifying, within 31 days after removal, that a laboratory analysis of a representative carbon sample obtained in accordance with Regulatory Position C.6.b of Regulatory Guide 1.52, Revision 2, March 1978, meets the laboratory testing criteria of Regulatory Position C.6.a of Regulatory Guide 1.52, Revision 2, March 1978, for a methyl iodide penetration of less than ~~0.05%~~ 1%;

SURVEILLANCE REQUIREMENTS (Continued)

3) Verifying a system flow rate of 9000 cfm ~~±3, -0%~~ ±10% at ≥ 7.2 inches W.G. (dirty filter) during system operation when tested in accordance with ANSI N510-1980.

c. After every 720 hours of charcoal adsorber operation, by verifying, within 31 days after removal, that a laboratory analysis of a representative carbon sample obtained in accordance with Regulatory Position C.6.b of Regulatory Guide 1.52, Revision 2, March 1978, meets the laboratory testing criteria of Regulatory Position C.6.a of Regulatory Guide 1.52, Revision 2, March 1978, for a methyl iodide penetration of less than ~~0.05%~~ 1%;

d. At least once per 18 months by:

1) Verifying that the pressure drop across the combined HEPA filters and charcoal adsorber banks of less than or equal to 7.2 inches Water Gauge while operating the system at a flow rate of 9000 cfm ~~±3, -0%~~, ±10%

2) Verifying that the system maintains the Fuel Building at a negative pressure of greater than or equal to ¼ inch Water Gauge relative to the outside atmosphere during system operation,

3) Verifying that the system starts on a Safety Injection test signal, and

4) Verifying that the heaters dissipate 37 ± 3 kW when tested in accordance with ANSI N510-1975,

e. After each complete or partial replacement of a HEPA filter bank, by verifying that the cleanup system satisfies the in-place penetration and bypass leakage testing criteria of less than 1% for HEPA filters and 0.05% for charcoal adsorbers in accordance with ANSI N510-1975 (however Prerequisite Testing, Sections 8 and 9 shall be in accordance with ANSI N510-1980) for a DOP test aerosol while operating the system at a flow rate of 9000 cfm ~~±3, -0%~~ ±10%; and

f. After each complete or partial replacement of a charcoal adsorber bank, by verifying that the cleanup system satisfies the in-place penetration and bypass leakage testing criteria of less than 1% for HEPA filters and 0.05% for charcoal adsorbers in accordance with ANSI N510-1975 (however Prerequisite Testing, Sections 8 and 9 shall be in accordance with ANSI N510-1980) for a halogenated hydrocarbon refrigerant test gas while operating the system at a flow rate of 9000 cfm ~~±3, -0%~~. ±10%

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3/4.9.13 EMERGENCY EXHAUST SYSTEM

LIMITING CONDITION FOR OPERATION

3.9.13 Two independent Emergency Exhaust Systems shall be OPERABLE.

APPLICABILITY: Whenever irradiated fuel is in the spent fuel pool.

ACTION:

a. With one Emergency Exhaust System inoperable, fuel movement within the fuel storage areas or crane operation with loads over the fuel storage areas may proceed provided the OPERABLE Emergency Exhaust System is in operation and discharging through at least one train of HEPA filters and charcoal adsorbers.

b. With no Emergency Exhaust System OPERABLE, suspend all operations involving movement of fuel within the fuel storage areas or crane operation with loads over the fuel storage areas until at least one Emergency Exhaust System is restored to OPERABLE status.

c. The provisions of Specifications 3.0.3 and 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.9.13 The above required Emergency Exhaust Systems shall be demonstrated OPERABLE:

a. At least once per 31 days on a STAGGERED TEST BASIS by initiating, from the control room, flow through the HEPA filters and charcoal adsorbers and verifying that the system operates for at least 10 continuous hours with the heaters operating;

b. At least once per 18 months, or (1) after any structural maintenance on the HEPA filter or charcoal adsorber housings, or (2) following painting, fire, or chemical release in any ventilation zone communicating with the system, by:

   1) Verifying that the Emergency Exhaust System satisfies the in-place penetration and bypass leakage testing acceptance criteria of less than 1% for HEPA filters and 0.05% for charcoal adsorbers and uses the test procedure guidance in Regulatory Positions C.5.a, C.5.c, and C.5.d of Regulatory Guide 1.52, Revision 2, March 1978, and the system flow rate is 9000 cfm ~~±3, -0%~~ ±10% at ≥ 7.2 inches W.G. (dirty filter);

iodide

2) Verifying, within 31 days after removal, that a laboratory analysis of a representative carbon sample obtained in accordance with Regulatory Position C.6.b of Regulatory Guide 1.52, Revision 2, March 1978, meets the laboratory testing criteria of Regulatory Position C.6.a of Regulatory Guide 1.52, Revisison 2, March 1978, for a methyl iodined penetration of less than ~~0.05%~~ 1%; and

3) Verifying a system flow rate of 9000 cfm ~~+3, -0%~~ ±10% at ≥ 7.2 inches W.G. (dirty filter) during system operation when tested in accordance with ANSI N510-1980.

c. After every 720 hours of charcoal adsorber operation, by verifying, within 31 days after removal, that a laboratory analysis of a representative carbon sample obtained in accordance with Regulatory Position C.6.b of Regulatory Guide 1.52, Revision 2, March 1978, meets the laboratory testing criteria of Regulatory Position C.6.a of Regulatory Guide 1.52, Revision 2, March 1978, for a methyl iodide penetration of less than 1%;

d. At least once per 18 months by:

1) Verifying that the pressure drop across the combined HEPA filters and charcoal adsorber banks is less than or equal to 7.2 inches Water Gauge while operating the system at a flow rate of 9000 cfm ~~±3, -0%~~ ±10%.

2) Verifying that on a ~~Spent Fuel Pool~~ Fuel Building Exhaust Gaseous Radioactivity-High test signal, the system automatically starts (unless already operating) and directs its exhaust flow through the HEPA filters and charcoal adsorber banks and isolates the normal fuel building exhaust flow to the auxiliary/fuel building exhaust fan;

3) Verifying that the system maintains the Fuel Building at a negative pressure of greater than or equal to 1/4 inches Water Gauge relative to the outside atmosphere during system operation; and

4) Verifying that the heaters dissipate 37 ± 3 kW when tested in accordance with ANSI N510-1975.

e. After each complete or partial replacement of a HEPA filter bank, by verifying that the cleanup system satisfies the in-place penetration and bypass leakage testing acceptance criteria of less than 1% for HEPA filters and 0.05% for charcoal adsorbers in accordance with ANSI N510-1975 (however Prerequisite Testing, Sections 8 and 9 shall be in accordance with ANSI N510-1980) for a DOP test aerosol while operating the system at a flow rate of 9000 cfm ~~±3, -0%~~ ±10%; and

f. After each complete or partial replacement of a charcoal adsorber bank, by verifying that the cleanup system satisfies the in-place penetration and bypass leakage testing acceptance criteria of less than 1% for HEPA filters and 0.05% for charcoal adsorbers in accordance with ANSI N510-1975 (however Prerequisite Testing, Sections 8 and 9 shall be in accordance with ANSI N510-1980) for a halogenated hydrocarbon refrigerant test gas while operating the system at a flow rate of 9000 cfm ~~±3, -0%~~. ±10%

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FINAL DRAFT

TABLE 3.8-1 (Continued)

CONTAINMENT PENETRATION CONDUCTOR

OVERCURRENT PROTECTIVE DEVICES

PROTECTIVE DEVICE NUMBER AND LOCATION	POWERED EQUIPMENT
480-V Motor Control Center (Continued)	
P-52PG19NGF2 B-40 Fuse	RCP A Space Heater
P-52PG19NGF3 B-40 Fuse	RCP B Space Heater
P-52PG19NEF1 B-40A Fuse	RCP A Oil Lift Pump
P-52PG19NGR3 B-40A Fuse	RCP B Oil Lift Pump
P-52PG19NFF1 B-15A Fuse	Ctmt Normal Sump Pump DPLF05A
P-52PG19NFF2 B-15A Fuse	Ctmt Normal Sump Pump DPLF05C
P-52PG19NAF2 B-25A Fuse	Instrument Tunnel Sump Pump DPLF07A
P-52NG03CBF4 B-15A Fuse	RCP Thermal Barrier CCW Iso Vlv BBHV15
P-52NG03CLF2 B-15A Fuse	RCP Thermal Barrier CCW ISo Vlv BBHV16
P-52PG20N~~BF5~~ CR3 B-100A Fuse	Reactor Cavity Cooling Fan DCGN02B
P-52PG20NFF4 B-60A Fuse	Ctmt Atmospheric Control System Fan DCGR01B
P-52PG20NBF1 B-40A Fuse	RCP C Space Heater
P-52PG20NCF1 B-40A Fuse	RCP D Space Heater
P-52PG20NFF3 B-40A Fuse	RCP C Oil Lift Pump
1EPR08C P-3A Fuse RP139 B-3A Fuse	Accumulator Tank A Isol Vlv EPHV8808A

- Plant Manager
  - Supt of Maint
    - Maint Svcs Supvr
      - Maint Engr
      - Mat Cont Supvr
        - Mat Coord Supvr
        - Storeroom Supvr
          - Warehouse Att
      - Utility Supvr
        - Utility Mech
        - Bldg Svcman
    - Maint Supp Supvr
      - Mech Supvr
        - Welder
        - Machinist
        - Mechanic
        - Utility Hlpr
      - Electrical Supv
        - Electrician
        - Utility Hlpr
  - Supt of Operations
    - Ops Coord - Ops#
      - Shift Supervisor
        - Supervising Opr
        - Reactor Operator
        - Station Operator
        - Utility Helper
    - Ops Coord - Planning and Projects
      - Engineer/Spec
      - Surv Coord
        - System Analyst
  - Supt of Tech Supp
    - Reactor Eng Supvr
      - Reactor Engineer
    - I&C Supervisor
      - Engineer/Spec
      - I&C Coordinator
        - I&C Specialist
        - I&C Technician
        - Utility Helper
      - Lead Computer Eng
        - Comp Eng/Spec
        - App Programmer
    - Site Chemist
      - Chemistry Supvr
        - HP/Chem Tech
        - Utility Helper
    - Site Health Phys*
      - HP Supervisor
        - HP/Chem Tech
        - Utility Helper
  - Supt of Plant Supp
    - Fire Prot Spec*
      - Training Spec
    - Chief of Security*
      - Security Ops Supv
      - Lieutenant
        - Sergeant
        - Officer
    - Data Mgmt Supvr
      - Data Base Analyst
      - Asst Supv Comp Ops
        - Technician
        - Computer Opr
      - Asst Supv Sys Sftwr
      - Data Comm Engr Spec
        - Comp Sys Tech
        - Clerk
    - Results Eng Supvr
      - Results Eng (M)
      - Results Eng (E)
  - Supt of Regulatory, Quality and Admin Services
    - Engineering Spec
    - Safety Specialist
    - Nuclear Medical Sp
    - Site Emerg Plannin Administrator
    - Document Cont Supv
      - Document Cont Cle
      - Analysis & Film O
    - Administrative Sup
      - Clerk
  - ~~Startup Manager~~
    - ~~Startup Organization~~

FIGURE 6.2-2

UNIT ORGANIZATION

*For technical matters of an immediate nature the respective individual reports directly to the Plant Manager.

#This position requires an SRO License.

2/1 (New Page)

HYDROGEN MIXING SYSTEMS

LIMITING CONDITION FOR OPERATION

3.6.4.3 Two independent hydrogen mixing systems shall be OPERABLE.

APPLICABILITY: MODES 1 and 2.

ACTION:

With one independent hydrogen mixing system inoperable, restore the inoperable system to OPERABLE status within 30 days or be in at least HOT STANDBY within the next 6 hours.

SURVEILLANCE REQUIREMENTS

4.6.4.3 Each independent hydrogen mixing system shall be demonstrated OPERABLE:

a. At least once per 92 days on a STAGGERED TEST BASIS by starting each non-operating system from the control room and verifying that the system operates for at least 15 minutes.

b. At least once per 18 months by verifying that on a Safety Injection test signal, the systems start in slow speed or, if operating, shift to slow speed.

SPRAY ADDITIVE SYSTEM (Continued)

solution recirculated within containment after a LOCA. This pH band minimizes the evolution of iodine and minimizes the effect of chloride and caustic stress corrosion on mechanical systems and components. The contained solution volume limit includes an allowance for solution not usable because of tank discharge line location or other physical characteristics. The educator flow test of 52 gpm with RWST water is equivalent to 40 gpm NaOH solution. These assumptions are consistent with the iodine removal efficiency assumed in the safety analyses.

3/4.6.2.3 CONTAINMENT COOLING SYSTEM

The OPERABILITY of the Containment Cooling System ensures that: (1) the containment air temperature will be maintained within limits during normal operation, and (2) adequate heat removal capacity is available when operated in conjunction with the Containment Spray Systems during post-LOCA conditions.

The Containment Cooling System and the Containment Spray System are redundant to each other in providing post accident cooling of the containment atmosphere. As a result of this redundancy in cooling capability, the allowable out-of-service time requirements for the Containment Cooling System have been appropriately adjusted. However, the allowable out-of-service time requirements for the Containment Spray System have been maintained consistent with that assigned other inoperable ESF equipment since the Containment Spray System also provides a mechanism for removing iodine from the containment atmosphere.

3/4.6.3 CONTAINMENT ISOLATION VALVES

The OPERABILITY of the containment isolation valves ensures that the containment atmosphere will be isolated from the outside environment in the event of a release of radioactive material to the containment atmosphere or pressurization of the containment and is consistent with the requirements of GDC54 thru 57 of Appendix A to 10 CFR Part 50. Containment isolation within the time limits specified for those isolation valves designed to close automatically ensures that the release of radioactive material to the environment will be consistent with the assumptions used in the analyses for a LOCA.

3/4.6.4 COMBUSTIBLE GAS CONTROL

The OPERABILITY of the equipment and systems required for the detection and 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 or the Purge System 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. The Hydrogen Purge Subsystem discharges directly to the Emergency Exhaust System. Operation of the Emergency Exhaust System with the heaters operating for at least 10 continuous hours in a 31-day period is sufficient to reduce the buildup of moisture on the adsorbers and HEPA filters. These Hydrogen Control Systems are consistent with the recommendations of Regulatory Guide 1.7, "Control of Combustible Gas Concentrations in Containment Following a Loss-of-Coolant Accident," Revision 2, November 1978.

Insert A from next page

insert A. 4

The Hydrogen Mixing Systems are provided to ensure adequate mixing of the containment atmosphere following a LOCA. This mixing action will prevent localized accumulations of hydrogen from exceeding the flammable limit.

JUSTIFICATION FOR DELETION OF

TECHNICAL SPECIFICATION 3/4.6.4.3

HYDROGEN MIXING FANS

FEBRUARY 1985

CONTENTS

Justification for Deletion of Tech. Spec. 3/4.6.4.3 Hydrogen Mixing Fans

1.0 BACKGROUND

The hydrogen mixing fans provide a dual function: ventilation of the areas around the reactor coolant pumps during normal operation and, for defense-in-depth, hydrogen mixing in the post LOCA mode. The post accident function of the fans has been reviewed in light of the containment layout and design, the hydrogen generation and accumulation rates, and the post-LOCA mixing of the containment atmosphere. This review indicates that the hydrogen mixing fans are not required to assure nearly uniform concentrations of hydrogen throughout the containment. The NRC has reached this same determination on other licensed operating PWRs with large dry containments, the majority of which have no hydrogen mixing fans. Therefore, the subject technical specification is deemed inappropriate and was not proposed by the SNUPPS utilities.

The SNUPPS FSAR will be revised to indicate that proper containment mixing will be achieved without the mixing fans. The fans will continue to be maintained in a qualified state and will continue to be used during normal operation. The basis for this determination follows.

2.0 CONTAINMENT DESIGN

The SNUPPS containment inside dimensions are 140 feet in diameter and 205 feet high and it has a net free volume of 2.5 million cubic

feet. The containment floor outside of the secondary shield walls (elevation 2000'-0") has a free area of 7,600 square feet. The free floor area between the secondary and primary shield walls (the steam generator compartments) has a free area of 4,700 square feet. These areas represent the accumulation area for post-LOCA water and total 12,300 square feet. As shown on FSAR Table 6.2.2-9, the anticipated post-LOCA flood depth will be approximately 4 feet (elevation 2004'-0").

The layout of the SNUPPS containment is shown on FSAR Figures 1.2-11 through 1.2-14. These figures reflect the design features provided specifically to ensure proper mixing of hydrogen on the outside of the secondary shield wall, an intermediate floor consisting mainly of grating is provided at elevation 2026'-0". On this elevation, only two areas of concrete flooring are provided below the two electrical penetration areas. The northernmost concrete floor extends below the secondary side steam and feed lines. Following a LOCA, cooler air from the upper elevations will drop through this grating and enter the steam generator compartments through the three large labyrinths which extend from elevation 2000'-0" to 2026'-0".

Elevation 2047'-6" is the main operating deck of the containment. The features of this elevation (shown on Figure 1.2-13) include concrete floor areas around the refueling pool, above the reactor coolant pumps and in front of the equipment hatch. The remainder

of the floor area outside of the secondary shield walls is covered with grating to promote free down flow of cooler air. The steam generator compartments are open with walls extending 12½ feet above the operating deck. These walls assist the chimney effect for natural circulation of hotter air from the steam generator compartments. Above each reactor coolant pump a 12 foot high hydrogen mixing fan is mounted on three removable concrete slabs. A six foot diameter opening is provided in the center hatch. The vanexial hydrogen mixing fan free area and cylindrical shell provide additional area for the escape of hotter air from the steam generator compartments through natural convection when the fans are not operating.

At elevation 2068'-8" (Figure 1.2-14) additional floor space is provided through the use of grating around the perimeter of the containment from the pressurizer compartment clockwise for approximately 230° to the equipment hatch area. The four safety related containment coolers are mounted on this elevation. Air is drawn through the 10 foot high cooling coils on three sides of each cooler where it is cooled, drawn past the fan motor and is discharged above the grating areas at the operating deck through blowout panels containing fusible links. Each cooler provides 67,000 cfm of cooled air in the slow speed accident operation mode. The cooled air is free to fall through the grating areas outside the steam generator compartments at elevation 2047'-6" and 2026'-0" and enter the steam generator compartments through the labyrinths between 2000'-0" and 2026'-0".

The two steam generator compartments are located on the east and west sides of the containment and extend from 2001'-4" to the underside of the floor at 2047'-6". The two compartments are free to communicate at the north end for this entire height. At the south end (under the refueling pool) a four foot high by 20 foot wide pipe trench provides communication between the two compartments. The pressurizer compartment is located in the southwest corner of the steam generator compartment. The pressurizer compartment walls are well vented just below the roof (elevation 2090'-4") for pressure relief and to allow hydrogen mixing. The pressurizer compartment acts as a large chimney.

3.0 <u>HYDROGEN GENERATION AND ACCUMULATION</u>

Section 6.2.5 of the SNUPPS FSAR contains a complete description of the hydrogen generation rates and its accumulation in volume percent with respect to time with no corrective action, with one 100 cfm recombiner placed in operation at one day and with the 100 cfm hydrogen purge system placed in operation at nine days following a LOCA. Refer to Figures 6.2.5-2 through 6.2.5-6.

As can be seen from these figures, the planned operation of the hydrogen recombiners limit the hydrogen concentration to less than 2% by volume. Operation of the purge system would be implemented only in the event of the failure of both 100% recombiners and if the hydrogen concentration reached 3%. Since the function of the recombiners is not jeopardized by a single failure, the hydrogen

purge system is not safety related except for the containment isolation valves. There are no known or postulated common mode failures which could affect both recombiners which have no moving parts inside containment. The recombination process is achieved by heating an orificed, natural convection, flow of air to greater than 1150F.

Since the bulk concentration of hydrogen will not exceed 2% by volume, a 100% margin exists for temporary local concentrations without exceeding the recommended 4% limit.

As noted in Section 6.2.5, the hydrogen produced from the three sources have large margins of conservatism included in the calculated amounts. The zirconium water reaction includes a factor of 50 between the calculated value of 47.32 lbm-moles based on 5% of the metal cladding reacting and the anticipated amount based upon .1% of the metal cladding reacting. The generation of hydrogen due to radiolysis is based upon Regulatory Guide 1.7 assumptions which are conservative in the "G" value selected and permit no credit for recombination in the water which would reduce the net hydrogen yield. The conservatisms in the calculations for hydrogen generated by corrosion of metals and paints include the estimates of exposed areas, the corrosion rates and the temperatures assumed in the containment. Also, the containment sprays may be terminated in the long term recovery mode and thus create a more benign environment from a corrosion standpoint.

4.0 POST-LOCA MIXING OF THE CONTAINMENT ATMOSPHERE

There are four mechanisms which help ensure uniform mixing of the containment atmosphere in addition to the hydrogen mixing fans and molecular diffusion. These mechanisms include initial blowdown, natural convection, containment sprays, and containment air coolers. These mixing mechanisms will be discussed with respect to the hydrogen generation rates at various phases following the LOCA.

During the short term blowdown and core reflood phases, all of the hydrogen generated from the zirconium water reaction is assumed to be released. The steam/water blowdown jet, the hot metal and concrete surfaces and the accumulation of hot water in the floor areas cause extreme mixing and natural convection within the containment subcompartments as the differential pressures equalize and the containment pressure increases while the ESF accident mitigation systems are sequenced into operation. Hydrogen pocketing is precluded by the severe conditions in the containment.

During the injection phase, the containment sprays and containment air coolers limit the peak containment pressure and begin to condense the released steam and cool the atmosphere which results in extreme turbulence in the open areas of the containment.

The hot surfaces in the steam generator compartments and the hot water on the containment floor cause the heated steam air mixture

to rise up past the steam generators and through the hydrogen mixing fans. Except for these openings, the secondary shield walls form a chimney from the top of the labyrinth openings at 2026'-0" to the underside of the operating deck. The steam generator walls and the hydrogen mixing fan shrouds complete the "chimney" which extends approximately 34 feet above the labyrinth openings. This chimney effect creates a significant natural convection flow. Also, during this phase the pressurizer compartment chimney is also assisting in the natural convection flow ventilation of the western steam generator compartment.

During the long term recirculation phase, the containment temperature and pressure are reduced. At the end of one day the containment sprays may have been already turned off and the containment temperature and pressure will be less than 140F and 18 psig, respectively. These conditions are significantly less than those assumed for calculating the long term hydrogen generation due to corrosion. Also, the decay heat load will have significantly diminished, thereby reducing the hydrogen generated from radiolysis due to short lived isotopes. As shown on Figure 6.2.5-3, the hydrogen generation rate drops from over 1 lbm-mole per hour to less than 0.4 lb-moles per hour during the first three days.

As demonstration of the amount of mixing required to ensure nearly uniform mixing of the steam generator compartments with respect to the bulk containment, the required ventilation flow rate through

the compartments is estimated assuming that 1 lb-mole/hr of hydrogen (approximately 400 scf/hr) was generated in the steam generator compartments and that it was permissible for the exiting flow to contain only .5% more hydrogen than the entering flow. As shown in Figure 6.2.5-2, with recombiner operation the concentration of the exiting flow would be less than 2.5% hydrogen because the bulk atmosphere maximum hydrogen concentration is only 2%. Using these assumptions, less than 1300 cfm is required to ventilate both steam generator compartments. The natural circulation capabilities of the above described chimneys are estimated to exceed these requirements by at least a factor of 10 with a temperature difference of several degrees between the steam generator compartments and the bulk containment atmosphere.

During the very long term recovery phase (up to 60 days) the hydrogen generation rate continues to fall and the recombiners bring the resultant concentrations to less than .5%. Even the slightest temperature difference between the 12,300 square feet of sump water, the several hundred thousand feet of containment heat sinks and the variations in containment temperature will assure natural convection currents in excess of the 1,300 cfm required by the example above. Finally, a minimum of two containment air coolers will distribute a total of 134,000 cfm of cooled air to the operating floor area.

5.0 SUMMARY AND CONCLUSIONS

Based upon the above discussions, it has been shown that adequate containment mixing is provided to ensure proper hydrogen mixing. The open containment design provides for communication of the areas above and below the operating deck and the areas inside the secondary shield wall. Natural convection is a major contribution to the mixing design during all phases following a LOCA; however, other mechanisms assist the mixing process. Blowdown and steam release assist the mixing prior to the actuation of the containment air coolers and containment sprays. During the injection phase and the initial phases of recirculation from the containment sump the containment sprays and air coolers assist the natural circulation mixing of the containment atmosphere. The immediate actions of the plant emergency procedures require that the containment cooling fans be verified operating in the emergency mode after a safety injection. These fans will continue operating for the long term until plant management determines, based on containment temperature, pressure, and hydrogen concentration, that they can be secured. Subsequent operation of the fan coolers will be dictated by containment conditions.

In conclusion, it has been shown that the safety function of the hydrogen mixing fans is not required and that the technical specification recommended by the NRC staff is not necessary.