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RECIP.NAME RECIPIENT AFFILIATION
CLARK,R.A. Operating Reactors Branch 3

SUBJECT: Forwards addl info re NUREG-0737,Item II.B.1 "Reactor Coolant Gas Vent Sys," in response to NRC 820223 request. One oversize drawing encl.Aperture card is available in PDR.

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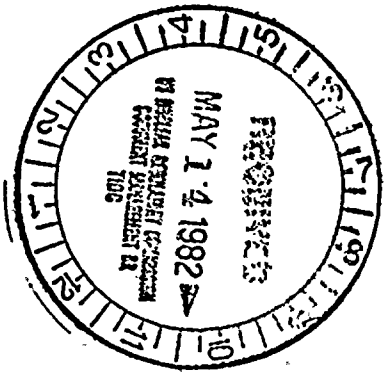
FLORIDA POWER & LIGHT COMPANY

May 7, 1982
L-82-192



Office of Nuclear Reactor Regulation
Attention: Mr. Robert A. Clark, Chief
Operating Reactors Branch #3
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Clark:

Re: St. Lucie Unit 1
Docket No. 50-335
Post-TMI Requirements
Reactor Coolant Gas Vent System

Your letter of February 23, 1982 contained a request for additional information concerning the St. Lucie Unit 1 Reactor Coolant Gas Vent System (NUREG-0737, Item II.B.1). The attachment to this letter contains our response to your request. We trust that this submittal will aid you in the completion of your review of the St. Lucie Unit 1 system.

Very truly yours,

Robert E. Uhrig
Vice President
Advanced Systems and Technology

REU/PKG/mbd

Attachment

cc: Mr. James P. O'Reilly, Region II
Harold F. Reis, Esquire

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ATTACHMENT

Re: St. Lucie Unit 1
Docket No. 50-335
Post-TMI Requirements
Reactor Coolant Gas Vent System

1. Verify that the reactor coolant gas vent system (RCGVS) flow restriction orifices are smaller than the size corresponding to the definition of a loss-of-coolant accident (10 CFR Part 50, appendix A) by providing the pertinent design parameters of the reactor coolant makeup system and a calculation of the maximum rate of loss of reactor coolant through the RCGVS orifices (reference NUREG-0737 Item II.B.I Clarification A.(4)).

Response:

The orifice used in the RCGVS (7/32" X 1") is the standard size orifice used throughout the C-E NSSS to limit mass loss from instrument line breaks to less than the makeup capacity of a single charging pump. Initial conditions upstream of the orifice were considered with pressures ranging from 1800 to 2250 psia at corresponding saturation temperatures to calculate the mass flow rate through the orifice. Under these conditions, the orifice will limit the mass loss to approximately 4 lbm/sec (29 gpm), which is well within the capacity of a single charging pump (44 gpm).

2. You have stated in Section VI.4 of your August 10, 1981 submittal that the routing of the RCGVS is such that it is protected from cold leg, branch cold leg, and non-RCS piping ruptures. Verify that internal missiles and the dynamic effects associated with the postulated rupture of other piping will not prevent the essential operation of the RCGVS (i.e., at least one vent path remains functional). In particular, demonstrate that there is no common mode failure which could affect the six solenoid operated valves located on the pressurizer cubicle wall and prevent the essential operation of the RCGVS (reference Appendix A to 10 CFR Part 50, General Design Criterion 4).

Response:

The design criteria for protection against missiles and postulated missile sources, generated in the Reactor Containment Building (RCB), is discussed in the St. Lucie Unit #1 FSAR, Section 3.5. The attached piping drawing shows the RCGVS line locations. The routing of the safety related piping associated with this system takes advantage of the existing missile barriers and shield walls. The major components of the RCGVS, solenoid valves, common piping header etc, are located on the exterior side of the pressurizer cubicle wall facing the steam generator shield wall, in a virtually risk free area. In this location, the components are either so far removed or shielded from missile sources, that the effect of missiles can be neglected. The only portions of the RCGVS piping and equipment that are exposed to the effects of missiles are those runs located at the reactor vessel head, and at the pressurizer steam space. The RCGVS line inside the pressurizer cubicle was routed to avoid the paths of potential missile sources listed in the FSAR Table

3.5-1. The routing of the RCGVS line located at the reactor head takes advantage of the reactor head shroud as a cover. It also is routed in a manner such that it avoids the path of the potential missiles listed in the FSAR. Some portions of the RCGVS piping may be exposed to missiles from the Steam Generator, however, these missiles are small and of low energy (maximum velocity of 5.8 ft/sec with a weight of 4.25 lbs) and the source is located at such a distance as to minimize the missile effect. All of the above reasons make the possibility of failure of the RCGVS due to missiles extremely unlikely.

The design criteria applied to the RCGVS for protection against the affects of pipe whip and jet impingement associated with other piping is discussed in section 3.6 of the FSAR. For reasons similar to that described above, the only portion of the RCGVS exposed to pipe whip and jet impingement is the run located at the pressurizer steam space. In the pressurizer cubicle, the high energy lines have been installed with pipe whip restraints in accordance with the criteria established in the FSAR. Therefore, the RCGVS piping in the pressurizer cubicle may be exposed to jet impingement, but not any other piping, and considering the small size of the lines, the effect of jet impingement is negligible.

Parallel vent paths are provided for both the reactor vessel head and the pressurizer steam space. Venting is accomplished through the appropriate line up of parallel sets of the solenoid valves. Therefore, single failure for the extremely unlikely event of missiles or dynamic effects will not prevent the essential operation of the RCGVS; at least one vent path will remain functional.

It has been discussed in the preceding paragraphs that there is virtually no chance of missile, pipe whip and jet impingement damage to the solenoid valves, therefore, the only common mode failure would come from the basic design of the valve. These valves were designed and selected for the system and environment in the containment. The valves were field tested under near-operating conditions in the secondary function of the RCGVS - normal venting of the RCS during plant outage. The chance of all six solenoid valves failing at the same time, of an internal defect, is too unlikely to be taken into account. Therefore, common mode failure is not postulated.

3. Verify that the following RCGVS failures have been analyzed and found not to prevent the essential operation of safety-related systems required for safe reactor shutdown or mitigation of the consequences of a design basis accident:

   a. Seismic failure of RCGVS components that are not designed to withstand the safe shutdown earthquake.

   b. Postulated missiles generated by failure of RCGVS components.

   c. Dynamic effects associated with the postulated rupture of RCGVS piping greater than one-inch nominal size.

d. Fluid sprays from RCGVS component failures. Sprays from normally unpressurized portions of the RCGVS that are Seismic Category I and Safety Class 1, 2, or 3 and have instrumentation for detection of leakage from upstream isolation valves need not be considered.

RESPONSE:

The RCGVS will not prevent the essential operation of safety related systems required for safe reactor shutdown or mitigation of the consequences of a design basis accident due to:

a. seismic failure of RCGVS components that are not designed to withstand the safe shutdown earthquake;

b. postulated missiles generated by failure of RCGVS components;

c. dynamic effects associated with the postulated rupture of RCGVS piping greater than one inch nominal size; and

d. fluid sprays from RCGVS components.

This is based on the following information:

a. The non-safety, non-seismic portions of the RCGVS (those portions used for venting and draining) are routed so as not to pass over or near systems and equipment required for safe shutdown or mitigation of the consequences of a design basis accident. The one exception to this is a one inch line passing over Hydrogen Recombiner 1B. This portion of piping has been seismically analyzed and provided with seismic supports. Additionally, where the RCGVS is tied into the non-seismic portion of the Containment Purge ductwork, a flexible connection is provided to reduce forces imposed on the ductwork.

b. Section 3.5 of the FSAR lists the spectrum of potential internal missiles for this plant. None of the equipment in the RCGVS falls under these categories. Therefore, the RCGVS components are not considered to be missile sources.

c. The normally pressurized portions of the RCGVS are all one inch and under piping. The only portions of the system that are larger than one inch are the accumulator and the line to the containment purge system. These lines are not normally pressurized and have design pressures well under the criteria for pipe rupture.

d. As noted in 3c above the only piping in the normally pressurized portions of the RCGVS are all one inch and under. Based on the criteria of section 3.6 of the FSAR, these lines are not postulated to rupture and therefore fluid spray from the lines will not be considered.

e. As discussed in 3b above, valves that are in the normally pressurized portions of lines are not postulated missile sources. Therefore, fluid spray from valves will not be significant.

4. Demonstrate, using engineering drawings (including isometrics) and design descriptions as appropriate, that the RCGVS paths to the containment atmosphere discharge into areas:

a. That provide good mixing with containment air to prevent the accumulation or pocketing of high concentrations of hydrogen, and

b. In which any nearby structures, systems, and components essential to safe shutdown of the reactor or mitigation of a design basis accident are capable of withstanding the effects of the anticipated mixtures of steam, liquid, and non-condensible gas discharging from the RCGVS.

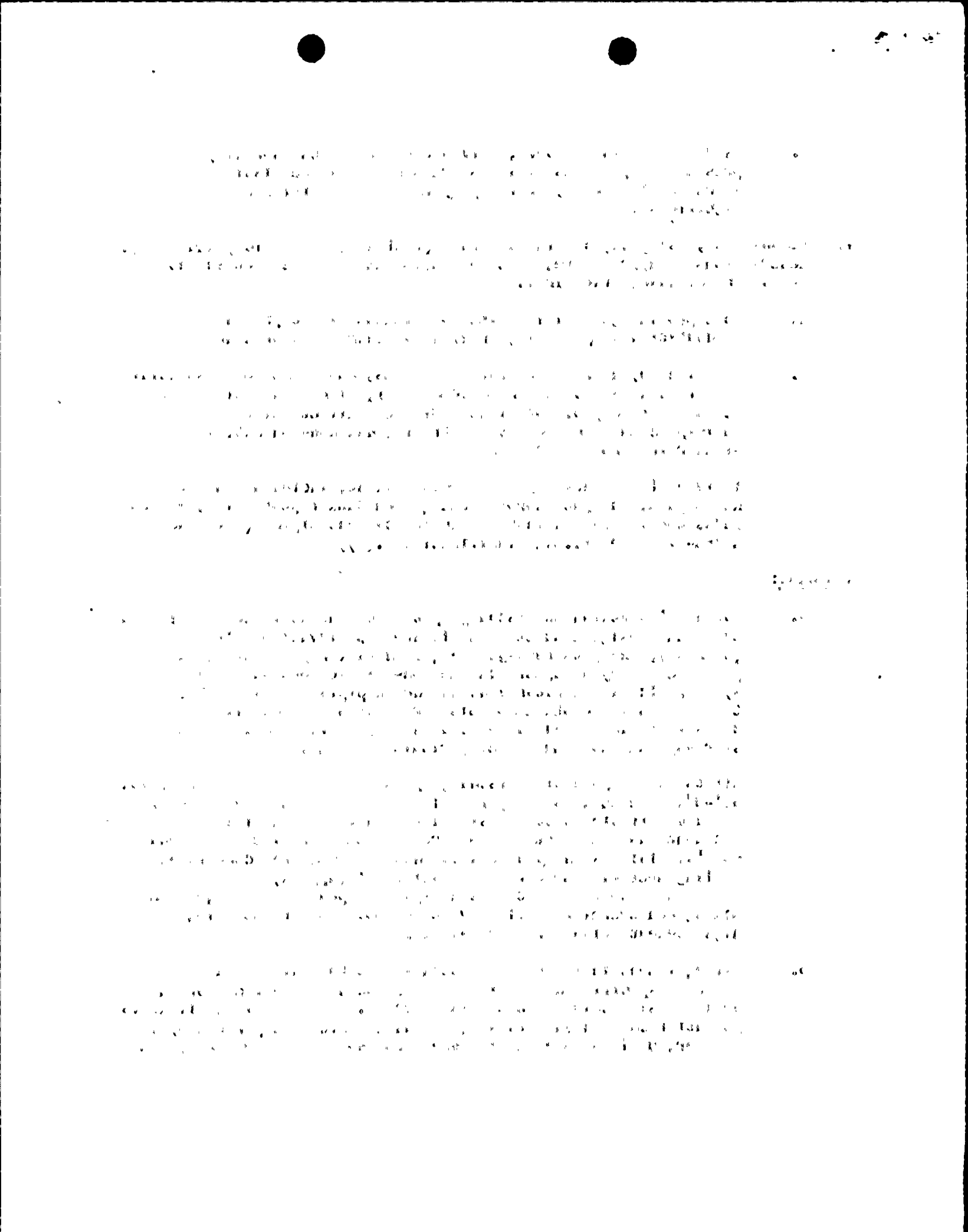
Include all potential paths to containment, including the direct RCGVS path, the path through the quench tank rupture disc, and the paths through the accumulator drain and vent piping (reference NUREG-0737 Item II.B.1 Clarification A.(9)).

RESPONSE:

a. Potential containment discharge paths for the RCGVS are considered to be the design exhaust point located at elevation 88'-8" (approx.), the path through the quench tank rupture disk, and any path created by a rupture in the non-seismic portion of the system. The accumulator vent and drain piping are not considered to be potential containment discharge paths as these lines are non-seismic and intended to be used only during normal plant start-up and shutdown or for periodic drainage.

All the RCGVS potential discharge path are located above elevation 62'-0". The RCB, and in particular the elevation above 62'-0", has a ventilation system designed to handle such design basis accidents as a main steam line break, feedwater line breaks and LOCA's. This is an open area and has a surrounding containment cooling duct ring header at elevation 98' (approx). The containment cooling system is designed to provide an adequate air mixing and therefore will prevent accumulation or pocketing of high concentrations of hydrogen gas.

b. All equipment inside the RCB essential to the safe shutdown of the plant is specified and designed to withstand the effects of the design basis accidents noted in 4a above. Additionally, all RCGVS potential containment discharge paths are either separated by a barrier, or located at a distance, from such equipment or systems.



V-1447
Category B
ASME Class 2
Function: Pressure switch isolation.
Test Requirement - IWV-3410
Basis for relief: This is normally an open passive valve which is not required to operate for shutdown the reactor or to mitigate an accident. The valve is to be excepted from testing.

V-1452 (1") and V-1453 (1")
Category B
ASME Class 2
Function: RCGVS vents
Basis for relief: These are locked closed vents used only for maintenance or venting of the system. During operation a blank flange is installed downstream of the valves. The valves are to be excepted from testing.

V-1454 (3/4") and V-1455 (3/4")
Category B
ASME Class 1
Function: Manual vents from pressurizer to accumulator.
Testing Requirement - IWV-3410
Basis for relief: These are locked closed manual vent valves used only for manual venting activities. Valve operation is not required for safe shutdown or mitigation of an accident. The valves will be excepted from testing.

6. Submit operating guidelines for use of the RCGVS including the following:

   a. Guidelines to determine when the operator should and should not manually initiate venting, and information and instrumentation required for this determination (reference NUREG-0737 item II.B.1 Clarification A.(2)). The guidelines to determine whether or not to vent should cover a variety of reactor coolant system conditions (e.g., pressures and temperatures). The effect of the containment hydrogen concentration on the decision to vent or to continue venting should also be addressed considering the balance between the need for increased core cooling and decreased containment integrity due to elevated hydrogen levels.

   b. Methods for determining the size and location of a non-condensible gas bubble (reference Position (2) and Clarification A.(2)).

   c. Guidelines for operator use of the vents, including information and instrumentation available to the operator for initiating or terminating vent usage (reference Position (2)).

   d. Required operator actions in the event of inadvertent opening, or failure to close after opening, of the vents including a description of the provisions and instrumentation necessary to detect and correct these fault conditions (reference Position (2) and Clarification A.(2)).

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[illegible]

[illegible]

[illegible]

a. [illegible]

b. [illegible]

c. [illegible]

d. [illegible]

e. Guidelines for the venting of small amounts of gases from the reactor vessel to the pressurizer, as discussed in Section V.4 of your submittal. Include criteria to be used in the decision to utilize this vent path and guidelines for the determination of venting duration. Explain when this vent path would be preferred to the other vent paths.

f. Methods for removing non-condensible gases from the steam generator U-tube bundles, contained in Combustion Engineering's Report CEN-128 (reference Clarification C.(2)).

RESPONSE:

Our letter L-82-74 dated March 2, 1982 provided you with a draft of our St. Lucie Unit 1 RCGVS Off-Normal Operating Procedure. This was submitted to you in response to your letter of November 30, 1982.

7. Verify that all displays (including alarms) and controls, added to the control room as a result of the TMI Action Plan requirement for reactor coolant system vents, have been or will be considered in the human factors analysis reqired by NUREG-0737 Item 1.D.1, "Contol Room Design Reviews."

RESPONSE

All displays and controls for the RCGVS are located on a console in the Control Room. The console was recently added to accomodate instrumentation required for items on the TMI Action Plan. Display for the RCGVS, a mimic type, allows the operator to easily and quickly identify the RCGVS potential vent path and vent controls. The St. Lucie Unit 1 control room and control boards, including the new console, are presently undergoing a human factors analysis as required by NUREG-0737.

All the RCGVS potential containment discharge paths are located above elevation 62'-0" where there is little equipment to be affected by RCGVS discharge. The design exhaust path is located at elevation 88'-8" (approx) and is directed above the pressurizer roof, therefore there will be no effect from the discharge. The quench tank rupture disk location is designed to allow pressurizer discharges, therefore RCGVS will not provide additional problems. Any path created by a rupture in the non-seismic portion will not affect the pressurizer (the nearest piece of equipment), as the non-seismic portions are located on the external pressurizer cubicle wall. The next nearest piece of equipment is the Hydrogen Recombiner 1B which is designed to withstand the effects of various liquids, steam and non-condensible gas.

5. Verify that the operability testing and inspection program for the RCGVS valves to be developed by FPL will be in accordance with subsection IWV of Section XI of the ASME Code for Category B valves (reference NUREG-0737 Item II.B.1. Clarification A.(11)).

RESPONSE:

The following exceptions from ASME Code Section XI subsection IWV for the RCGVS valves are planned to be taken at St. Lucie Unit 1 in the operability testing program. The bases for relief is also provided.

Valves with Operators

V-1441, V-1442, V-1443, V-1444, V-1445, V-1446 and V-1447
1" ASME class 2 solenoid valves
Function: Venting of RCS
IWV 3410 Test requirement - 90 days (3 months)
Basis for relief from IWV-3410 -

Failure of the valve in the open position while at full pressure while testing would cause a partial or total loss of system function.
Plant shutdown and cooldown would be required to repair.

Alternate testing - These valves will be tested in cold shutdown.

Manual Valves:

V-1239 (3/4")
Category B
ASME Class 1
Function: Pressurizer vent to RCGVS

V-1450 (1")
Category B
ASME Class 2
Function: Reactor vessel vent to RCGVS

Test Requirement - IWV-3410
Basis for relief: Operating of the valves during operation will disable system. The valves will be normally locked open. Valve operation is not required to prevent or mitigate an accident. The valves are to be excepted from testing.