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MIDDLE SOUTH UTILITIES SYSTEM

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Mr. R. L. Tedesco
Assistant Director of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: LOUISIANA POWER & LIGHT COMPANY
WATERFORD SES UNIT NO. 3
DOCKET NO. 50-382
CONTAINMENT PURGING

Ref: LP&L letter W3P81-1835, D. L. Aswell to R. L. Tedesco, dated August 19, 1981

Att: Waterford-3 Containment Purge Study

Dear Mr. Tedesco:

Standard Review Plan 6.2.4, Revision 1, Subsection II.8 and the associated Branch Technical Position CSB 6-4 provide the NRC staff position on purging of the containment. In accordance with these requirements, a nuclear unit may waive BTP Items B.1.c and B.5.a regarding the size of the purge system used during normal operation and the justification by acceptable dose consequence analysis, provided that use of the purge system is limited to 90 hours per year while the plant is in the startup, power, hot standby and hot shutdown modes of operation. Therefore, in response to NRC Question 022.8 (March, 1979), we committed to this 90 hour/year restriction.

Item II.E.4.2 of NUREG-0737, position (7) delineated the NRC staff position on containment purge valves (CPVs). Pursuant to the recommendations in this position, an operability study was performed and submitted via the above referenced letter. This study showed that in order to completely comply with the NRC's position on CPV operability, a limitation of 40 degrees opening must be imposed. LP&L is in the process of mechanically implementing this limitation. This modification decreased purging capacity from 60,000 scfm to 15,000 scfm and consequently increased purging requirements.

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A review of the Waterford-3 containment purge system and anticipated purge requirements have dictated a need for removal of the 90 hour/year Technical Specification. This review identified the following reasons for its removal: 1) the aforementioned decreased purging capacity; 2) the inherent uncertainty of purging needs; 3) LP&L's policy to maintain occupational exposures ALARA; and 4) the fact that an excessive restriction on containment purges would limit access for maintenance and surveillance of Engineered Safeguard Features components.

Justification for unlimited purging during normal operation is established through an attachment to this letter. This justification is in accordance with the requirements of Standard Review Plan 6.2.4, Revision 1, and its associated Branch Technical Position. The justification includes analyses to demonstrate that a loss-of-coolant accident (LOCA) while purging containment would neither degrade ECCS effectiveness, nor produce radiological dose consequences in excess of 10 CFR 20 and 100 guidelines, as applicable.

Although we feel appropriate analyses and design modifications have been made to justify unlimited purging, we do intend to limit the number and duration of purges to the extent feasible.

We would appreciate your review of the subject matter and we would be responsive to any further concerns.

Very truly yours,

L. V. Maurin

LVM/MJM/pco

Attachment

cc: W. M. Stevenson, E. L. Blake, S. Black

ATTACHMENT
WATERFORD-3 CONTAINMENT PURGE STUDY

INTRODUCTION

Per the Waterford-3 Safety Evaluation Report NUREG-0787 (SER) dated July 1981, the containment purge system is limited to 90 hours/year of operation during MODES 1, 2, 3 and 4. The following is a discussion of the Waterford-3 purge system design, the need for purging, and a comparison with the requirements of BTP 6-4. It is presented as background and justification for our request for unlimited purge authorization.

SYSTEM DESIGN

The Waterford-3 Containment Atmosphere Purge System is discussed in FSAR Subsection 9.4.5.3. The containment isolation portion of the purge system is safety class 2 and seismic Category I and is discussed in FSAR Subsection 6.2.4. The purge system consists of one 48 inch purge inlet and one 48 inch purge exhaust. Each 48 inch line consists of three butterfly valves in series, one in containment, one in the annulus, and one in the RAB. All valves are limited to 40° open and capable of closure during a LOCA. The valves are leak tight at maximum containment internal design pressure. For a more detailed discussion of the valves operability please refer to the Waterford-3 Containment Purge Valve Operability Study [1].

Purging during normal operation is initiated by operator action. Make-up air enters through a louvered damper, passes through a medium efficiency filter and an electric heating coil, and then flows in series through butterfly valves 2HV-B150B, 2HV-B151A, 2HV-B152A and a wire mesh screen to enter containment. Exhaust air flows out through butterfly valves 2HV-B153B, 2HV-B154B, and 2HV-B155A to the RAB Normal Ventilation System. Air then flows through a filter train for removal of radioactive particulates and radioiodines before being discharged by exhaust fans to the stack.

Termination of containment purging is an automatic feature at the Waterford-3 plant. Normal plant instrumentation and controls prohibits and terminates purging when containment pressure exceeds the range of -5.0 in. W.G. to +4.5 in. W.G. Class IE instrumentation ensures containment isolation and purge termination by closing all six butterfly valves within 5 seconds. Isolation is actuated on high containment pressure, low pressurizer pressure and high radiation. The high radiation signal (CPIS) is generated on inputs from monitors inside containment and on the plant stack. Their setpoints ensure that any radiological releases will not exceed 10 CFR 100 limits during accident conditions or 10 CFR 20 limits during normal operation.

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(1) Containment Purge Valve Operability Study submitted via L.P.L. letter W3P81-1835, D. L. Aswell to R. L. Tedesco, dated August 19, 1981

SURVEILLANCE PROGRAM

Filtering of the Waterford-3 discharged purge air is accomplished via a set of filter banks comprised of a prefilter, HEPA filter, and charcoal filters. These filter banks meet the maintenance and testing requirements of Regulatory Guide 1.140 and ANSI-N509-1976, as discussed in FSAR Subsection 9.4.3.

The isolation function of the containment purge valves will be tested in accordance with the attached Technical Specification 3/4.6.4. The valves shall be demonstrated operable during the cold shutdown or refueling mode at least once per 18 months by (a) verifying that on a containment isolation test signal, each purge isolation valve actuates to close, and (b) verifying that on a high radiation test signal, each purge isolation valve actuates to close. Furthermore, the 5 second isolation time of the purge valves shall be verified prior to returning the valves to service after maintenance, repair or replacement work is performed on them, or at least once per 3 months by cycling the valves through one complete cycle of travel.

The leakage rate of the containment purge valves will be tested in accordance with the attached draft Technical Specification 3/4.6.1.8. The purge isolation valves shall be given Type C local leak detection tests at not less than Pa (44 psig). The valves shall be demonstrated operable after each cold shutdown prior to entering MODE 2, if not performed in the previous 92 days, by measuring the leakage rate and adding this measured leakage rate to the leakage rates determined pursuant to Specification 4.6.1.2.d for all other Type B and C penetrations. The stated acceptance criterion is that the sum of all local leak detection tests will not exceed 60 percent of the maximum allowable leakage rate (L_a). In addition, the leakage rate for the purge valves shall be compared to the previously measured leakage rate for the same valve to detect valve degradation. An engineering evaluation shall be performed to determine what corrective action, if any, is necessary.

In addition to the above surveillance program, the containment purge valve isolation signals are designed such that they cannot be locked, reset, or overridden. Instrumentation channels and bypasses that activate the purge isolation valves shall be demonstrated operable by the performance of applicable channel check, channel calibration, channel functional test, and the response time test, as specified per Technical Specification 3/4.3.2.

BRANCH TECHNICAL POSITION CSB 6-4

The Waterford-3 containment purge system meets the provisions of BTP CSB 6-4 in the following manner (paragraphs below correspond o similarly numbered paragraphs in Part B of the BTP).

1) a) Operability of the containment purge valves is addressed in the Waterford-3 Pump and Valve Operability Assurance Program that is discussed in FSAR Subsection 3.9.2.2. This program was approved by the NRC in the Waterford-3 Safety Evaluation Report (SER) NUREG-0787, Subsection 3.9.3.2. To further assure purge valve operability, and in accordance with the Staff's "Guidelines for

Demonstration of Operability of Purge and Vent Valves" a detailed operability study was submitted via LP&L letter W3P81-1835, D. L. Aswell to R. L. Tedesco dated August 19, 1981.

b) The Waterford-3 Containment Atmosphere Purge System consists of one 48 in. vent and one 48 in. make-up line.

c) The Waterford-3 utilizes a 48 in. purge and vent line designed such that any radiological consequences will not exceed 10 CFR 100 and 10 CFR 20 guideline values. The balance of this text provides justification for these line sizes.

d) The purge system is part of the Waterford-3 Containment Isolation System (CIS) and meets the appropriate standards of quality, redundancy, and testability. The CIS is discussed in FSAR Subsection 6.2.4 and addressed favorably by the NRC in SER Subsection 6.2.4.

e) Isolation of the purge system lines is actuated on high containment pressure, low pressurizer pressure, or high radiation in containment or at the plant stack. Diverse power and activating signals are provided for purge isolation.

f) Maximum valve closure time, including instrumentation delay, is five seconds from the time the closure signal is generated.

g) Any debris generated during a LOCA must travel a tortuous path to reach the Containment Atmospheric Purge System isolation valves. The valves and ducts are located above the operating floor which is either solid construction or grated and are further protected by a wire-mesh screen at the duct opening. Consequently it is not considered credible for any debris to reach and prevent closure of the isolation valves.

2) Waterford-3 does not rely on the purge system for temperature and humidity control.

3) To minimize the need for purging, Waterford-3 has an Airborne Radioactivity Removal System (ARRS) and a Containment Atmospheric Release System (CARS). The ARRS is a "kidney" system, located within containment, to reduce activity levels. The CARS releases containment air to the annulus. Refer to FSAR Subsections 9.4.5.2 and 6.2.5.2.3 for a more detailed discussion.

4) Per the plant Technical Specifications, the purge isolation valves are tested for leakage rate and isolation capability. Refer to the Surveillance Program section of this text and to Waterford-3's Technical Specifications which will be submitted under separate cover.

5) a) To demonstrate the adequacy of the containment purge valves, an analysis of the radiological consequences of a loss of coolant accident (LOCA) coincident with purging was performed. A double-ended hot leg slot LOCA was postulated because this resulted in the quickest containment pressure buildup. Refer to FSAR Subsection 6.2.1 and 15.6.3.3 for a more detailed LOCA discussion. The source term used is conservatively assumed to be that of an adiabatic expansion of saturated steam at 60 uCi/g dose equivalent of I-131, and corresponds to an iodine spike prior to the onset of fuel damage. Containment isolation is actuated at 19.7 psia and the valves close in 5 seconds.

The method used to calculate the mass of steam released is that recommended in Perry's Chemical Engineers' Handbook.(2) Pressure drop due to friction was considered for only one of the three isolation valves. Friction loss factors of 0.5 and 1.0 were used for the purge line inlet and exhaust, respectively. These loss factors were taken from I. E. Idelchick's "Handbook of Hydraulic Resistance".(3) For the above conditions the source term is 8.96 Ci. Based on an Exclusion Area Boundary relative concentration of 6.3×10^{-4} s/m^3, a breathing rate of 3.47×10^{-4} m^3/s, and a I-131 thyroid dose conversion factor of 1.48×10^6 rem/Ci - inhaled, a dose of 2.9 rem to the thyroid is calculated. This dose is a small fraction of the 10 CFR 100 guideline limit of 300 rem and shows that the radiological consequences of the postulated release are minimal.

b) The fans, filters and ductwork located beyond the purge system isolation valves are not safety related.

c) The peak containment pressure LOCA analysis was compared to an analysis with the two 48 in. diameter purge makeup and exhaust lines open at the time of the postulated LOCA, (refer to FSAR response to NRC Question 022.8). This comparison was performed for fully open (90°) purge valves and it concluded that the resultant difference in containment minimum back pressure would not have any significant effect on the results of the ECCS analysis presented in FSAR Subsection 6.3.3. The present design of limiting the containment purge valves to 40 degrees open will only enhance the conservatism of this comparison.

d) Leakage past the containment purge valves is a function of seat integrity. The valves are equipped with ethylene-propylene-diene polymer (EPDM) T-rings. Significant degradation of these seats is not expected during their recommended 4-year life

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(2) Perry's Chemical Engineer's Handbook, Fourth Edition, McGraw-Hill Book Company, New York pp 5-24, 26

(3) I. E. Idelchik, "Handbook of Hydraulic Resistance", AEC-tr-6630, pp 361

expectancy. However, prudence dictates that the valves should undergo a leakage test frequency beyond the requirements of 10 CFR 50, Appendix J. Consequently, the purge isolation valves will be leak tested pursuant to attached plant Technical Specification 3/4.6.1.8. To further assure containment integrity, all leakage past the first two of three purge valves is vented to the annulus where it is processed through the Shield Building Ventilation System.

NEED FOR PURGING

Waterford-3 plans to purge intermittently for short periods of time dependent on the operational needs of the plant. Principal operating purge demands are: (1) the need to maintain the containment pressure within Technical Specification limits, (2) to maintain activity levels within the containment atmosphere as low as reasonably achievable (ALARA) so as to permit personnel access for inspection and maintenance of active safety equipment, and (3) to satisfy the surveillance requirements of the Technical Specifications.

Plant Technical Specification 3.6.1.5 requires maintaining containment pressure between -12.5 and +5.5 in.W.G. The normal plant controls system prohibits purging when containment pressure exceeds 4.5 in.W.G. Pressure build-up can occur from (1) influent nitrogen and instrument air, and (2) the increase of containment air temperature during reactor plant heat-up. Assuming a 10 scfm leakage of nitrogen and instrument air into containment the consequent pressure increase will be 4.5 in.W.G. per 50 hours. An increase of containment temperature during reactor plant heat-up from an assumed initial temperature of 60°F to 120°F (normal operating air temperature) will yield a total pressure increase of 47 in.W.G. In general, the containment pressure will increase but the rate of pressurization is dependent on the amount of influent and environmental conditions. However a need to "burp" the containment exists.

Personnel entries into the containment area for maintenance and inspection are necessary to assure that the engineered safety features of Waterford-3 will be available in the event of a malfunction and to assure efficient plant operation. Purging is an effective and timely method in assuring that the associated occupational exposures are within ALARA Guidelines. The calculation of expected purging requirements is based on the number of containment entries and the amount by which airborne activity must be reduced to keep internal doses below MPC limits. The anticipated number of personnel entries for scheduled maintenance and surveillance activities could reach one every other week. Anticipated activity levels within containment are directly related to the reactor coolant system leakage rate. Per the recommendation of NUREG-0017[4], a leak rate of 1.0 percent per day of the noble gases, and 0.001 percent per

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[4]NUREG-0017, Calculation of Release of Radioactive Materials in Gaseous and Liquid Effluents from PWR's (April, 1976)

day of the iodines contained in the primary coolant, will leak directly to the containment building atmosphere. Assuming Waterford-3 specific concentrations and a purge frequency of 26 times per year, airborne activity levels prior to purging are expected to be 444 c/MPC. A 20 hour purge will reduce activity levels to the at power equilibrium valve of 9.2 c/MPC and a consequent containment entry time of 4.3 hours/week per individual. However, ALARA considerations and unscheduled containment entries could increase the purging time.

CONCLUSIONS

LP&L has adopted a policy to maintain occupational exposure ALARA in both the design and the operation of the Waterford-3 plant. Pursuant to the requirements of 10 CFR 20.103 (b)(1), it is our policy to use process or other engineering controls to the extent practicable, to limit concentrations of radioactive materials in air to levels which delimit an airborne radioactivity area. We feel that the Waterford-3 containment purge system, operating as proposed, will aid in achieving these requirements.

In summary, it is our opinion that the need for containment purging, the favorable comparison to the recommendations of Branch Technical Position 6-4 inclusive of the ECCS backpressure analysis and the radiological consequences of a LOCA analysis, the purge valve operability study, the limited opening of the CPV's to 40 degrees, and the comprehensive surveillance requirements of the Waterford-3 plant justify no restrictions on intermittent purging.