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EISENHUT,D.G.	Division of Licensing

SUBJECT: Forwards description of design & results of analyses of reactor coolant gas vent sys,in response to NUREG-0737,Item II.B.1.Development of operating procedures postponed until design approved.

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August 10, 1981
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Office of Nuclear Reactor Regulation
Attention: Mr. Darrell G. Eisenhut, Director
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

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Dear Mr. Eisenhut:

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

Please find attached our St. Lucie Unit 1 submittal in response to NUREG-0737 item II.B.1. The submittal contains a description of the design and results of analyses of the Reactor Coolant Gas Vent System. As we previously stated in our letter of December 23, 1980 (L-80-418), we have postponed development of operating procedures until such a time that the design is approved. Procedures for operation and technical specifications will then be developed and submitted.

Very truly yours,

Robert E. Uhrig
Vice President
Advanced Systems & Technology

REU/PKG/ras

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

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REACTOR COOLANT GAS VENT SYSTEM
DESCRIPTION OF DESIGN AND RESULTS OF ANALYSES
ST. LUCIE UNIT 1 - DOCKET NO. 50-335

I. INTRODUCTION

Pursuant to the requirements of NUREG-0737, Item II.B.1, a description of the design, location, size and power supply for the vent system along with results of analyses for loss-of-coolant accidents initiated by a break in the vent pipe has been prepared for St. Lucie Unit 1 and appears below.

The purpose of the Reactor Coolant Gas Vent System (RCGVS) is to vent non-condensible gases from the Reactor Coolant System (RCS) which may inhibit core cooling during natural circulation. The vents in this system are part of the reactor coolant pressure boundary and, as such, they have been designed to conform to the requirements of Appendix A to 10CFR50, "General Design Criteria," and Item II.B.1 of NUREG-0737. The RCGVS does not lead to an unacceptable increase in the probability of a loss-of-coolant accident nor challenge containment integrity.

II. DESIGN BASES

The RCGVS is designed to:

1. provide vent paths during normal and accident conditions for the reactor vessel head and pressurizer steam space which are remotely operated from the control room;

2. provide vent paths from the primary system to the quench tank or to the containment atmosphere in an area allowing good mixing;

3. provide positive indication of valve position in the control room;

4. provide protection against single failure in the power and control of the vent valving;

5. Seismic Category I and safety related requirements;

6. limit reactor coolant mass loss to below the definition of a LOCA in 10CFR50, Appendix A;

7. be operable following design basis events and loss of offsite or onsite AC power;

8. permit venting of superheated steam, steam water mixtures, water, fission gases, helium, nitrogen and hydrogen;

9. permit refueling and maintenance operations without interference;

II. DESIGN BASES (Continued)

10. provide the capability to monitor RCGVS leakage during power operation.

III. SYSTEM DESIGN DESCRIPTION

The RCGVS is schematically illustrated on the flow diagram, Figure 1. The system can be described as follows:

a. Vent paths are provided for the reactor vessel head or pressurizer steam space to either the containment atmosphere or the pressurizer quench tank. Venting is accomplished through the appropriate line-up of any of six (6) solenoid valves remotely operated from the control room. The valves are located at a central station on the pressurizer cubicle north wall. Positive indication of valve position is also provided on a control panel (see Section IV.2.C) in the control room activated by reed switch assemblies on the solenoids.

b. The solenoid valves represent the active components in the RCGVS. As such the power supply for these valves is from emergency sources (i.e, station batteries). Additionally, the system is designed for a single active failure and thus parallel vent paths with valves powered from alternate power sources are provided.

c. The solenoid operated valves are normally closed and designed to fail closed. They are powered from redundant safety grade 125V DC power supplies. Power is required to open the valves and they are spring loaded such that loss of power to the solenoid will result in a spring closing the valve, thus minimizing the probability of a vent path failing to close once opened. Sufficient redundancy in the quantity of valves, vent paths, power supplies and valve controls are provided such that a single active failure of any component will not cause inoperability of the entire RCGVS.

d. Power is removed from the solenoid valves to minimize the probability of inadvertent operation of the RCGVS. FPL will develop administrative procedures for reconnection of power in the event that operation of the RCGVS is required.

e. Vent points utilized are existing vents previously used for manual venting during normal start-up and shutdown operations. The reactor vessel vent is located directly on the reactor vessel head and the pressurizer vent is located on the high point of piping upstream of the Power Operated Relief Valves (PORV).

III. SYSTEM DESIGN DESCRIPTION (continued)

f. The vent flow rate capability is based on the following criteria:

   i. The system is designed primarily for venting hydrogen. The vent rate is sufficient to vent one-half of the RCS volume of hydrogen in standard cubic feet in one hour at RCS pressures greater than 50 psia.

   ii. Coolant liquid loss through the vent will not exceed makeup capacity of one (1) charging pump in the event of a Safety Class 2 pipe break or inadvertent valve operation, thus limiting leakage to less than the LOCA definition of 10CFR50, Appendix A.

   iii. The vent mass rate will not result in heat loss from the RCS in excess of the normal pressurizer heater capacity. Venting will not result in uncontrollable pressurizer pressure or level changes.

g. To meet the vent rate requirements above, of which III.f.ii is the most limiting, flow restricting orifices have been sized and installed at the existing vent points described in III.e. These orifices also represent the division between Safety Class 1, Reactor Coolant Pressure Boundary and Safety Class 2 portions of the system.

h. Vent paths are provided to both the pressurizer quench tank and containment atmosphere. The quench tank path allows for controlled venting of non-condensible gases in that the discharge into the quench tank is below the tank water level, thus promoting cooling of the gas or water vapor, and from the tank non-condensible gases can be discharged to the gaseous waste management system. The vent to containment atmosphere terminates in an area where good air mixing and cooling exist. In the unlikely event of generation of large quantities of gas combined with a failure in the vent path to containment atmosphere, gases can be discharged to the quench tank where with sufficient pressure a rupture disc on the tank will fail and release the gases to the containment atmosphere at approximately the same location.

i. The addition of the RCGVS does not affect the rate of generation of combustible gases following a postulated Loss of Coolant Accident (LOCA) as previously analyzed in the safety analysis report in accordance with the requirements of 10CFR50.44. Additionally, vent paths to containment atmosphere discharge to open areas of the containment of good air mixing.

III. SYSTEM DESIGN DESCRIPTION (continued)

j. Pursuant to Technical Specification 3.4.6.2, Paragraph d, a method of leakage detection is provided to identify and ensure that any leakage in the RCGV system is identifiable. This allows continued power operation at leak rates greater than 1 gpm but less than 10 gpm. Remote leakage detection is accomplished through the use of a pressure indicator mounted in the control room which will alarm on high pressure indicating a leak through one of the primary RCGVS valves (V1441 thru V1444). A solenoid valve (V1449) is then opened and the leakage is discharge to an accumulator and eventually drained to the containment's graduated sump where it can be measured.

k. The leakage detection piping may also be utilized for venting the RCS during normal start-up and shutdown operations. A bypass line upstream of the orifice on the pressurizer vent is provided to faciliate venting during normal shutdown operations.

IV. MAJOR COMPONENTS

.1 Mechanical Components

Major system components are listed, along with a brief description, in Table 1.

a. Piping:

All piping is manufactured from austenitic stainless steels and is Nuclear Safety qualified. Safety Class 1 piping forming part of the reactor coolant pressure boundary is qualified in accordance with ASME Section III, 1977 Edition, Summer 1978 Addenda. System piping is flanged where required to facilitate removal of components that might interfere with refueling operations.

b. Manual Valves:

Manual valves are manufactured from austenitic stainless steel and qualified in accordance with ASME Section III, 1977 Edition, Winter 1978 Addenda. Additionally, all valves are also seismically qualified.

c. Solenoid Valves:

The solenoid valve bodies are austenitic stainless steel forgings qualified in accordance with ASME Section III, 1977 Edition, Winter 1978 Addenda. The solenoids and electrical appurtenances are also qualified to IEEE 382-1972, 323-1974 and 344-1975. Additionally, all valves are seismically qualified and designed to fail closed on loss of electric power to the solenoid.

d) Orifices:

The two (2) orifices are austenitic stainless steel bar stock with a 1/4 inch hole drilled through, sized to provide the appropriate flow rates required by the RCGVS. Fabrication was in accordance with ASME Section III, 1977 Edition, Summer 1978 Addenda.

e. Accumulator:

The accumulator is a length of 8 inch nominal diameter Schedule 40 pipe capped at both ends and is non-nuclear safety related. Its function during leakage detection is to allow for the expansion and condensation of steam leaking through any of the primary RCGVS valves. A drain from the accumulator discharges to the containment sump where leakage can be measured.

f. Charcoal Filter:

The charcoal filter is a length of 4 inch Schedule 160 pipe filled with charcoal and connected to the vent line on the accumulator. The purpose of the filter is to prevent carry-over of radioactive particles from the RCGVS to the plant vent system during leakage detection or normal start-up/shutdown operations. The heavy wall of the filter pipe is for radiation shielding purposes and not service conditions. The filter is also non-nuclear safety related.

.2 Instruments and Controls

a. Pressure Instrumentation:

The pressure instrumentation is provided for leakage detection only and as such is not required for post-accident conditions. For this reason the pressure instrumentation is not Class IE qualified. The locally mounted pressure transmitter and associated tubing are

IV. MAJOR COMPONENTS (continued)

a. (continued)

seismically supported such that in the unlikely event of a design seismic occurence the function of the pressure transmitter may fail but the integrity of the pressure retaining components will be maintained. Power for the pressure instrumentation is also from emergency sources.

b. Control Switches:

The valve control switches provided are of a modular plug-in design with key-locks provided. Each module is provided with two (2) indicating lights, red and green, which are tested by pressing the light bulb. Control switches are qualified in accordance with IEEE 323-1974 and 344-1975.

c. Control Room Auxiliary Console:

A new control panel, the Control Room Auxiliary Console, is provided in the control room and is utilized for the RCGVS instruments and controls. The panel is safety related and of seismic design and construction. A graphic display is provided allowing the operator to observe the various flow paths available prior to activation of any solenoid valve.

V. PRINCIPAL MODES OF OPERATION

.1 Start-up

Filling of the RCS prior to plant start-up can be accomplished either manually or remotely using the RCGVS. For manual operation, manual valves V1454 and V1455 are opened to the accumulator, thus bypassing the pressurizer remote/manual vent path. Reactor vessel venting can be accomplished by opening either V1441 or V1442 through the accumulator via V1449 or through the pressurizer vent path, via V1443 or V1444, to the manual bypass. If it is decided not to use the manual bypass, filling is accomplished by lining up the pressurizer vent valve (V1443 or V1444) and the reactor head vent valve (V1441 or V1443) directly to the accumulator via V1449.

During start-up operations, fluid or gases released from the RCS are directed to the accumulator. Potentially contaminated fluids are drained from the accumulator directly to a floor drain which discharges to the containment sump. Any contaminated gases released are vented from the accumulator, through the charcoal filter to the containment purge header.

[illegible]

V. PRINCIPAL MODES OF OPERATION (continued)

.2 Normal Operation

This system is not intended for use during normal power operation and administrative controls are provided to minimize the possibility of inadvertant operation. Additionally, power is removed from all valves during normal plant conditions.

During normal operation, leakage detection is maintained by use of the pressure instrumentation. A rise in pressure will indicate leakage past any of valves V1441 thru V1444. Technical Specifications require the ability to identify leakage above 1 gpm from the RCS to allow continued reactor operation. This may be accomplished in the RCGVS using either of two methods:

a. If the pressure increase is slow enough, the leakage rate can be determined by observing the rate of pressure increase per unit time.

b. The leakage can be diverted through V1449 to the accumulator. When initial transients have subsided, the accumulator discharge to the containment sump will allow for leakage measurement by the existing leakage detection system. Verification of the leakage source may be accomplished by periodically closing V1449 and observing change in leakage indicated by sump instrumentation, containment radiation or charging versus letdown flows.

.3 Refueling Shutdown

Procedure for the RCGVS during plant refueling shutdown (Mode 5 to Mode 6) are basically the same as for start-up. However, reactor head vent valves, V1441 or V1442, need not be open for refueling shutdown operations.

.4 Accident Conditions

Use of the RCGVS during accident conditions in which large quantities of non-condensible gases are generated vary depending on the rate of gas generation and on vent paths available assuming design basis accidents.

The primary method of controlled venting for low gas generation rates is through the quench tank. Reactor and/or pressurizer vent valves could be lined up with V1445 and the gas released to the quench tank. Monitoring of quench tank pressure is highly recommended during this mode of operation. From this point the gas could be discharged to the gaseous waste management system.

V. PRINCIPAL MODES OF OPERATION (continued)

.4 (Continued)
For high gas generation rates, gases may be vented to the containment atmosphere by opening V1446. Should V1446 fail, vent to containment atmosphere can still be accomplished through V1445 and the quench tank rupture disc.

For extremely low gas generation rates in the reactor vessel, the capability exists to vent the vessel by lining up a reactor vent valve, V1441 or V1442, with a pressurizer vent valve, V1443 or V1444, and allowing gases to "bubble" to the pressurizer at rates dependent on pressure differential due to pressurizer level, system pressure/temperature and reactor coolant pumps status. Although this capability exists, this vent path is not preferred.

VI. SAFETY EVALUATION

.1 Transients:

During normal plant operation the reactor vessel vent and pressurizer vent up to the first isolation valves will be subject to existing RCS transients previously analyzed in the Safety Analysis Report except that flow rates will be zero (0) and temperatures will decrease to containment ambient due to heat transfer from the piping as it extends from the vessel head and pressurizer. Downstream of the first isolation valves no transients will occur during normal operation except in the event of valve leakage.

Plant start-up and shutdown is a normal event and the RCGVS is designed for 500 cycles of this transient. Pressures and temperatures encountered during start-up and shutdown are far below those used in the design of this system.

The post accident venting of hydrogen transient is the design basis for the RCGVS and is classified as an emergency with 20 cycles occuring over the lifetime of the plant.

.2 Single Active Failure Analysis

Single active failure for the RCGVS would incorporate either failure of a power operated valve or loss of A or B power supply (LOOP concurrent with a diesel generator failure). Redundancy in valves for the reactor vessel vent and pressurizer vent (V1441 thru V1444) will allow continued system operation in the event of such an occurence. Failure of V1445 or V1446 however, though not prohibiting venting, will dictate what vent path is available. Table 2 is a listing of possible component failures and the impact on operation of the RCGVS.

.3 Seismic Analysis

All components, piping and supports in the RCGVS, in the Nuclear Safety Class 1 and 2 piping, are specified and designed as Seismic Category I. Piping has been analyzed and supported in accordance with St. Lucie Unit #1 seismic criteria. All valves have been analyzed and tested for operability during a seismic event by manufacturers. The seismic analysis is consistent with previous plant design and construction.

.4 Pipe Break Analysis

The separation between Safety Class 1 (Reactor Coolant Pressure Boundary) and Safety Class 2 portions of the RCGVS is accomplished by the use of the restricting orifices described in III.g. A pipe break downstream of these orifices, in the Class 2 piping, would result in a mass loss less than a LOCA as defined in 10CFR50, Appendix A and thus a separate analysis of inadvertent system operation or pipe breakage is not required to meet 10CFR50.46.

The unlikely event of a pipe break in the Safety Class 1 portions of the RCGVS would result in a mass loss greater than the minimum defined as a LOCA. The Emergency Core Cooling System (ECCS) as designed in accordance with 10CFR 50.46 is sized for pipe line breaks in the reactor coolant pressure boundary with blowdown areas as large as 9.82 square feet (reference Chapter 6 of the Final Safety Analysis Report). All Class 1 piping in the RCGVS is 3/4 inch nominal pipe size and a break in any of these lines will not burden the existing ECCS system. Additionally, routing of the RCGVS piping is such that it is protected from pipe whip and jet impingement effects from postulated pipe breaks in RCS cold leg piping, branch lines to the cold leg and non-RCS piping.

With respect to Title 10 of the Code of Federal Regulations, Part 50.59, a proposed change shall be deemed to involve an unreviewed safety question; (i) if the probability of occurence or the consequences of an accident or malfunction of equipment important to safety previously evaluated in the safety analysis report may be increased; or (ii) if a possibility for an accident or malfunction of a different type than any evaluated previously in the safety analysis report may be created; or (iii) if the margin of safety as defined in the basis for any technical specification is reduced.

VI. SAFETY EVALUATION (continued)

The Reactor Coolant Gas Vent System (RCGVS) is an addition to the Reactor Coolant System (RCS) mandated by the NRC under the provisions of 10CFR, Part 50.109, as a result of investigations into the accident at Three Mile Island. The system and component design criteria for the RCS are established in Chapter 5 of the St. Lucie Unit #1 Final Safety Analysis Report and have been utilized as the basis for the design and implementation of the RCGVS. Therefore the probability of occurence or the consequences of an accident previously evaluated in the safety analysis report, namely, the small break LOCA, has been addressed and is not increased. The RCGVS is an addition to the RCS with the dedicated function of mitigating the consequences of an accident not previously evaluated in the safety analysis report and does not in itself represent the source of such an accident or any other type not previously evaluated. Additionally, because the primary function of the RCGVS is to mitigate the consequences of an accident not previously addressed in the safety analysis report the margin of safety as defined in the basis for any technical specification is not reduced, but increased. The design philosophy of the RCGVS is consistent with that of all other Nuclear Safety Class systems of St. Lucie, and with all applicable codes, regulations and regulatory guides. It is also consistent with the requirements of NUREG-0737 "Clarification of TMI Action Plan Requirements", Part II.B.1 issued by the NRC October 31, 1980.

VII. <u>TESTING AND INSPECTION</u>

All components, except pressure instrumentation, have been specified and purchased as Seismic Category 1 and Nuclear Safety Class (where required). Vendors have substantiated either through test, calculational and/or operational data that system components will remain operable under the design seismic loads. Vendors have tested and inspected all safety class equipment in accordance with applicable ASME and IEEE codes.

A periodic operational testing and inspection program shall also be developed by FPL in accordance with ASME Section XI, Subsection IWV, to ensure system operability after installation.

[illegible]

TABLE 1

MAJOR SYSTEM COMPONENTS

1. Valves (All materials austenitic stainless steel, for Code Qualification, See Section IV).

1A) Power Operated

Tag No.	Size	Operator	Design Pressure	Design Temp	Safety Class	Power Supply(A/B)
V1441	1"	Solenoid	2500psig	700°F	2	A
V1442	1"	Solenoid	2500psig	700°F	2	B
V1443	1"	Solenoid	2500psig	700°F	2	A
V1444	1"	Solenoid	2500psig	700°F	2	B
V1445	1"	Solenoid	2500psig	700°F	2	B
V1446	1"	Solenoid	2500psig	700°F	2	A
V1449	1"	Solenoid	2500psig	700°F	2	B

1B) Manual

Tag No.	Size	Rating	Safety Class	Position
V1239	3/4"	1500#	1	Locked Open
V1447	1"	1500#	2	Normally Open
V1450	1"	1500#	2	Locked Open
V1452	1"	1500#	2	Locked Closed
V1453	1"	1500#	2	Locked Closed
V1454	3/4"	1500#	1	Locked Closed
V1455	3/4"	1500#	1	Locked Closed

2. Orifices

Tag No.	Size	Material	Design Pressure	Design Temp	Safety Class
I-SO-01-58	3/4"x1"x1/4"ID	316 SS	2485psig	650°D	1
I-SO-01-59	3/4"x1"x1/4"ID	316 SS	2485psig	675°F	1

3. Accumulator (Non-Nuclear Safety Related)

Material	304 Stainless Steel
Diameter	8 inch
Length	29 inches
Thickness	Schedule 40 Pipe
Tag No.	8-RC-865
Code	B31.1

4. Charcoal Filter (Non-Nuclear Safety Related)

Material	304 Stainless Steel
Diameter	4 inch
Length	4'-0"
Thickness	Schedule 160 Pipe
Tag No.	4-RC-864
Code	B31.1

TABLE 2
FAILURE MODES EFFECTS ANALYSIS FOR THE REACTOR COOLANT GAS VENT SYSTEM

No.	Name	Failure Mode	Cause	Symptoms and Local Effects Including Dependent Failures	Method of Detection	Inherent Compensating Provision	Remarks and Other Effects
1.	Pressure Indicator PIA-1117	a. Spurious high press indication/alarm	Electro-mechanical failure, setpoint drift	No impact on normal operation. Loss of ability to detect leakage into the vent system piping.	Valve position indication in the C.R.	None	
		b. Spurious low press indication	Electro-mechanical failure, setpoint drift	No impact on normal operation. Loss of ability to detect leakage into the vent system piping.	Valve position indication in the C.R.	None	
2.	Quench Tank Isolation Valve V1445	a. Fails Open	Mechanical binding, seat leakage	Inability to isolate quench tank from the reactor coolant gas vent	Valve position indication in the C.R. system.	None	Redundant isolation valves to the reactor vessel and pressurizer preclude uncontrolled venting to the quench tank.
		b. Fails Closed	Mechanical failure, loss of power.	No impact on normal operation. Inability to vent pressurizer or reactor to quench tank.	Valve position indication in the C.R.	None	Venting to the containment is possible, if necessary.
3.	Pressure Instrument Isolation Valve V1447	a. Fails Open	Mechanical binding, seat leakage	None	Operator	Redundant valves	
		b. Fails Closed	Mechanical failure	Loss of ability to detect seat leakage from the pressurizer and reactor isolation valves into the reactor coolant gas vent system piping.	Operator	None	Unlikely event since valve is normally open and has only a manual operator.
4.	Containment Isolation Valve V1446	a. Fails Open	Mechanical Binding, seat leakage	Inability to isolate reactor coolant vent system from containment.	High containment press & humidity if venting is in progress. Valve position indication in the C.R.	None	Redundant isolation valves provided to preclude uncontrolled venting to RCS.
		b. Fails Closed	Mechanical Failure, loss of power to valve.	No impact on normal operation. Inability to vent pressurizer or reactor to containment.	Valve position indication in the C.R. Operator	None	Venting to the quench tank is possible, if necessary.

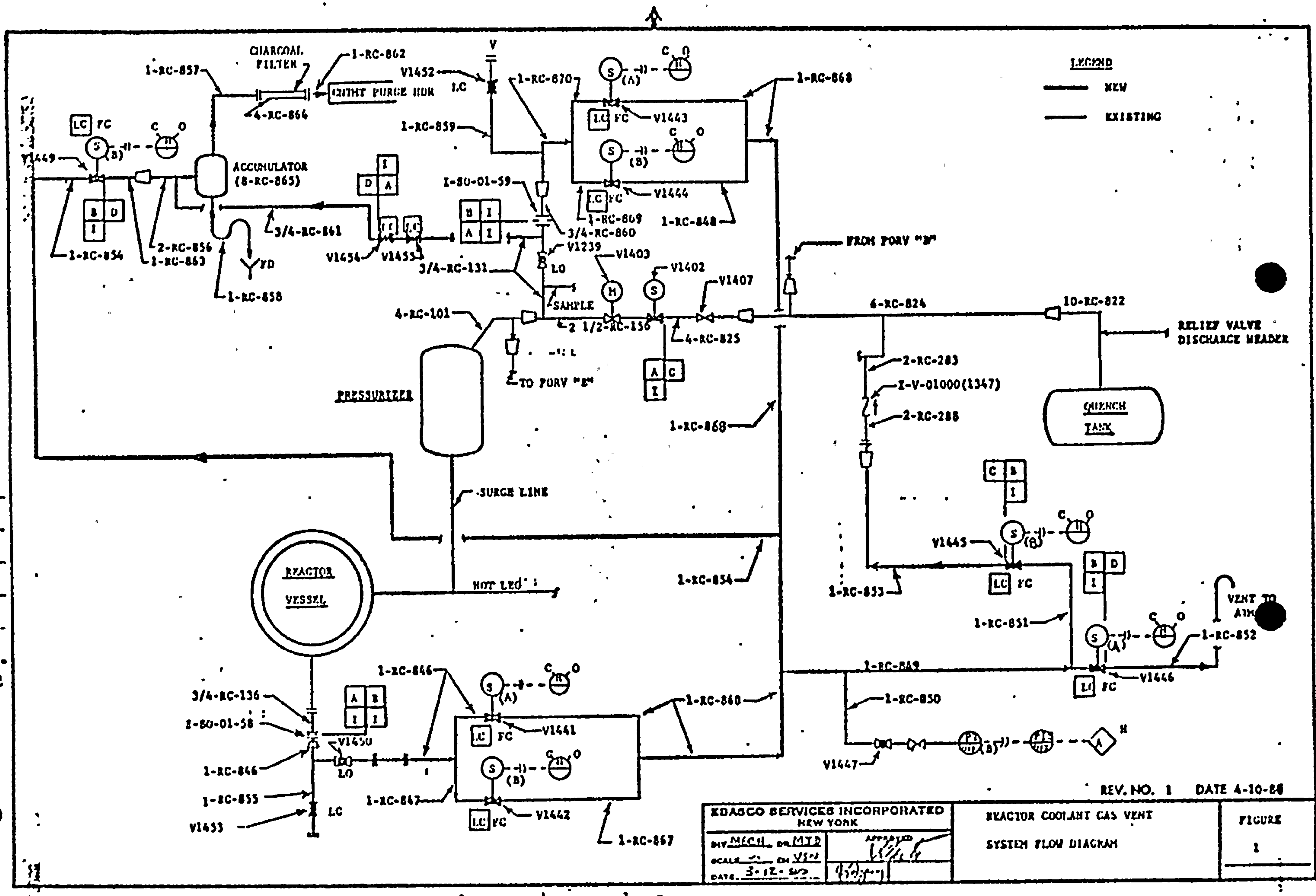
TABLE 2

FAILURE MODES EFFECTS ANALYSIS FOR THE REACTOR COOLANT GAS VENT SYSTEM

No.	Name	Failure Mode	Cause	Symptoms and Local Effects Including Dependent Failures	Method of Detection	Inherent Compensating Provision	Remarks and Other Effects
5.	Pressurizer Vent Isolation Valve VI443 or VI444	a. Fail Open	Mechanical Binding, seat leakage	No impact on normal operation. Inability to vent the reactor vessel without also venting pressurizer.	Valve position indication in the C.R. PIA-1117 high pressure indication.	None	Redundant isolation valves to containment VI446 & quench tank VI445 precludes uncontrolled venting of the pressurizer.
		b. Fails Closed	Mechanical failure, loss of power	Inability to vent the pressurizer.	Valve position in the C.R. Isolation valve Operator.	Parallel redundant isolation valve.	Parallel isolation valve allows venting of the pressurizer.
6.	Reactor Vessel Vent Isolation Valve VI441 or VI442	a. Falls Open	Mechanical Binding, seat leakage.	No impact on normal operation. Unable to vent pressurizer without also venting the reactor vessel.	Valve position indication in the C.R. PIA-1117 high pressure indication.	None	Redundant isolation valves to containment VI446 & VI445 precludes uncontrolled venting of the reactor vessel.
		b. Falls Closed	Mechanical failure, loss of power.	Inability to vent the reactor vessel.	Valve position in the C.R. Operator	Parallel redundant isolation valve.	Parallel isolation valve allows venting of the reactor vessel.
7.	Position Indicator for VI441 & VI442	False indication of valve position	Electro-mechanical failure.	Loss of ability to detect valve position in reactor vessel vent line.	Pressure Gauge PIA-117 indication shows valve is opened.	None	
8.	Position Indicator for VI443 & VI444	False indication of valve position	Electro-mechanical failure.	Loss of ability to detect valve position in pressurizer vent line.	Pressure Gauge PIA-1117, indication shows valve is opened.	None	
9.	Position Indicator for VI445.	False indication of valve position	Electro-mechanical failure	Loss of ability to detect valve position in quench tank vent line.	Quench tank temp & pressure verify valve position. Press gauge PIA-1117.	None	

TABLE 2
FAILURE MODES EFFECTS ANALYSIS FOR THE REACTOR COOLANT GAS VENT SYSTEM

No.	Name	Failure Mode	Cause	Symptoms and Local Effects Including Dependent Failures	Method of Detection	Inherent Compensating Provision	Remarks and Other Effects
10.	Position Indicator for VI446	False indication of valve position	Electro-mechanical failure	Loss of ability to detect valve position in containment vent line.	Containment pressure/humidity/radiation levels verify containment valve position. Press gause PIA-1117.	None	
11.	Vent & Drain Valves VI452 & VI453	a. Seat leakage	Contamination, mechanical damage	No impact on system operation.	None	Drain lines are blind flanged.	
		b. Fails Closed	Mechanical binding	No impact on normal operations. Inability to drain affected line section or test isolation valves per IAW ASME XI.	Operator	None	
12.	Leakage Detection Valve VI449	a. Fails Open	Mechanical binding, seat leakage	Inability to isolate leakage detection system from RCGVS.	Valve position indication in C.R.	None	Leakage detection system represents another path to containment, though not recommended to be used as such.
		b. Fail Closed	Mechanical failure, loss of power	No impact on system operation. Loss of ability to measure leakage remotely.	Valve position indication in C.R.	None	
13.	Position Indicator for VI449	False indication of valve position	Electro-mechanical failure	Loss of ability to detect valve position in leakage detection line.	Drain from leakage detection system to graduated sump, increase in sump level shows valve is open.	None	


LEGEND
NEW
EXISTING
CHARCOAL FILTER
1-RC-857
1-RC-862
4-RC-864
V1452
LC
1-RC-870
1-RC-868
1-RC-859
V1443
V1444
ACCUMULATOR (8-RC-865)
V1449
2-RC-856
1-RC-854
1-RC-863
3/4-RC-861
1-RC-858
YD
1-SO-01-59
1-RC-869
3/4-RC-860
1-RC-848
V1454
V1455
V1239
LO
3/4-RC-131
SAMPLE
V1403
V1402
V1407
FROM PORV "B"
6-RC-824
10-RC-822
RELIEF VALVE DISCHARGE HEADER
4-RC-101
2 1/2-RC-136
4-RC-825
TO PORV "B"
PRESSURIZER
2-RC-283
2-RC-288
QUENCH TANK
1-RC-868
SURGE LINE
V1445
1-RC-853
1-RC-854
REACTOR VESSEL
HOT LEG
1-RC-851
VENT TO ATM
1-RC-852
V1446
1-RC-849
1-RC-850
V1447
1-RC-846
1-RC-860
3/4-RC-136
1-SO-01-58
V1450
V1441
1-RC-846
1-RC-855
1-RC-847
V1442
V1453
1-RC-867
REV. NO. 1 DATE 4-10-80
EBASCO SERVICES INCORPORATED
NEW YORK
REACTOR COOLANT GAS VENT
SYSTEM FLOW DIAGRAM
FIGURE
1

II.B.1 REACTOR COOLANT SYSTEM VENTS

Position

Each applicant and licensee shall install reactor coolant system (RCS) and reactor vessel head high point vents remotely operated from the control room. Although the purpose of the system is to vent noncondensible gases from the RCS which may inhibit core cooling during natural circulation, the vents must not lead to an unacceptable increase in the probability of a loss-of-coolant accident (LOCA) or a challenge to containment integrity. Since these vents form a part of the reactor coolant pressure boundary, the design of the events shall conform to the requirements of Appendix A to 10 CFR Part 50, "General Design Criteria." The vent system shall be designed with sufficient redundancy that assures a low probability of inadvertent or irreversible actuation.

Each licensee shall provide the following information concerning the design and operation of the high point vent system:*

(1) Submit a description of the design, location, size, and power supply for the vent system along with results of analyses for loss-of-coolant accidents initiated by a break in the vent pipe. The results of the analyses should demonstrate compliance with the acceptance criteria of 10 CFR 50.46.

(2) Submit procedures and supporting analysis for operator use of the vents that also include the information available to the operator for initiating or terminating vent usage.

Changes to Previous Requirements and Guidance

(1) The probability of a valve failing to close, once opened, should be minimized.

(2) Establishes environmental qualification (Commission Order, May 23, 1980).

(3) Establishes provisions for testing.

(4) Delete requirements of September 27, 1979 letter from Vassallo to applicants stating that vents shall satisfy single-failure criteria of IEEE-279. Vent systems are not required to have redundant paths. A degree of redundancy should be provided by powering different vents from different emergency buses.

(5) Documentation date changed to July 1, 1981 and implementation date to July 1, 1982.

Clarification does not change NRC concept of requirement, but provides more detail on scope. The dates have been revised to provide time for procurement and installation.

*It was the intent of the October 30, 1979 letter to delete the requirement to meet the criteria of 10 CFR 50.44 and SRP 6.2.5 for beyond-design-basis events. The analysis requirements of Position 2 in the September 13, 1979 letter are therefore unnecessary.

SYSTEM DESCRIPTION REFERENCE

- Generic requirement incorporated in entire package. For 10CFR50.46 compliance, see III.f.ii and VI.4

- Procedures will be prepared upon Commission approval of system design (reference FPL letter to NRC L-80-418 dated 12/23/80).

Not requirements, see Clarification Section on next sheet.

A. General

(1) The important safety function enhanced by this venting capability is core cooling. For events beyond the present design basis, this venting capability will substantially increase the plant's ability to deal with large quantities of noncondensible gas which could interfere with core cooling.	- Inherent in system design, see III.
(2) Procedures addressing the use of the reactor coolant system vents should define the conditions under which the vents should be used as well as the conditions under which the vents should not be used. The procedures should be directed toward achieving a substantial increase in the plant being able to maintain core cooling without loss of containment integrity for events beyond the design basis. The use of vents for accidents within the normal design basis must not result in a violation of the requirements of 10 CFR 50.44 or 10 CFR 50.46.	- Procedures will be prepared upon Commission approval of system design. For 10CFR50.44 compliance see III.i. For compliance to 10CFR50.46 see III.f.ii and VI.4.
(3) The size of the reactor coolant vents is not a critical issue. The desired venting capability can be achieved with vents in a fairly broad spectrum of sizes. The criteria for sizing a vent can be developed in several ways. One approach, which may be considered, is to specify a volume of noncondensible gas to be vented and in a specific venting time. For containments particularly vulnerable to failure from large hydrogen releases over a short period of time, the necessity and desirability for contained venting outside the containment must be considered (e.g., into a decay gas collection and storage system).	- Paragraphs III.f and III.h.
(4) Where practical, the reactor coolant system vents should be kept smaller than the size corresponding to the definition of LOCA (10 CFR 50, Appendix A). This will minimize the challenges to the emergency core cooling system (ECCS) since the inadvertent opening of a vent smaller than the LOCA definition would not require ECCS actuation, although it may result in leakage beyond technical specification limits. On PWRs, the use of new or existing lines whose smallest orifice is larger than the LOCA definition will require a valve in series with a vent valve that can be closed from the control room to terminate the LOCA that would result if an open vent valve could not be reclosed.	- Paragraphs III.f.ii, III.g and III.c.
(5) A positive indication of valve position should be provided in the control room.	- Paragraph III.a.
(6) The reactor coolant vent system shall be operable from the control room.	- Paragraph III.a.
(7) Since the reactor coolant system vent will be part of the reactor coolant system pressure boundary, all requirements for the reactor pressure boundary must be met, and, in addition, sufficient redundancy should be incorporated into the design to minimize the probability of an inadvertent actuation of the system. Administrative procedures, may be a viable option to meet the single-failure criterion. For vents larger than the	- Paragraph III.g, IV.1.a, IV.1d, VI.4 and VII address RCS pressure boundry design. System redundancy is discussed in Paragraphs III.b, III.c and III.d. For 10CFR50.46 compliance see Paragraphs III.f.ii and VI.4.

LOCA definition, an analysis is required to demonstrate compliance with 10 CFR 50.46.

(8) The probability of a vent path failing to close, once opened, should be minimized; this is a new requirement. Each vent must have its power supplied from an emergency bus. A single failure within the power and control aspects of the reactor coolant vent system should not prevent isolation of the entire vent system when required. On BWRs, block valves are not required in lines with safety valves that are used for venting.

- Paragraph III.c

(9) Vent paths from the primary system to within containment should go to those areas that provide good mixing with containment air.

- Paragraph III.h

(10) The reactor coolant vent system (i.e., vent valves, block valves, position indication devices, cable terminations, and piping) shall be seismically and environmentally qualified in accordance with IEEE 344-1975 as supplemented by Regulatory Guide 1.100, 1.92 and SEP 3.92, 3.43, and 3.10. Environmental qualifications are in accordance with the May 23, 1980 Commission Order and Memorandum (CLI-80-21).

- For equipment qualification see Section IV

(11) Provisions to test for operability of the reactor coolant vent system should be a part of the design. Testing should be performed in accordance with subsection IWV of Section XI of the ASME Code for Category B valves.

- Section VII

(12) It is important that the displays and controls added to the control room as a result of this requirement not increase the potential for operator error. A human-factor analysis should be performed taking into consideration:

- Paragraph IV.2.c.

(a) the use of this information by an operator during both normal and abnormal plant conditions,

(b) integration into emergency procedures,

(c) integration into operator training, and

(d) other alarms during emergency and need for prioritization of alarms.

B. BWR Design Considerations

- Not applicable to St. Lucie Unit #1

(1) Since the BWR owners' group has suggested that the present BWR designs have an inherent capability to vent, a question relating to the capability of existing systems arises. The ability of these systems to vent the RCS of noncondensible gas generated during an accident must be demonstrated. Because of differences among the head vent systems for BWRs, each licensee or applicant should address the specific design features of this plant and compare them with the generic venting capability proposed by the BWR owners' group. In addition, the ability of these systems to meet the same requirements as the PWR vent system must be documented.

(2) In addition to RCS venting, each BWR licensee should address the ability to vent other systems, such as the isolation condenser which may be

required to maintain adequate core cooling. If the production of a large amount of noncondensible gas would cause the loss of function of such a system, remote venting of that system is required. The qualifications of such a venting system should be the same as that required for PWR venting systems.

C. PWR Vent Design Considerations

(1) Each PWR licensee should provide the capability to vent the reactor vessel head. The reactor vessel head vent should be capable of venting noncondensible gas from the reactor vessel hot legs (to the elevation of the top of the outlet nozzle) and cold legs (through head jets and other leakage paths).

- Paragraphs III.a and III.c

(2) Additional venting capability is required for those portions of each hot leg that cannot be vented through the reactor vessel head vent or pressurizer. It is impractical to vent each of the many thousands of tubes in a U-tube steam generator; however, the staff believes that a procedure can be developed that assures sufficient liquid or steam can enter the U-tube region so that decay heat can be effectively removed from the RCS. Such operating procedures should incorporate this consideration.

- Procedures for venting system generator tube bundles have been prepared by CE. (Reference CE Report CEN-128).

(3) Venting of the pressurizer is required to assure its availability for system pressure and volume control. These are important considerations, especially during natural circulation.

- Paragraphs III.a and III.e.

Applicability

This requirement applies to all operating reactors and applicants for operating license.

Implementation

Installation should take place by July 1, 1982. Until staff approval is obtained, installation may proceed; but operating procedures should not be implemented and valves should be placed in a condition so as to minimize the potential for inadvertent actuation (e.g., remove power).

Type of Review

A preimplementation review will be performed prior to authorizing use of the vent.

Documentation Required

By July 1, 1981, the licensee shall provide the following information on the reactor coolant vent system for staff review:

(1) The information requested in items 1 and 2 under "Position";

- See above.

(2) A discussion of the design with respect to conformance to the design criteria discussed under "Clarification," including deviations, if any, with adequate justification for such deviations; and,

- See Above

(3) Supporting information including logic diagrams, electrical schematics, piping and instrumentation diagrams, test procedures, and technical specifications.

- See Figure 1. Precedures and technical specification will be prepared upon Commission approval of system design (Reference FPL letter to NRC L-80-418 dated 12/23/80)

Technical Specification Changes Required

Changes to technical specifications will be required.

- See above.

References

NUREG-0660

Commission Orders, May 23, 1980 (CLI-80-21)

Letter from D. G. Eisenhut, NRC, to All Operating Nuclear Power Plants, dated September 13, 1979.

Letter from D. B. Vassallo, NRC, to All Pending Operating License Applicants, dated September 27, 1979.

Letter from H. R. Denton, NRC, to All Operating Nuclear Power Plants, dated October 30, 1979.