NORTHEAST UTILITIES

THE CONNECTICUT LIGHT AND POWER COMPANY
WESTERN MASSACHUSETTS ELECTRIC COMPANY
HOLYOKE WATER POWER COMPANY
NORTHEAST UTILITIES SERVICE COMPANY
NORTHEAST NUCLEAR ENERGY COMPANY

General Offices • Selden Street, Berlin, Connecticut

P.O. BOX 270
HARTFORD, CONNECTICUT 06141-0270
(203) 666-6911

July 11, 1984

Docket No. 50-336
A04104

Director of Nuclear Reactor Regulation
Attn: Mr. James R. Miller
Operating Reactors Branch #3
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

References: (1) W. G. Counsil letter to J. R. Miller, dated May 15, 1984.

(2) J. R. Miller letter to W. G. Counsil, dated June 11, 1984.

Gentlemen:

Millstone Nuclear Power Station, Unit No. 2
Containment Venting at Power
NUREG-0737, Item II.E.4.2.7

Northeast Nuclear Energy Company (NNECO) informed the NRC Staff in Reference (1) of a request for an informal appeal meeting, in accordance with the provisions of Generic Letter 84-08, to review the requested modification of the Hydrogen Purge System valves to close on a radiation signal.

The Staff acknowledged our request in Reference (2) and further requested our detailed analysis supporting our position that modification of the Hydrogen Purge System valves is not necessary. The attached information provides the basis for our position as documented in Reference (1).

This letter transmits a comprehensive overview of the various relevant facets of the issue under appeal: whether the Hydrogen Purge System valves should receive a closure signal from a radiation monitor.

Section 1 summarizes the applicable correspondence docketed on this issue to date and reviews the approximate six year history of the containment purge and vent issue for Millstone Unit No. 2.

Section 2 outlines the reasons why containment venting is necessary at Millstone Unit No. 2. Section 3 provides a description of the two systems utilized to vent the containment. The unique features of these systems which provide the necessary protection of the health and safety of the public during containment venting at power are described.

Section 4 provides the results of an evaluation of the radiological consequences of containment venting coincident with significant reactor coolant system leakage. The evaluations were performed using models similar to those

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employed by the Staff in their generic Safety Evaluation Report supporting Item II.E.4.2.7 of NUREG-0737 and plant specific inputs. The results of this evaluation demonstrate that dose consequences from the scenarios evaluated are well below 10CFR Part 20 limits.

A discussion of the procedures and operator actions required to effect containment venting is provided in Section 5. Included is an outline of the indications available to the operator which would alert him to the fact that reactor coolant leakage is present in the containment, the actions he will take if leakage is indicated and license requirements under such conditions. It is unrealistic to indefinitely ignore the capability of an operator to identify, diagnose and correct a situation such as a reactor coolant system leak of a size which must exist to create significant offsite dose consequences at Millstone Unit No. 2 during venting.

The attached information provides a basis which is considered more than adequate justification for current system design and operation at Millstone Unit No. 2. The recommendations of NUREG-0737, Item II.E.4.2.7 have been reviewed and have been found to be unjustified. The NRC Staff generic safety evaluation report is not applicable to Millstone Unit No. 2 since its results (radiological consequences) are orders of magnitude greater than for corresponding cases evaluated herein. While a reevaluation of the cost of the requested modification results in a smaller required expenditure than previously evaluated, NNECO maintains its position as stated in Reference (1) and as justified herein.

Information regarding the qualification of the Hydrogen Purge System valves is included in Section 3 of the attached report. Additional information, if necessary, as well as the matter of leakage testing frequency will be the subject of future correspondence to be docketed on or about July 30, 1984.

In the event that this submittal alone does not provide the basis for closure of this issue, arrangements for the appeal meeting to discuss the attached information and the Staff's position will be made through the Millstone Unit No. 2 Project Manager.

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY

W. G. Counsil

W. G. Counsil
Senior Vice President

cc: V. Stello, Jr., Chairman, Committee to Review Generic Requirements

Docket No. 50-336

MILLSTONE NUCLEAR POWER STATION
UNIT NO. 2

JUSTIFICATION FOR CONTAINMENT VENTING THROUGH THE HYDROGEN PURGE SYSTEM

July, 1984

MILLSTONE NUCLEAR POWER STATION
UNIT NO. 2
JUSTIFICATION FOR CONTAINMENT VENTING
THROUGH THE
HYDROGEN PURGE SYSTEM

CONTENTS

1.0 Introduction

The NRC Staff informed Northeast Nuclear Energy Company[1] (NNECO) of concerns regarding the capability of containment purge valves to perform their intended function during a loss-of-coolant accident. Specifically, the capability of the purge valves to close against the ascending containment pressure following a large break LOCA was questioned. In addition, effects of open containment purge valves on the resulting containment back pressure during LOCA and the impact on ECCS performance was identified as an issue to be evaluated.

NNECO responded[2] to the NRC Staff's concern with commitments to evaluate and justify unlimited purging for Millstone Unit No. 2. Subsequently, NNECO informed the Staff[3] that the containment purge valves were not sufficiently qualified to justify unlimited purging. Technical Specifications were proposed which required the purge valves to be locked closed in MODES 1 through 4. The Staff amended the operating license requiring the purge valves to be locked closed in MODES 1 through 4 by Amendment No. 61[9].

Containment purge and vent issues were again introduced onto the Millstone Unit No. 2 docket as a result of the Staff review of Item II.E.4.2 of NUREG-0737, the TMI Action Plan. The Staff provided the results of their review of multiplant issue B-24 (Venting and Purging Containment while at full power) and Item II.E.4.2 of NUREG-0737 noting that the issues were resolved with three exceptions.[11] Additional information was requested from NNECO in the following areas:

1. Hydrogen Purge System vent valve capabilities to close on demand and the need and duration to vent through these valves;

2. Technical Specifications for leakage testing of the hydrogen purge and 48 inch purge valves;

3. Modification of the hydrogen purge valves to close on high radiation.

NNECO promptly provided the requested information on the hydrogen vent valves which demonstrated their capability to close against the containment pressure transient postulated following a large break LOCA(12). NNECO also provided the results of a radiological evaluation of the consequences of venting the containment coincident with a large break LOCA.

Our response also justified the position that additional technical specifications for leakage testing of both the vent and purge valves were not necessary. At that time NNECO also provided a basis for not modifying the isolation logic for the hydrogen vent valves.

The Staff reiterated the positions with regard to hydrogen vent valve capabilities, leakage testing and closure on a high radiation signal and requested additional information and commitments from NNECO.(13) In response to the Staff's request, NNECO provided additional justification for the positions stated above and maintained that additional technical specifications for leakage testing and modifications to the hydrogen vent valves for closure on high radiation was not warranted.(14)

It is NNECO's position that a firm basis exists to support the current design and operation of the Hydrogen Purge System vent valves at Millstone Unit No. 2 and that backfit modifications to either the design or operation of the valves has not been demonstrated to be necessary by the Staff. As such, NNECO has elected to appeal the Staff's proposed modification of the hydrogen vent valve isolation logic (16) in accordance with the provisions of Generic Letter 84-08. The information included herein addresses the need for venting the containment at Millstone Unit No. 2, plant specific design descriptions of the system utilized to accomplish this task, a radiological evaluation of venting the containment coincident with postulated reactor coolant system leakage into the containment, and a description of the procedural controls currently in place which ensure the proper operation and control of containment venting.

Table 1 lists a chronology and brief summary of the correspondence docketed to date on this matter for Millstone Unit No. 2.

This information supports NNECO's conclusion that the generic NRC position that a high radiation closure signal is required for the hydrogen vent valves is not applicable to Millstone Unit No. 2 and its imposition would represent an unwarranted backfit.

TABLE 1

MILLSTONE UNIT NO. 2
CONTAINMENT VENT AND PURGE
CORRESPONDENCE CHRONOLOGY

1. R. Reid letter to W. G. Counsil, November 29, 1978.

   NRC Staff requests licensees to respond to generic concerns regarding containment purging and venting during normal plant operation.

2. W. G. Counsil letter to R. Reid, January 3, 1979.

   NNECO responds to Reference (1) indicating that unlimited purging of the Millstone Unit No. 2 containment will be justified.

3. W. G. Counsil letter to R. Reid, April 27, 1979.

   NNECO proposed technical specifications to require the purge valves to be locked closed in MODES 1-4 due to lack of valve qualification to close against accident pressures.

4. D. G. Eisenhut letter to All Light Water Reactors, September 27, 1979.

   NRC staff guidelines for containment purge and vent valve operability.

5. D. G. Eisenhut letter to All Light Water Reactors, October 17, 1979.

   The NRC Staff provides operability and demonstration guidelines addressing generic concerns about containment purge and vent valves.

6. W. G. Counsil letter to D. L. Ziemann and R. Reid, November 13, 1979.

   NNECO responds to Reference (5). The Staff operability guidelines were determined to be not applicable due to the commitment to maintain the purge valves locked closed in MODES 1-4.

7. R. W. Reid letter to W. G. Counsil, December 11, 1979.

NRC Staff forwards criteria regarding electrical override/bypass of Engineered Safeguards Features (ESF) noting that the Millstone Unit No. 2 containment purge valve circuitry did not appear to conform to certain guidelines.

8. W. G. Counsil letter to R. Reid, January 16, 1980.

NNECO responds to Reference (7) with a commitment to electrically disconnect the containment isolation actuation circuitry from the containment purge valves. Additional information on all ESF circuitry is provided in response to Reference (7).

9. R. A. Clark letter to W. G. Counsil, dated October 8, 1980.

The NRC Staff issues Amendment No. 61 to DPR-65 for Millstone Unit No. 2. The amendment included the technical specifications requiring the purge valves to be locked closed in MODES 1-4.

10. W. G. Counsil letter to D. G. Eisenhut, May 20, 1981.

NNECO responds to Item II.E.4.2 of NUREG-0737, Containment Isolation Dependability. NNECO documents the current position that the Hydrogen Purge System vent valves receive diverse closure signals adequate to ensure isolation when required. Since the large containment purge valves are locked closed, the Item does not apply to the large valves.

11. R. A. Clark letter to W. G. Counsil, February 9, 1983.

The NRC Staff forwards their Safety Evaluation Report on Multiplant Issue B-24 and Item II.E.4.2 of NUREG-0737. The correspondence notes that with the exception of three specific items, the two issues are resolved. The three items consisted of a request for information on the Hydrogen Purge System valves, technical specifications for increased leakage testing for both the Hydrogen Purge and Containment Purge valves seals, and a request that NNECO modify the Hydrogen Purge System valves to close on a radiation monitor signal.

12. W. G. Counsil letter to R. A. Clark, March 28, 1983.

NNECO responds to Reference (11) providing the requested information on the Hydrogen Purge System valves. The response also provided justification based on valve seal performance for not increasing the frequency of leakage testing and for not installing a radiation signal which initiate Hydrogen Purge System valve closure.

13. J. R. Miller letter to W. G. Counsil, September 2, 1983.

The NRC Staff responds to Reference (12) and requests more specific information for the Hydrogen Purge System valves. The Staff also reiterates their request for technical specifications requiring more frequent valve seal leakage testing and a radiation closure signal to isolate the Hydrogen Purge System valves.

14. W. G. Counsil letter to J. R. Miller, October 27, 1983.

NNECO responds to Reference (13) reiterating the Reference (12) positions and citing the NRC Staff Safety Evaluations of Reference (11) as partial justification. Additional information was provided to justify current plant design and operational practices regarding valve seal leakage testing and isolation circuitry.

15. J. R. Miller letter to W. G. Counsil, April 25, 1984.

The Staff reiterates their request for information on the Hydrogen Purge System valves, valve seal leakage testing technical specifications and the modification to the Hydrogen Purge System valve isolation logic. The Staff cites NUREG-0737 Item II.E.4.2.7 as a basis for their latter request. The Staff notes that NNECO may appeal the latter request in accordance with the procedures of Generic Letter 84-08.

16. W. G. Counsil letter to J. R. Miller, May 15, 1984.

NNECO requests an appeal meeting to review the NRC Staff request that the Hydrogen Purge System valves be modified to close on a radiation signal. NNECO commits to provide additional information on the qualifications of the Hydrogen Purge System valves and the issue of surveillance frequency for seal leakage.

17. J. R. Miller letter to W. G. Counsil, June 11, 1984.

NNECO's request for an appeal meeting is acknowledged. The Staff requests NNECO to provide the analyses supporting our position on the isolation of the Hydrogen System valves prior to the appeal meeting.

2.0 Containment Operating Conditions and License Requirements

The Millstone Unit No. 2 plant employs a cylindrical concrete containment which is reinforced and prestressed by a post tensioning system of horizontal and vertical tendons. The nominal dimensions of the containment are listed in Table 2.1.

Section 3.6.1.4 of the Technical Specifications provide limits on the internal containment pressure. The limits of -12 inches of water and +2.1 psig must be adhered to in Operating MODES 1 through 4. Should the internal containment pressure deviate outside this range a plant shutdown is required if the pressure is not restored to within the limits within one hour. To comply with this license requirement, the containment pressure is monitored on a narrow range pressure indicator. The range of the meter is -15 to +15 inches of water. The containment pressure is recorded once per shift.

Containment internal pressure increases primarily due to air operated valves located within the structure. Valve operation and accumulator leakage results in the addition of mass into the structure. High temperature/pressure fluid leaks from both the primary and secondary systems introduce mass and energy into the containment. Vapor from such leaks is condensed by the containment air recirculating and cooling units. Three of these units are normally operating out of a total of four. Cooling water is supplied to the coolers by the Reactor Building Closed Cooling Water (RBCCW) system. Each unit is designed to remove approximately two million BTU's per hour. In the event the energy input from a high temperature/pressure fluid leak exceeds the heat removal capability of this system, the containment pressure will increase. Any non-condensible gases which may be present in a primary or secondary coolant leak will also be released into the containment and cause a pressure increase.

Plant operating practice is to vent the containment through the Hydrogen Purge System vent valves when the internal pressure increases to approximately 10-12 inches of water as measured on the narrow range pressure monitor. It is not desireable to exceed the upper range of this instrument. Venting is performed until the internal pressure is decreased to approximately 0 inches of water.

Data are presented in Table 2.2 for the period from January 1, 1984 through June 1, 1984 illustrating the frequency and duration of containment venting. Typically, venting operations are required more frequently during plant heatup due to the additional energy input into the containment at these times resulting in the containment internal temperature increasing from approximately 60°F to 110°F. Startup from the most recent refueling outage took place in the beginning of January, 1984.

Figure 2.1 presents Section 3/4.6.1.4 of the Millstone Unit No. 2 Technical Specifications which delineates the requirements for internal containment pressure.

TABLE 2.1

MILLSTONE UNIT NO. 2 CONTAINMENT
NOMINAL DIMENSIONS

Inside Diameter	130 ft
Inside Height	175 ft
Cylindrical Wall Thickness	3.75 ft
Dome Thickness	3.25 ft
Foundation Slab Thickness	8.5 ft
Liner Plate Thickness	1/4 inch
Internal Free Volume	1,899,000 ft^3

TABLE 2.2

MILLSTONE UNIT NO. 2

CONTAINMENT VENTING TIMES

JANUARY 1, 1984 THRU JUNE 1, 1984

DATE	START TIME	START PRESSURE*	STOP TIME	STOP PRESSURE*	DURATION# HRS/MIN.
1/3	2256	-	0312	-	4/16
1/6	2117	-	0115	-	3/58
1/16	0828	10.0	1238	0	4/10
1/25	1605	14.0	1835	0	2/30
2/4	1252	13.7	1550	0	2/58
2/7	0837	-	1018	-	1/41
2/13	1600	9.0	1840	0	2/40
2/19	1845	10.0	2100	0	2/15
2/28	1145	11.5	1430	0.5	2/45
2/29	0655	4.0	0830	0	1/35
3/6	0543	9.0	0808	0	2/25
3/14	0323	12.5	0535	0	2/12
3/21	1150	11.0	1436	0	2/46
3/28	1645	11.2	1925	0	2/40
3/29	1140	11.5	1430	0	2/50
4/5	1328	11.2	1452	2.5	1/24
4/15	1110	11.0	1352	0	2/42
4/20	1630	10.0	1845	0	2/15
4/23	1045	10.5	1310	0	1/55
4/24	1305	10.5	1600	0	2/55
4/30	0250	13.0	0550	0	3/0
5/1	2100	10.0	2330	0	2/30
5/4	1930	15.0	2320	0	3/50
5/12	0613	9.0	1000	0	3/47
5/18	0415	9.0	0620	0.5	2/05
5/19	2115	10.5	2335	0.4	2/20
5/28	1217	11.0	1430	0	2/13
6/1	1250	11.5	1705	0	4/15

*Pressure is in inches of water. Where dashes are noted, the datum was not recorded.

#Over the period of 5 calendar months, 28 venting operations were performed totaling approximately 78 hours.

3.0 Containment Hydrogen Purge System Design

The Containment Hydrogen Purge System is an engineered safeguards feature provided to control the concentration of hydrogen which may be released into the reactor containment following postulated incidents. The Hydrogen Purge System is redundant to the Hydrogen Recombiner System. The purge system is comprised of pipe headers with inlets in the highest portion of the containment which pass through two separate containment penetrations to connections in the Enclosure Building Filtration System (EBFS).

A schematic of the Hydrogen Purge System and the Enclosure Building Filtration System is presented in Figure 3.1.

The Enclosure Building at Millstone Unit No. 2 is a limited leakage steel framed structure partially supported off the containment and auxiliary building which surrounds the above ground portion of the containment. The Enclosure Building is designed to perform a secondary containment function. The region between the enclosure building and the containment, the electrical and piping penetration rooms and the engineered safety feature rooms are designed as the enclosure building filtration region (EBFR). During operation of the EBFS, the EBFR is maintained at a slightly negative pressure. Air from the EBFR is processed through particulate, HEPA, and charcoal filters and discharged through the 375-foot stack at Millstone Unit No. 1.

The Hydrogen Purge and EBFS, operated concurrently, are used to vent the containment to ensure the internal pressure is within the limits prescribed by the Technical Specifications. Additional details on each of these systems and their interrelationships during containment venting operation are provided below.

Hydrogen Purge System

The Hydrogen Purge System was designed originally as a redundant system to the Hydrogen Recombiner System for post accident hydrogen control in the containment. In the event of a failure of the hydrogen recombiners, controlled venting of the containment could be performed to reduce the concentration of hydrogen gas to below the flammability limits. The Hydrogen Purge System is piped to the Enclosure Building Filtration System which provides two functions:

- o the motive force to draw the effluents from the containment,
- o filtering capability to minimize the off site dose consequences which would occur as a result of post accident purging/venting.

The concepts and design of these systems is applied to the need for containment pressure control.

The Hydrogen Purge System consists of open ended pipe headers which draw from the highest point in the dome of the containment. The piping is then routed from the dome (elevation ~150 ft.) to separate penetrations at elevations 45 ft. 6 in. and 37 ft. 7 in. Containment isolation valves are provided inside and outside the containment for both trains. Each train of the Hydrogen Purge System is provided with independent valving and instrumentation and powered from independent emergency power sources.

The Hydrogen Purge System containment isolation valves are solenoid actuated air operated valves. Each hydrogen purge valve is provided with an auxiliary air accumulator to assure an air supply for operation. The cylinder air-operated valves, if open, are closed by the accumulator air assuming a failure of the normal instrument air system. Air is available in the accumulator for opening the purge valves, if required. Each accumulator is sized for four open or close operations.

The hydrogen purge containment isolation valves inside containment are designed to fail in their last position. The isolation valves located outside containment fail in the closed position. In addition, handwheels are provided on the valves located outside containment for manual operation if required.

The Hydrogen Purge System containment isolation valves are 6 inch diameter butterfly type 9212 valves supplied by Fisher Controls Company. The valves are built to ASME Section III, Class 2 and are N-stamped. The valve operators and valves are designed to close against a differential pressure of 60 psi at a temperature of 289°F. The actuators, solenoids, and attached piping are seismically qualified to a safe shutdown earthquake. Additional design details on these valves are presented in Table 3.1.

The Hydrogen Purge System containment isolation valves receive a closure signal on a Containment Isolation Actuation Signal (CIAS). Upon receipt of a signal, they are required to close in not more than five (5) seconds. These valves are tested for isolation time at least once every 92 days pursuant to Technical Specification 4.6.3.1.1. A CIAS is generated on two diverse parameters, namely pressurizer pressure - low and containment pressure-high.

During containment venting, the effluent from the Hydrogen Purge System is piped to the Enclosure Building Filtration System which is described below.

Enclosure Building Filtration System

The Enclosure Building Filtration System (EBFS) consists of independent, fully redundant fans, filter banks, heating elements, ductwork, and isolation dampers. The system is shown schematically in Figure 3.1 including the interconnection to the Hydrogen Purge System. The EBFS is designed to collect, filter, and discharge leakage from the containment following an accident. This is accomplished through drawing air from the Enclosure Building Filtration Region (EBFR) which is comprised of the region between the containment and the enclosure building, the containment penetration rooms (electrical and piping) and the engineered safety features rooms.

fans draw from this plenum, through the filter banks and discharge to the Millstone Unit No. 1 375 ft. stack. The majority of the ductwork from the EBFS to the stack is below ground.

The EBFS filter banks include prefilters, HEPA filters and charcoal filters. The filter banks, fans and other equipment of the EBFS are located in the Millstone Unit No. 2 Auxiliary Building.

The prefilters are provided to remove coarse airborne particles to prolong the HEPA filter life. The HEPA filters are provided to remove fine airborne particles that penetrate the prefilters. The activated coconut shell charcoal filters are impregnated to remove the iodine as well as elemental iodine contaminates.

The EBFS electric heaters, located in the suction lines upstream of the filter banks, are controlled by an associated relative humidity control system to maintain the relative humidity of the air entering the filter units below 60 percent. These control systems are provided with manual overrides for special system operation.

The EBFS fans are belt driven centrifugal fans capable of operating individually or in parallel with the redundant system. Each fan is provided with a means of manual speed adjustment.

Ductwork for that portion of the EBFS located outside the enclosure building is round with angle flanged girth joints. Longitudinal seams are continuously welded air tight.

The EBFS is supplied emergency power from the onsite diesel generators.

Descriptions of the EBFS components are provided in Table 3.2

For containment venting, the EBFS is operated in conjunction with the Hydrogen Purge System to draw and process containment air in order to maintain the internal containment pressure within the required limits.

Effluents from the Hydrogen Purge System (during venting) are piped to the EBFS plenum located in the Enclosure Building. The redundant EBFS fans draw from this plenum, through the filter banks and discharge to the Millstone Unit No. 1 375 ft. stack. The majority of the ductwork from the EBFS to the stack is below ground.

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The EBFS is supplied emergency power from the onsite diesel generators.

Descriptions of the EBFS components are provided in Table 3.2

TABLE 3.1

HYDROGEN PURGE VALVE
QUALIFICATION DATA

Valve Numbers:	2-EB-91 2-EB-100	2-EB-92 2-EB-99
Bechtel Valve Designations:	HV 8378 HV 8380	HV-8377 HV-8379
Valve Location	Inside Containment	Enclosure Building
Valve Type/Size	Butterfly/6-Inch	Butterfly/6-Inch
Valve Model	Fisher 9212	Fisher 9212
Operator Type	Air Cylinder	Diaphragm
Operator Model	Fisher 481-15-30	Fisher 656-40
Design Code	ASME Section III Class 2	ASME Section III Class 2
"N" Stamped	Yes	Yes
Design Conditions		
Pressure (PSIG)	60	60
Temperature (°F)	289	289
Flow (SCFM)	250	250
Design Life (Years)	40	40
Flange Rating	150#	150#
Operating Conditions		
Normal: Pressure (PSIG)	15	15
Normal: Temperature (°F)	200	200
Maximum: Pressure (PSIG)	54	54
Maximum: Temperature (°F)	289	289
Medium	Hydrogen	Hydrogen
External Environment:		
Temperature (°F)	N/A	120
Relative Humidity	N/A	100
Radiation Exposure (Accumulated) (except seating material)	10^7 Rads	10^7 Rads

(Continued on next page)

TABLE 3.1

HYDROGEN PURGE VALVE
QUALIFICATION DATA

Operating Conditions (Cont'd)		
Max/Min ΔP at Design Flow (PSI)	0.009/0.013	0.009/0.013
Closing Time Max (Seconds)	5	5
Normal Position	Closed	Closed
Failure Position	As Is	Closed
Handwheel	No	Yes
Minimum Air Required (PSIG)	80	80
Normal Air Supplied (PSIG)	80-100	80-100
Valve Flange Orientation	Horizontal	2EB-92 Horizonal 2EB-99 Vertical
Valve Materials		
Body	SA 516, Gr. 70	
Seat	Ethylene Propylene	
Disc	SA 516, Gr. 70	
Shaft	ASTM A 564, Gr. 630	
Pins	ASTM A 564, Gr. 630	
Accumulator Package		
Minimum Number of Operations	4	4
Double Acting Solenoid Valves	ASCO 4-Way Dual Control Model 834445	
Seismically Qualified	Yes	Yes
Valve Operators		
Maximum Shutoff Pressure	60 PSI at 289^{o}F	
Limit Switches:		
Indicate Full Open	Yes	Yes
Redundant Indication Fully Closed	Yes	Yes

Seismic Requirements

Valves are capable of operation during and after the loading due to seismic forces. Valves withstand an inertial load of 3.0 g in any direction in addition to normal operating loads. The extended parts of the valves have a natural frequency of vibration greater than 20 CPS.

TABLE 3.2

ENCLOSURE BUILDING FILTRATION SYSTEM COMPONENT DESCRIPTION

Prefilters

Manufacturer	AAF
Quality per unit	9
Rated flow per filter unit (cfm)	1000
Type	Replaceable
Media	Glass fiber
Average efficiency	70%
Rating basis	NBS dust-spot method
Rated pressure drop unloaded (in. w.g.)	0.10

HEPA Filters

Manufacturer	AAF
Quantity per unit	9
Rated flow per filter unit (cfm)	1000
Type	High efficiency, dry
Media	Glass filber (waterproof, fire retardant)
Separators	Asbestos (waterproof)
Cell side material	Cadmium plated carbon steel
Face guards	4-Mesh galvanized hardware cloth
Gasketing	ASTM D-1056 Grade SCE-43
Efficiency	99.97% with 0.3
Rating basis	MIL-STD-282
Rated pressure drop unloaded (in. w.g.)	0.9
Codes:	Health and Safety Bulletin 306, dated March 31, 1971 UL-586 MIL-STD-282, dated May 28, 1965

Charcoal

Manufacturer	AAF
Quantity (per unit)	27
Rated flow per charcoal element (cfm)	333
Type	Activated coconut shell
Impregnant	5 w/o iodide and potassium iodide
Granule size	10-4 mesh
Ignition temperature (C)	340
Charcoal per element (lb)	43
Maximum moisture content (%)	3
Gasketing material	ASTM-D1056, Gr. SCE-43
Casing	Type 304 stainless steel
Efficiency (%)	99.9 (elemental iodine) 99.95 (methyl iodide)

TABLE 3.2

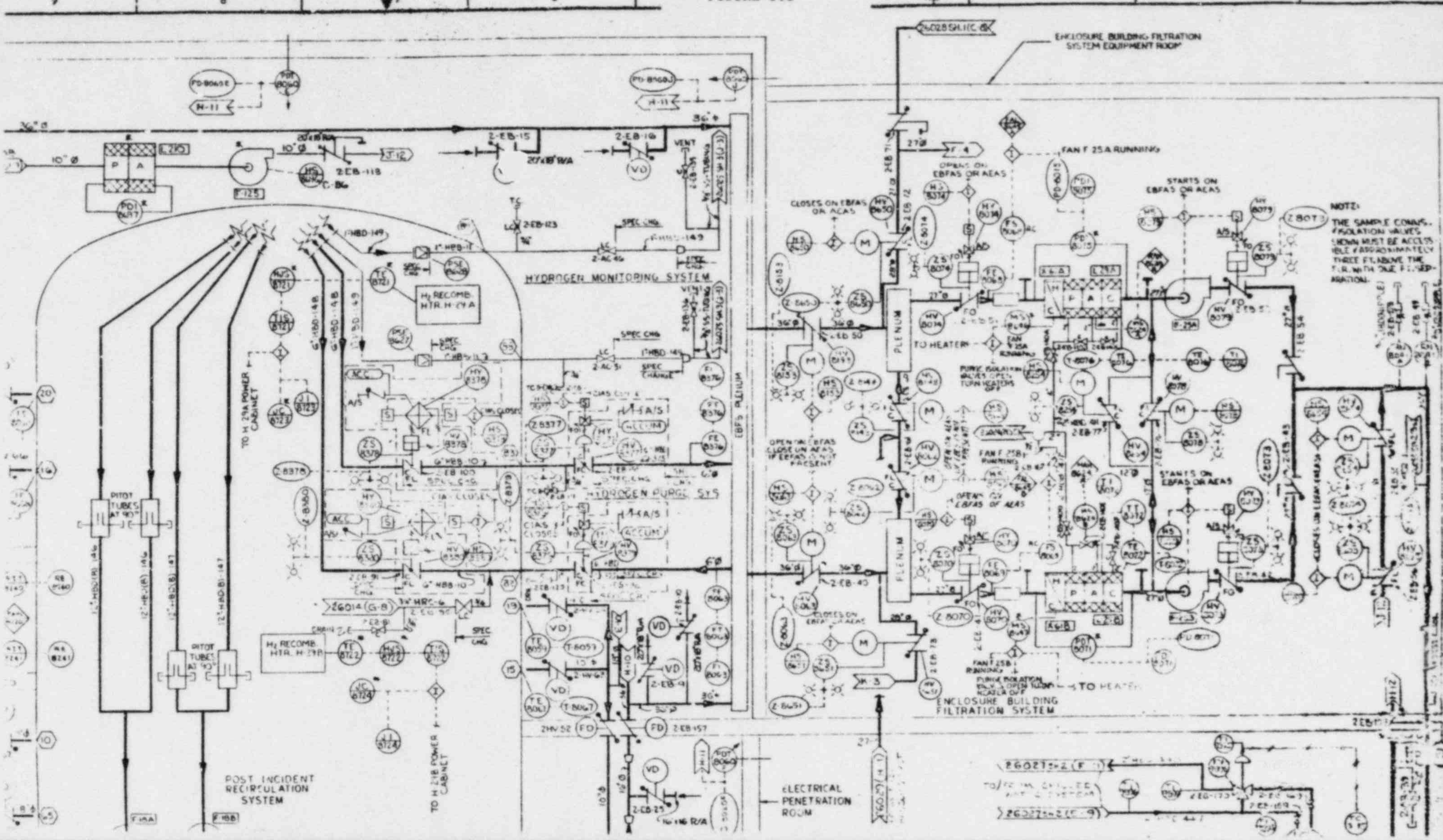
Rating basis	AEC-DP-1082 (elemental iodine) Radio-methyl iodide traces (methyl iodide)
Holding capacity	
Retentivity (seconds)	0.25
Rated air flow (cfm)	1000
Rated pressure drop (in. w.g.)	1.10
Air face velocity (fpm)	42
Codes	AEC-DP-1082 (July, 1967)
Fans	
Manufacturer	Buffalo forge
Model number	445BL
Quantity per unit	1
Arrangement/class	1/3
Drive	Belt driven
Rotor diameter in.	22-1/4
Capacity (cfm), each	9000
Static pressure (in. w.g.)	6.0
Static efficiency (%)	60
Brake horsepower (bhp)	7.8
RPM	1889
Capacity (cfm), two fans in parallel arrangement	10,400
Static pressure (in. w.g.)	6.3
Static efficiency (5)	69
Brake horsepower (bhp)	7.3
Codes	AMCA-211-A
Motors	
Manufacturer	General Electric
Quantity (Per unit)	1
Type	Standard induction
Voltage (volts)	460
Horsepower rating, hp	25
Enclosure	Open drip proof
NEMA Design letter	B
Frame designation	284-T
Insulation class	B
Codes	NEMA, MG-1
Electric heaters	
Manufacturer	Indeeco
Quantity per unit	1
Type	Electric
Power rating, kW	25
Surface temperature (F)	900
Rated pressure drop (in. w.g.)	0.10
Codes	UL approved

TABLE 3.2

Piping, valves and fittings

A.	Suction	
	Pipe sizes	Wall thickness
	2½ to 10 in.	SCH40
	12 to 48 in.	0.375 in. wall
	Material	Seamless ASTM A-53B (containment) Seamless ASTM A-333 (penetration)
	Design pressure (psi)	60
	Design temperature (F)	289
	Code	ANSI B-31.1.0 (containment) ANSI B-31.7 Class II (penetration)
	Seismic	Class I
	Construction	
	Piping	2½ in. and larger: butt welded except at flanged equipment
	Valves	2½ in. and larger: butt welded (except Butterfly Valves) 150 lb. ANSI rating carbon steel
B.	Discharge	
	Pipe sizes	Wall thickness
	2 in. and smaller	Sch 80
	2½ in. to 10 in.	Sch 40
	12 in. and larger	0.274 wall
	Material	Seamless ASTM A-53A or B
	Design Pressure (psi)	50
	Design Temperature (F)	120
	Standard	ANSI B-31.1.0
	Seismic	Class I
	Construction	
	Piping	2½ in. and larger: butt welded except at flanged equipment 2 in. and smaller: 300 lb. M.I. Screwed
	Valves	2 in. and smaller: 125 lb. WSP, screwed bronze

FIGURE 3.1


ENCLOSURE BUILDING FILTRATION SYSTEM EQUIPMENT ROOM
FAN F 25A RUNNING
OPENS ON EBFAS OR AEAS
CLOSES ON EBFAS OR AEAS
STARTS ON EBFAS OR AEAS
NOTE: THE SAMPLE CONN'S ISOLATION VALVES SHOWN MUST BE ACCESSIBLE APPROXIMATELY THREE FT. ABOVE THE FLR. WITH ONE FT. SEPARATION.
HYDROGEN MONITORING SYSTEM
HYDROGEN PURGE SYS
H_2 RECOMB. HTR. H-29A
H_2 RECOMB. HTR. H-29B
TO H 29A POWER CABINET
TO H 29B POWER CABINET
PITOT TUBES AT 90°
PLENUM
EBFS PLENUM
TO HEATER
ENCLOSURE BUILDING FILTRATION SYSTEM
POST INCIDENT RECIRCULATION SYSTEM
ELECTRICAL PENETRATION ROOM

4.0 Radiological Evaluation of Venting Containment Coincident with Reactor Coolant Leakage

The NRC Staff proposed backfit of a radiation signal to initiate automatic closure of the Hydrogen Purge System containment isolation valves was supported, in part, by a generic safety evaluation report of the radiological consequences of containment purging and venting while the Reactor Coolant System (RCS) is pressurized. Due to the generic nature of the report the conclusions reached and the bases supporting the conclusions are not applicable to the specific situation at Millstone Unit No. 2 where the system design has been shown to accommodate the subject concern. Based on the plant specific features described in Section 3 and the radiological evaluation described herein, a radiation signal to initiate automatic closure of the Hydrogen Purge System containment isolation valves is not justified.

Specific design and operating features of the containment venting system include a low flow rate several orders of magnitude smaller than assumed in the Staff's generic SER, filtering with HEPA and charcoal filters, and an elevated release point. These two mitigative features were not considered in the generic analyses. These features act to limit the consequence of containment venting coincident with RCS leakage into the containment. Current procedural controls ensure that appropriate operator actions will be taken to limit offsite dose consequences in the unlikely event that RCS leakage does not result in an automatic containment isolation.

Evaluation Model and Inputs

The model used to evaluate the radiological doses is generally similar to that developed by the NRC in the generic report. The model was based on the following conservative assumptions:

1. Half of the iodine which leaks from coolant vaporizes and mixes instantaneously with half of the containment volume.

2. All of the noble gases in the leaking coolant are released into half of the containment volume.

3. The mixture of the iodine and noble gas isotopes are proportional to those reported in NUREG-0017 (PWR Gale Code).

4. The noble gas concentration in the coolant is 100/E (uCi/gm). The initial iodine concentration in the coolant is 1 uCi/gm DEQ I-131.

5. Initially, there are no iodine or noble gas isotopes in the containment atmosphere.

Two scenarios were evaluated to determine the significance of protracted venting coincident with reactor coolant leakage. Case 1 assumed a reactor coolant leak equivalent to the makeup capacity of two charging pumps (88 gpm). Case 2 assumed a reactor coolant leak equivalent to a small break loss-of-coolant-accident with a 200 Lbs/sec break flow (break size equal to 0.02 ft^2).

Credible venting times were utilized in the evaluation of Case 1. A venting time approximately equal to the longest time which the Hydrogen Purge System valves are open for venting at any given time, as listed in Section 2, was used (4 hours). Case 2 assumed a conservative venting time of 30 minutes coincident with the 200 Lbs/sec leak. In reality, a containment isolation signal will be generated for Case 2 in approximately 350 seconds (6 minutes) which will close the Hydrogen Purge Valves. In both cases operator actions would be initiated by procedural controls on reactor coolant system leakage. These controls are discussed in more detail in Section 5.

There are several input parameters which are the same for both cases. These include initial coolant activity, maximum purge flow rate, containment mixing volume and filter efficiency. The initial coolant activity for iodines and noble gas was assumed to be 1 uCi/gm DEQ I - 131 and 100/E, respectively. A purging flow rate of 500 cfm of containment air was used in these analyses. This is conservative since the purge system flow rate as calculated based on actual plant data was determined to be 290 cfm. The additional 210 cfm was included for added conservatism. Because of the low purge flow rate as well as the large distance separating the reactor coolant piping from the purge intake (see Figure 3.1), a containment mixing volume equal to one-half of the actual available free air volume is justified. The HEPA and charcoal filters were assumed to have zero (0) efficiency. Their presence in the EBFS would act to reduce the offsite dose even further. The filters were ignored due to the uncertainty in effluent humidity which was not quantified in the evaluations performed. It is reasonable to assume, however, that additional reductions in dose consequences could be expected. All of the above data as well as breathing rate and the X/Q used in the analysis are summarized in Table 4.1.

Appendix 4A describes the radiological models for iodine and noble gases.

Radiological Consequence Results

The calculated radiological doses at the site boundary are summarized in Table 4.2. The results demonstrate that for the two cases evaluated, both the thyroid and whole body doses are below the limits specified in 10CFR Part 20.

The consequences of venting coincident with a large break loss-of-coolant-accident were also evaluated as documented in the W. G. Counsil letter to R. A. Clark, dated March 28, 1983. The results of this evaluation demonstrated that the offsite doses would increase less than 0.1% from the previously accepted values.

The results presented in Table 4.2 demonstrate the capability of the current Millstone Unit No. 2 systems to limit offsite doses in the event the containment is being vented coincident with significant reactor coolant system leakage. Operator actions would enhance the inherent system design to further reduce the consequences of such a scenario as postulated herein. The need for a radiation signal to initiate Hydrogen Purge Valve isolation is not justified on the basis of offsite dose consequences or accidents at Millstone Unit No. 2.

Table 4.1

Summary of Assumptions Used In Analysis

1. Initial coolant concentrations:

   Iodine = 1.0 uci/gm DOSE EQUIVALENT I-131
   Noble Gas = $100/\bar{E}$

2. Purge rate of gas = 500 cfm

3. Containment free air volume = 1.9×10^6 ft^3

4. Fraction of containment volume in which coolant is assumed to mix = 0.5

5. Enclosure building filter efficiency = 0

6. Millstone Unit No. 1 stack X/Q (s/m^3):

   Site boundary = 1.03×10^{-4}

7. Breathing rate = 3.17×10^{-4} m^3/sec

Case 1 Assumptions

1. Primary coolant leak rate into containment = 88 gpm

2. No iodine spike assumed

3. Maximum duration of purge = 4 hours

Case 2 Assumptions

1. Primary coolant leak rate into containment = 200 lbs/sec

2. Iodine spike assumed which increases the iodine release rate from fuel to coolant by a factor of 500

3. Maximum duration of purge = 0.5 hours

Table 4.2

Organ	Calculated Site Boundary Dose (rems) Case 1	Case 2	10CFR20 Limit (rems)
Thyroid	1.2×10^{-1}	4.6×10^{-1}	1.5
Whole Body	1.1×10^{-2}	4.2×10^{-3}	0.5

Appendix 4A

Radiological Models for Iodine and Noble Gas Release Due to Reactor Coolant Leakage Coincident with Containment Venting

Iodine Model

The differential equation which describes the concentration of activity in the containment as a function of time for the case where no iodine spike is assumed, is:

$$L - P \cdot C_1 - \lambda \cdot C_1 \cdot V = \frac{dC_1}{dt} \cdot V$$

where: L = leakage of isotope into containment from primary coolant (uCi/second)

P = purge rate of gas out of containment (m^3/second)

V = containment volume into which activity is assumed to mix

λ = radioactive decay constant (1/second)

C_1 = concentration of isotope in containment (uCi/m^3)

C_{10} = initial concentration of isotope in containment

t = time (second)

The solution of the above equation yields:

$$C_1 = \frac{L}{P + \lambda \cdot V} \left(1 - e^{-(P/V + \lambda)t}\right) + C_{10}\, e^{-(P/V + \lambda)t}$$

The total amount of activity which is released to the environment via the purge system can be calculated by the following equation.

$$G = \int_0^t P \cdot C_1(t)\, dt$$

where: G = total activity released (uCi)

Performing the integration yields:

$$G = \frac{P \cdot L}{(P + \lambda V)} \left(t + \left(e^{-(P/V + \lambda)t} - 1\right)/(P/V + \lambda)\right)$$

$$+ \frac{P \cdot C_{10}}{P/V + \lambda} \left(1 - e^{-(P/V + \lambda)t}\right)$$

The thyroid dose is calculated by the following:

$$Dose_{Thy} = \sum_{j=1}^{n} (G_j)(DCF_j)(X/Q)(B) \times \frac{Ci}{10^6\ uCi}$$

where: $Dose_{Thy}$ = dose to thyroid (REMS)

DCF_j = thyroid dose conversion factor for isotope j (Rem/Ci inhaled)

X/Q = second/m^3

B = breathing rate = 3.17×10^{-4} m^3/second

The differential equations which describe the activity in the coolant, containment and environment as a result of iodine spiking, are given below:

$$\frac{dC}{dt} = i - jC$$

$$\frac{dC_1}{dt} = KC - lC_1$$

$$\frac{dG}{dt} = C_1 P$$

where: G = total activity released of isotope (uCi)

C = iodine concentration in coolant (uCi/gm)

C_1 = iodine concentration in containment (uCi/m^3)

i = leak rate from fuel to coolant/coolant mass (uCi/gm sec)

$$= 500\left(\frac{L}{M_c} + \lambda d\right) \cdot C_o$$

where: L = letdown rate (gm/sec)

M_c = mass of primary coolant (gm)

λ_d = radioactive decay constant of isotope (1/sec)

C_o = initial concentration in coolant (uCi/gm)

j = removal from coolant by leakage, letdown and decay

$$= \frac{W + L}{M_c} + \lambda d$$

where: W = coolant leakage rate (gm/sec)

K = addition to containment atmosphere from leaking coolant divided by containment volume (gm/sec $\cdot$ m^3)

$$= \frac{W}{2 \times V}$$

where: V = available containment volume, (m^3)

$1/2$ = partition factor

l = removal of activity from containment volume by purge and decay.

$$= \frac{P}{V} + \lambda$$

where: P = purge flow rate, m^3/sec

The solution of the differential equations given above is:

$$C = C_o e^{-jt} + \frac{i}{j} (1 - e^{-jt})$$

$$C_l = \frac{Ki}{(l^2 - lj)} e^{-lt} + \frac{Ki}{(j^2 - jl)} e^{-jt} + \frac{Ki}{jl}$$

$$+ \frac{K\ Co}{l - j} e^{-jt} + \frac{K\ Co}{j - l} e^{-lt} + C_{lo}e^{-lt}$$

$$G = P \cdot \left[\left(\frac{Ki}{l^2 j - l^3} + \frac{K\ Co}{l^2 - lj} - \frac{C_{lo}}{l}\right)e^{-lt} + \left(\frac{Ki}{j^2 l - j^3} + \frac{K\ Co}{j^2 - jl}\right)e^{-jt} + \frac{Kit}{jl} - \frac{Ki}{l^2 j - l^3} - \frac{Ki}{j^2 l - j^3} - \frac{K\ Co}{l^2 - lj} - \frac{K\ Co}{j^2 - jl} + \frac{C_{lo}}{l} \right]$$

where: Co = initial concentration in coolant, (uCi/gm)

$C_{l}o$ = initial concentration in containment (uCi/m^3)

Noble Gas Model

The equation used for determining the whole body dose is as follows:

$$Dose_{WB} = \sum_{i=1}^{n} 0.25\ (G_i)(E_i)(X/Q)$$

Where: 0.25 = conversion factor $\frac{Rads}{MeV/dis \cdot Ci \cdot sec/M^3}$

G_i = amount of noble activity released to environment for isotope i (same equation used as derived for iodine released to the environment for non spike case).

E_i = average gamma energy per disintegration (MeV/dis for isotope i

X/Q = atmospheric dispersion coefficent from MP-1 stack

5.0 Procedural Controls

Procedural controls are currently inplace at Millstone Unit No. 2 which ensure that containment venting operations are carried out appropriately using the equipment and systems described in Section 3. Operating Procedure (OP) 2314B and 2314G provide the prerequisites, precautions and directions to carry out the venting operation described herein.

Additional procedures exist which delineate specific actions which the operators will take in event reactor coolant system leakage is evident. These actions are taken in order to comply with Technical Specification limits on identified and unidentified sources of leakage.

Containment Venting

Containment venting during MODES 1-4 is accomplished through the use of the Hydrogen Purge System and the Enclosure Building Filtration System (EBFS). Sections 7.9 and 7.10 of OP 2314B specifies the equipment operations necessary to initiate and terminate venting. Specific provisions of the procedure are noted below.

1. A containment air sample is required to be taken, analyzed and the results available to the shift supervisor prior to the venting. This provision would alert the operators to abnormal contamination or radiation in the containment prior to initiation of venting operations.

2. The EBFS must be in operation which provides the flow path and filtering capability for the venting operation.

3. The procedure prescribes that only one train of the Hydrogen Purge System be utilized for a maximum vent path of 6 inches in diameter.

4. The procedure directs the operators to investigate the cause for radiation monitor alarms. In the event of reactor coolant leakage,

radiation alarms would provide one indication alerting the operators of an abnormal situation.

EBFS operation is outlined in OP 2314G. This procedure directs the equipment lineups for filtering the Enclosure Building Filtration Region. The EBFS must be in the EBFR lineup prior to containment venting as prescribed in OP 2314B. When operating the EBFS, Millstone Unit No. 2 operators must inform the Millstone Unit No. 1 shift supervisor of the system operation since the EBFS will be discharging to the Unit No. 1 stack.

Radiation monitors located in the Millstone Unit No. 1 stack continuously monitor the activity of effluents being discharged. The monitors alarm in the Millstone Unit No. 1 control room which is adjacent to the Millstone Unit No. 2 control room. In the event these monitors alarm, the Millstone Unit No. 1 operators would initiate investigative activities to determine the cause of the alarm. Their cognizance of a Millstone Unit No. 2 venting operation would provide one potential source for the alarm. Control room indication is provided for the dampers and fans of the EBFS which are operated in OP 2314G. Valve position indication is also provided in the control room for the Hydrogen Purge System valves.

Reactor Coolant Leakage

Plant operators receive information on reactor coolant system leakage from several sources. Leakage rates must be within limits prescribed in Technical Specification 3/4.4.6.2. These limits are 1 gpm unidentified and 10 gpm identified leakage and no pressure boundary leakage. If these limits are exceeded, a shutdown to cold shutdown is required unless the leakage can be reduced to less than these limits. A shutdown is mandatory if pressure boundary leakage is identified.

Several sources of information regarding reactor coolant leakage are available to the operators.

Leakage is calculated by a computer program which prints out once per 24 hours at 0000 each day. This is attached to the Control Room Shift Surveillance and the values of leakage recorded. It is possible to obtain a leakage calculation at any time. If the computer is not operable it is possible to perform manual leakage calculations by executing procedure SP 2602A, Reactor Coolant Leakage.

During operation the control room operators are aware of increased demand for makeup to the RCS and would utilize either method mentioned above to determine the magnitude of the leakage.

Reactor Coolant leakage detection is indicated by containment humidity, sump level and radiation levels.

Gaseous and particulate containment radiation monitors are used to determine if the leakage is from the primary or secondary systems.

The sump pumping is recorded on the Control Room Daily Surveillance. Increased pumping would lead to an investigation to determine the source of water.

The identified and unidentified leakage rates are reviewed by the Operations Supervisor and or the Operations Assistant. Therefore any indicated increases would be apparent to higher management and corrective action would be taken.

Abnormal Operating Procedure (AOP) 2568, Reactor Coolant System Leak, is initiated as a result of various indications of leakage. These include the automatic start of one or more charging pumps, an unbalance between charging and letdown flows of greater than 4 gpm during steady state operations and the computer calculation of RCS leakage. This procedure directs the operator to locate the leak, monitor pressurizer level, isolate the leak if possible and quantify the leak through a computer calculation. If neccessary, a containment entry will be made for the purposes of identifying and quantifying the leakage.

The information available to the operator and the procedural requirements in RCS leakage situations ensure that he will be cognizant of abnormal changes in containment conditions during venting operations.

6.0 SUMMARY

The issue of containment purging during reactor operation has been resolved for the most part at Millstone Unit No. 2. The Staff request that NNECO modify the Hydrogen Purge System containment isolation valves to close on a radiation signal is considered to be an unsubstantiated backfit. This position is based on a plant specific radiological evaluation of containment venting coincidental with a postulated reactor coolant leak in the containment, unique plant specific design features, and procedural controls which ensure operator cognizance of reactor coolant system and containment integrity.

Operation of equipment within the containment at Millstone Unit No. 2 results in pressure changes within the structure. Plant design and analyses require limits on the containment internal pressure. Such limits are deemed important and as such are included in the license as technical specifications. NNECO maintains the internal containment pressure through controlled venting utilizing existing systems designed for such operation.

The plant specific features of the Hydrogen Purge and Enclosure Building Filtration Systems render a generic justification for modifications to the Hydrogen Purge System valves inappropriate. A plant specific evaluation of several scenarios on which the Staff has based its position has demonstrated that the current design and operation of Millstone Unit No. 2 provides more than adequate protection of the public health and safety. Evaluations of other reactor coolant leakage scenarios postulated to exist coincident with containment venting would render similarly acceptable conclusions.

Procedural controls and operator action cannot be credibly ignored. As such, the procedures and required actions have been outlined to demonstrate what actions operators take to identify, quantify and isolate any abnormal reactor coolant leakage. Strict limits on reactor coolant leakage ensure that operators are cognizant of primary plant conditions. Numerous sources of data are available to assist the operators in their determinations regarding reactor coolant system integrity.

The information presented herein provides an appropriate basis which justifies the current design and operation of the Hydrogen Purge System and its application to containment venting operations.