TENNESSEE VALLEY AUTHORITY

CHATTANOOGA, TENNESSEE 37401

400 Chestnut Street Tower II

January 8, 1981

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Director of Nuclear Reactor Regulation
Attention: Mr. A. Schwencer, Chief
Licensing Branch No. 2
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Dear Mr. Schwencer:

In the Matter of) Docket No. 50-327
Tennessee Valley Authority)

Sequoyah Nuclear Plant unit 1 Technical Specification 3.6.1.9 limits containment purge to 90 hours per year. Since the full power license for Sequoyah unit 1 was issued in September 1980, approximately 40 hours of vent time has been expended.

Enclosed is our containment purge study for Sequoyah which we believe justifies a revision to this technical specification. We would like to schedule a conference call or meeting as soon as possible to discuss this issue.

Please get in touch with D. L. Lambert of my staff at FTS 857-2581 to make arrangements.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

L. M. Mills

L. M. Mills, Manager
Nuclear Regulation and Safety

Sworn to and subscribed before me
this 8th day of Jan. 1981

Bryant M. Lowery
Notary Public
My Commission Expires 4/4/82

Enclosure

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ENCLOSURE

SEQUOYAH NUCLEAR PLANT CONTAINMENT PURGE STUDY

Introduction

The change outlined in Supplement No. 2 to the Sequoyah safety evaluation report limiting operation of the containment purge and venting systems to a total of no more than 90 hours per year per reactor unit during modes 1, 2, 3, and 4 will have a severe impact on the plant capacity factor. The following is a discussion of the design, testing, and surveillance programs established at Sequoyah on the containment purge system and the performance of the system to date. Also presented are the expected specific venting and purging requirements to maintain the operability of the plant.

System Design

All the purge isolation valves are symmetric disk butterfly valves manufactured by Henry Pratt. As shown on FSAR figure 9.4.20, there are two supply and two exhaust lines for the upper compartment and two supply lines and one exhaust line for the lower compartment. The isolation valves in these lines are 24-inch valves. There is one supply and one exhaust line to the instrument room for instrument room purge. The isolation valves for these lines are 12-inch valves. The operators for the 24-inch valves are Bettis 732C-SR-80 series and the 12-inch valves use Bettis 721C-SR-60 series which require air to open, are spring loaded to close, and fail closed. The minimum working air pressure for the operators is approximately 60 lb/in^2 for the 12-inch valves and 80 lb/in^2 for the 24-inch valves. Each Bettis operator has an ASCO solenoid actuator. Maximum containment pressure will not hinder venting of the ASCO actuator.

The valve, piping, and debris screen arrangements are shown on FSAR figure 9.4-29. The inlets to the piping housing the purge valves do not open into containment areas that experience high subcompartment pressures. The highest subcompartment pressure that affects a purge valve is approximately 12 lb/in^2g.

The ductwork inside containment on the main purge air exhaust lines is designed as follows:

1. Upper compartment exhaust line 1 has a 90° bend 3.5 pipe diameters upstream of the inboard valve. The valve shaft is in the plane of the bend.

2. Upper compartment exhaust line 2 has a 45° bend 4.5 pipe diameters upstream of the inboard valve. The valve rotation is such that flow distribution would act to close the valve. There are no 90° bends inside containment.

3. The lower compartment exhaust line has a 90° bend 8 pipe diameters upstream of the inboard valve. The valve shaft is in the plane of the bend.

All other lines are straight piping runs inside containment.

Prototype Testing

In situ testing of similar containment purge valves was conducted at the D. C. Cook Nuclear Plant. The test demonstrated that symmetric disk purge valves could close against an overpressure simulating a design basis event overpressure. A comparison of the D. C. Cook and Sequoyah purge valves is provided below.

	Sequoyah	D. C. Cook
Manufacturer	Henry Pratt	Fisher
Line Size	12", 24"	24", 30"
Disk Type	Symmetric	Symmetric
Operator	Bettis 732CSR 80 (24) 721CSR 60 (12)	Bettis 732 B SR
Debris Screen	Yes 1/2" x 1/2"	Yes 1-3/16" x 2"
Valve Pressure Rating	150 pounds	-
Valve Closure Time	4 seconds + 1 Second Instrumentation Delay	5 Seconds
Containment Design Pressure	12 lb/in^2g	12 lb/in^2g

The table shown above provides a comparison of various factors concerning the purge lines at Sequoyah and D. C. Cook. The critical parameters are disk type, line size, and closure time and, as can be seen, the Sequoyah valves compare favorably with the D. C. Cook valves.

D. C. Cook tested their valves at a differential pressure of 8.3 lb/in^2. At Sequoyah the maximum pressures in the vicinities of the purge valves during closure are 12 lb/in^2g in the lower compartment and 6.5 lb/in^2 in the upper compartment.

The finer mesh in the Sequoyah debris screens, as compared to D. C. Cook, provides a larger pressure drop reducing the pressure differentials across the valves during closure. Based on the information provided above, TVA has concluded that the tests performed at D. C. Cook provide sufficient evidence that the purge valves at Sequoyah will close without damage in the event of a LOCA during purge operations.

Surveillance Program

The Sequoyah purge system utilizes two pairs of 14,000-cfm supply and exhaust fans along with smaller, approximately 800 cfm, supply and exhaust fans for the incore instrument room. All air discharged by these fans is filtered prior to release through a set of filter banks comprised of a prefilter, high efficiency particulate filter, and charcoal filters. These filter banks are tested every 12 months in accordance with ANSI N510-1975 and verified to remove greater than or equal to 99 percent of particulate (POP) and halogenated hydrocarbon test gas.

Upon receipt of a high radiation signal from the purge fan discharge, a high radiation signal from the containment air monitors, or a safety injection signal, the purge system will automatically shut down and all system isolation valves close. Each purge line penetration through the containment vessel has inboard and outboard isolation valves that are periodically tested for leakage and closing time. With the present surveillance program at Sequoyah, the isolation valves are leak tested after every cycling of the valve or every 90 days. The valves are tested for closing time after any maintenance on the valve or every 90 days. The performance to date of the Sequoyah purge valves has been excellent with leak rates that have been almost unmeasurable and closing time averaging well below the required four seconds. This surveillance program meets, or in most cases exceeds, the surveillance requirements at other operating nuclear plants.

In addition to the above surveillance program, testing of the bypass, override, and reset circuits of all systems receiving engineered safety feature signals, including the containment purge system, has been completed at Sequoyah. These tests verified that safety feature actuation signals could not be inadvertently blocked, overridden, or bypassed, and also verified that safety-related equipment would not return to its nonsafety mode upon reset of the ESF signal.

Containment Venting Requirements

Existing plant technical specifications require maintaining containment pressure between -0.1 and +0.3 psig relative to the annulus (area between the containment vessel and the shield building). Sequoyah has experienced, as have many other plants, problems with maintaining containment pressure when completely isolated. The containment pressure slowly increases due to control air bleedoff from the many air-operated valves inside containment. The rate of pressurization is dependent on environmental temperature and barometric pressure changes throughout the day.

Experiences at Sequoyah indicate that, when the containment is isolated, venting to release containment pressure is required approximately once every 8 hours for approximately ten minutes (30 minutes daily) for a total of approximately 183 hours per year. Sequoyah has been using an 8-inch line on the purge system for venting purposes when the purge system is not in normal operation. The isolation valves on this duct have been left in the open position and a purge valve in the annulus opened whenever venting was required.

A proposal to modify this venting method is being pursued which would allow using the small (~ 800 cfm) instrument room exhaust fan in conjunction with the same 8-inch purge duct penetration. This method would direct the vent flow through the purge system filter bank before being exhausted to the environment. The proposal includes leaving the two purge isolation valves on the 8-inch duct open to avoid unnecessary cycling of the valves and the required leak test after each cycle. A third isolation valve outside the shield building and downstream of the inboard and outboard containment isolation valves would be utilized to isolate the flow path when not venting. This valve also closes on a containment isolation signal essentially providing triple isolation between the containment and the environment. This proposed system would be similar to the system D. C. Cook uses for venting purposes.

Conta nment Purging Requirements

Ice condenser containments require significantly more containment entries than other types of containments. This is due to both additional surveillance required by technical specifications and additional inspection and maintenance on the ice condenser system components. Current experience at Sequoyah and other ice condenser plants indicates that containment entries are required at least every two days to perform maintenance on the ice condenser systems, in particular the air handling units. Based on this high rate of maintenance, entries are required daily to inspect these units. Ice weighing activites are expected to require several weeks per year when a crew of people will be inside all day.

Other maintenance activities are expected to require entry into containment on a weekly basis. Activities such as repair on pressurizer and steam generator pressure and level instrumentation, reactor coolant pump seal flow transmitters, containment air monitors, and moveable detectors and drives require entry into the containment incore instrument room and lower containment raceway. This maintenance in many cases would require prolonged stays inside containment.

With a 90-hour limit on containment purging and the expected frequency and duration of containment entry at Sequoyah, occupational exposure to personnel will obviously be considerably higher than if unrestricted purge was allowed. The extent of this higher exposure will be dependent only on the leakage rate from the reactor coolant system since, as indicated above, there exists very little flexibility in the amount of time personnel will be required to be in containment. Activity levels in the containment of operating plants indicate that Sequoyah can expect occupational exposures ranging from 100-1,000 times higher than if unrestricted purge was allowed (D. C. Cook experiences 1-5 times MPC in the upper containment and significantly higher levels in the lower containment). The purge time required to reduce activity levels by a factor of 10 is over 3 hours. In light of this, the 90 hours of purge time will be of little benefit in reducing the airborne activity levels due to the frequence and duration of containment entry.

Another consideration in limited purging is the time delay for the activity level in the ice condenser compartment to come to equilibrium with the levels in the containment. Since the ice condenser is a closed system with only inleakage from the containment as a source of air, a buildup of airborne activity would be extremely difficult to reduce even though the purge system would reduce the levels in the containment relatively quickly. It is therefore necessary to keep activity levels in the containment as low as possible to prevent this buildup in the ice condenser compartment.

To accomplish this, given the activity levels experienced at D. C. Cook, purging for a minimum of 3 hours per day during normal operation would be required (1,095 hours per year). This amount of purging would reduce airborne activity from 5 times MPC to 0.5 times MPC (I_{131}). Since this purge time would eliminate the need for one of the three daily containment ventings, the total required purge time is expected to be approximately 1,217 hours per year (1,095 purging plus 122 venting).

Conclusions

TVA has adopted a very conservative approach toward occupational exposure in setting limits below Federal standards. It has been, and will continue to be, our policy to follow the ALARA approach toward occupational exposure both in the design and operation of our nuclear plants. Requirements of 10 CFR Part 20 indicate that the licensee should use process or other engineering controls as much as practicable to limit the concentration of airborne contaminants below the levels defining an airborne radioactivity area. We feel that the containment purge system at Sequoyah, if allowed to be used as designed, will fulfill these requirements.

With the 90-hour limit on purging and venting, Sequoyah will be required to shut down within 6 months of entering mode 4 due to the time required for containment venting alone (30 minutes per day). Airborne activity levels inside containment, although not expected to be a problem during the first fuel cycle, have the potential to limit maintenance activities and thereby limit the time Sequoyah can operate in modes 1, 2, 3, and 4. It is our opinion that, given our strict and comprehensive surveillance program and the performance of our system to date, the expected Sequoyah purge requirement indicated above does not significantly increase the probability of an offsite release in excess of 10 CFR 100 guidelines.