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June 15, 1981

BECo. Ltr. #81-127

Mr. Thomas A. Ippolito, Chief
Operating Reactors Branch #2
Division of Licensing
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

License No. DPR-35
Docket No. 50-293

Pilgrim Nuclear Power Station (PNPS)
Conformance with 10CFR50.44

References:
A) Letter, USNRC to Boston Edison Co. dated October 30, 1979
B) Letter, Boston Edison Co. to USNRC dated October 19, 1979
C) Letter, USNRC to Boston Edison Co. dated March 14, 1979

Dear Sir:

Enclosure A to this letter contains the Boston Edison Company's evaluation of Pilgrim Nuclear Power Station's (PNPS) compliance with 10CFR50.44 which documented the basis for our letter of October 19, 1979. Enclosure B contains the detailed evaluation of said compliance performed subsequent to discussions with you and members of your staff to respond to your letter of October 30, 1979. The results of this recently performed evaluation demonstrate that though rapid access for brief periods of time is possible, the calculated upper limit dose rates may preclude personnel access for the extended periods of time projected as necessary to perform equipment maintenance to assure the single failure criterion is satisfied.

The system modifications which would have resulted from this awareness were in fact developed and installed during the 1980 refueling outage as a result of the lessons learned from TMI. We trust this information is responsive to your needs, should you have any additional questions, please do not hesitate to contact us.

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Send Drawings to:
BC

Very truly yours,

AVMorisi

Enclosures:

A - Evaluation of PNPS Compliance with 10CFR50.44

B - Detailed Analysis of PNPS Compliance with 10CFR50.44

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PILGRIM NUCLEAR POWER STATION, UNIT #1
10CFR50.44 EVALUATION

INTRODUCTION:

Compliance with 10CFR50.44 depends on maintaining combustible gas control while meeting the dose requirements of 10CFR100 for post accident cases, and meeting General Design Criterion (GDC) 41, GDC 42, and GDC 43. Since the notice of hearing for the Pilgrim construction permit was published before December 22, 1968, purging, as defined in 10CFR50.44, is an acceptable means of maintaining combustible gas control provided the above criteria are met.

This analysis is the basis for the conclusion in Reference (a) that Pilgrim meets 10CFR50.44 with existing equipment. Subsequently, it was found that one of the assumptions of Reference (a) was incorrect. It was assumed that local operator action could be used for satisfying single failure and loss of power design criteria. A recent Reactor Building habitability study, a result of the TMI Lessons Learned implementation efforts, has demonstrated that the Reactor Building may be inaccessible after an accident. The Reactor Building area dose rates may be too high to permit personnel entry. Because timely operator access for local action cannot be guaranteed, all 10CFR50.44 requirements are not met with existing equipment. Modifications are in progress to upgrade the system so that Pilgrim will comply with 10CFR50.44. These modifications are being implemented as quickly as possible.

Also, it is noted that an existing nitrogen repressurization system (shown in FSAR Figure 5.2-8a) and an existing containment oxygen monitoring system are not included in this evaluation. They are not designed to meet Seismic Class I requirements and are not redundant.

SYSTEM DESCRIPTION:

The present primary containment combustible gas control system is a purging system. It consists of an existing Standby Gas Treatment System (SGTS) and the Drywell and Torus purge and vent lines. The SGTS is shown in FSAR Figure 5.3-2. The Drywell and Torus purge and vent lines are shown in FSAR Figure 5.2-8a. As shown, exhaust from both the Torus and Drywell can be routed to the Main Stack via the SGTS. Makeup is supplied via the purge lines. Hence, hydrogen concentration is controlled below flammability limits (4 volume percent as required in Regulatory Guide 1.7) by a bleed and feed method (purge method as defined in 10CFR50.44). Since calculations indicate that the Drywell would reach approximately 4 volume percent hydrogen in about 14 hours and the Torus would reach approximately 4 volume percent hydrogen in about 22 hours without combustible gas control, this method was judged acceptable because of the ample time for implementation.

DOSES:

Dose calculations were based upon a continuous 50 cfm purge from the primary containment starting 2 hours after the accident and continuing for 30 days. A continuous constant rate purge was selected to simplify calculations. Fifty cfm was selected as a reasonable approximation of the higher and lower purge rates required. With these assumptions, calculations show that the Pilgrim LPZ doses would be within 10CFR100 limits.

Purging is not required immediately after an accident. Calculations indicate that the Drywell reaches approximately 3 volume percent hydrogen about 4 hours after an accident. Hence, no purging should be required within 2 hours after an accident.

GDC 41:

GDC 41 requires the system to be redundant, to have leak detection capabilities, to provide isolation and containment, and to function after a loss of power. Pilgrim complies with this criterion assuming operator action can be used for satisfying loss of power and random single failure criteria.

As shown in FSAR Figure 5.2-8a, the primary containment vent lines (2") and purge lines (20") have flow paths from the containment to the Seismic Category I SGTS. The exhaust from the primary containment can be routed to either SGTS unit (the 2" line would be used). Each SGTS is 100 percent redundant. FSAR Section 5.3.3.4-2 and FSAR Figure 5.3-2 show these flow paths and describe the SGTS. Hence, with credit for appropriate local operator action, system redundancy is obtained.

The SGTS units are arranged so that the fans draw rather than push gases through the filter trains. Hence, leakage is controlled inward rather than outward for untreated gases. Flow indication and filter system differential pressure indication are provided. Therefore, if gross leakage occurred, it would be detected quickly by sudden changes in these parameters. Hence, leakage is controlled.

Containment and isolation capabilities are provided by the Primary Containment Isolation System (shown in FSAR Figure 5.2-8A and described in FSAR Section 5.2.4.6). Hence, reliable isolation is provided.

Local operation of vent and makeup lines were proposed to satisfy redundancy and loss of power criteria. Since calculations indicated purging is not required immediately after an incident, local valve control was judged acceptable. Calculations indicate that without combustible gas control, Drywell hydrogen concentrations of approximately 3 volume percent and approximately 4 volume percent would be reached about 4 hours and 14 hours, respectively, after an accident. Thus, the time for operator action appeared acceptable.

GDC 42 and GDC 43:

Inspection and testing of the present Containment Atmospheric Control System is described in Sections 4.7A and 4.7B of the Pilgrim Technical Specifications. It is noted that the SGTS is designed to draw rather than push gases through the filter trains. Hence, leakage is controlled inward rather than outward for untreated gases.

COMBUSTIBLE GAS MONITORING:

The existing containment combustible gas monitoring system consists of two redundant, remotely operable, seismically qualified hydrogen analyzers. Several local test points are also available at which grab samples could be obtained. The hydrogen analyzers can continuously monitor Drywell hydrogen concentration and have a remote readout in the main Control Room. Test points include both Drywell and Torus locations. Since the increase of combustible gas concentration in the containment due to radiolysis is relatively slow and has been modeled (Regulatory Guide 1.7), an appropriate sampling frequency could be determined.

CONTAINMENT MIXING:

Significant combustible gas concentration stratification within the Drywell or the Torus is not expected. Organizations such as Energy Incorporated and General Electric have investigated containment mixing. Energy Incorporated has estimated less than 0.1% variation in hydrogen concentration in the Drywell and expects good mixing will take place in the Torus because of thermal gradients (Reference (b)). Energy Incorporated's conclusions are supported by GE's evaluation of mixing in the containment around their BWR 6. General Electric believes that a very small temperature (T) or concentration (C) difference is sufficient to promote good mixing ($T = 2.6 \times 10^{-5}$ °F or $C = 4.3 \times 10^{-8}$ in the containment around a BWR 6). GE also believes that the analysis used on the containment around a BWR 6 will also apply to a Mark I Containment. Based upon the above analysis, in the open Pilgrim BWR Mark I containment, no significant combustible gas concentration stratification is expected within the Drywell or Torus.

HYDROGEN GENERATION:

Hydrogen generation estimates are based upon the requirements of 10CFR50.44 and Regulatory Guide 1.7. In accordance with 10CFR50.44, the amount of hydrogen generated by a fuel cladding and water reaction was obtained by using the larger of:

1. 5 times the total amount of hydrogen calculated in the last Pilgrim reload submittal (in compliance with 10CFR50.46(b)(3)).
2. An average core wide cladding penetration of 0.23 mils.

In the last Pilgrim 1 reload submittal, GE calculated an average metal water reaction percentage of 0.13% (also confirmed by Reference (c)). Five times 0.13 is 0.65 percent cladding interaction. A 0.23 mil average cladding penetration is equivalent to 0.68 percent cladding interaction. Hence, the 0.23 mil average cladding penetration was used. All hydrogen generated by the core metal-water reaction was assumed to be released immediately. Radiolytic hydrogen generation rates and accumulation curves were calculated by GE (Reference (d)). GE used AEC Safety Guide 7 to generate their curves. These assumptions are the same as those used in Regulatory Guide 1.7.

The calculation methods used for hydrogen concentration calculations were verified by Bechtel (References (e) and (f)) with independent calculations.

Hydrogen inputs from corrosion for Pilgrim (no chemical spray) are minor (References (e) and (f)). Hence, their absence will not introduce a significant effect.

REFERENCES

(a) BECo Letter #79-207 dated 10/19/79, Containment Atmospheric Control System.

(b) Supplement No. 1 to Dresden Station Special Report No. 39 and QAD Cities Special Report No. 14.

(c) GE Letter No. SSX:79-64

(d) 7/13/73 letter, W. J. Neal (GE) to S. A. Giusti (Bechtel)

(e) BLE-459 dated 9/25/75

(f) ELB-2604 dated 6/24/75

PILGRIM NUCLEAR POWER STATION

CONFORMANCE WITH 10CFR50.44

ENCLOSURE B

I. CONTAINMENT ATMOSPHERIC CONTROL SYSTEM

General

The Containment Atmospheric Control System is provided to obviate the possibility of an energy release within the Primary Containment from a Hydrogen-Oxygen reaction following a postulated Loss of Coolant Accident (LOCA). This was to be accomplished by maintaining an atmosphere containing less than 4% hydrogen in the Drywell and Pressure Suppression Chamber (Torus). The system will:

(1) Perform initial purging of the Primary Containment.
(2) Provide for a supply of nitrogen makeup gas.
(3) Provide for normal and purge exhaust lines to the Standby Gas Treatment System for normal operating conditions.
(4) Provide for emergency exhaust from the Drywell and Torus for release of contaminated Drywell and Torus gases to the Standby Gas Treatment System.

Principal Design Parameters and Characteristics

Pressure Suppression Chamber:	Internal Design Pressure -	+56 PSIG
	External Design Pressure -	+ 2 PSIG
Drywell:	Internal Design Pressure -	+56 PSIG
	External Design Pressure -	+ 2 PSIG

Drywell Free Volume	(Approx.)	147,000 FT^3
Pressure Suppression Chamber Free Volume	(Approx.)	120,000 FT^3
Pressure Suppression Pool Water Volume, Max.	(Approx.)	94,000 FT^3
Pressure Suppression Pool Water Volume, Min.	(Approx.)	84,000 FT^3
Submergence on Vent Pipe Below Pressure Suppression Pool Surface	(Approx.)	4 FT
Design Temperature of Drywell		281°F
Design Temperature of Pressure Suppression Chamber		281°F
Downcomer Vent Pressure Loss Factor		6.21
Break Area/Total Vent Area		0.0194
Drywell Free Volume/Pressure Suppression Chamber Free Volume		1.34
Primary System Volume/Pressure Suppression Pool Volume		0.268
Drywell Free Volume/Primary System Volume		7.4
Calculated Maximum Pressure During Blowdown Drywell		45 PSIG
Pressure Suppression Chamber		27 PSIG
Initial Pressure Suppression Chamber Temperature Rise		35°F

II. EVALUATION OF 10CFR50.44 COMPLIANCE

General

10 CFR 50, Appendix A, Criterion 41, requires a Containment Atmospheric Cleanup System to be operable after a postulated accident to control fission products released to the environment, and to control the concentration of hydrogen or oxygen or other substances in the containment atmosphere to assure containment integrity is maintained.

P&ID M-227, Containment Atmospheric Control System, illustrates the PNPS equipment which BECo stated meets the requirements of 10CFR50, Appendix A, Criteria 41, 42, and 43.

(a) The system shall:

(1) Have suitable redundancy in components and features.
(2) Have suitable interconnections.
(3) Have leak detection capability.
(4) Provide isolation and containment.
(5) Function after a loss of power with concurrent single failure. The worst loss of power scenario for this issue is expected to be loss of offsite power with concurrent loss of one onsite emergency diesel generator.
(6) Be periodically inspected.
(7) Be periodically pressure and functional tested.

(b) Refer to P&ID M-227, Containment Atmospheric Control System.

(1) Upon occurrence of a LOCA, the following valves will close due to high drywell pressure and/or low reactor water level:

a. AO 5035 A/B
b. AO 5036 A/B
c. AO 5033 A/B/C
d. AO 5041 A/B
e. AO 5042 A/B
f. AO 5043 A/B
g. AO 5044 A/B
h. AO 5030 A/B (high drywell pressure only)

This satisfies the containment isolation provision of 10 CFR 50 Appendix A, GDC 41 (see item II.a.4 above).

(c) The following would be required to provide a reliable containment purge flow path to maintain acceptable containment pressure in accordance with 10 CFR 50.44 (G) and H_2 concentration less than 4% in accordance with 10 CFR 50.44.

(1) Establish a Drywell and Torus vent path to the standby gas treatment system by placing the Drywell and Torus normal exhaust line valves (AO-5043 A/B and AO-5041 A/B) control switches in the Emergency Open position. This overrides the containment isolation signal and allows these valves to be opened.

(2) Establish a Drywell and Torus nitrogen makeup supply path by placing the nitrogen makeup supply valves (AO-5033 A/C) control switches in the Emergency Open position, and the nitrogen pressure control valves (PVC-5030 A) control switch 5030 into the override position and manually opening the nitrogen makeup supply block valves. This will establish a nitrogen addition path to the Drywell and Torus.

(3) Nitrogen addition to the Drywell and Torus is initiated whenever the containment H_2 concentration approaches 4% or whenever venting occurs. Nitrogen addition is stopped whenever H_2 concentration is reduced to 2%, or when the H_2 concentration is reduced to 3% <u>and</u> containment pressure is reduced to the acceptable range.

(4) The following local operator actions are necessary to implement the above:

a. The nitrogen makeup supply block valves must be manually opened to establish a functional flow path. This action can be accomplished in approximately 10 minutes. The flow path would be suitably redundant in that:

1. If the Torus N_2 makeup supply is lost, the Drywell N_2 could enter (bubble into) the Torus via the downcomer lines. This requires that sufficient Drywell to Torus differential pressure be established via the vent line(s) to create the flow path.

2. If the Drywell N_2 makeup supply is lost, then the Torus N_2 could enter the Drywell via the Torus to Drywell vacuum breaker valves AO-5045 A-K. Drywell pressure must be reduced to 0.5 psig below the Torus pressure via vent valves to initiate this flow path.

3. If the Torus vent path is lost via AO-5041 A/B, the Drywell vent path via AO-5043 A/B can be used to vent primary containment via the Torus N_2 makeup, the Torus-to-Drywell vacuum breaker valves, and the Drywell vent valves.

4. If the Drywell vent path is lost via AO-5043 A/B, then the Torus vent path via AO-5041 A/B can be used to vent primary containment via the Drywell N_2 makeup, the Drywell to Torus downcomer lines, and the Torus vent valves.

(5) When hydrogen generation has ceased, the containment pressure can be reduced to less than 2 psig, and N_2 makeup is maintained to keep H_2 concentration to less than 3%.

(6) The above actions are consistent with the operator response procedures of PNPS procedure No. 5.4.6, Post-Accident Venting. This procedure additionally requires that H_2 analyzers be placed in service. PNPS procedure 2.2.70 describes how this is done.

(d) The following would be required to provide a reliable containment purge flow path to maintain containment pressure within acceptable limits and H_2 concentration less than 4%, with loss of offsite power coincident with single failure of one emergency diesel generator (see II.a.5 above).

Loss of "A" Bus	Loss of "B" Bus
5033 A	5033 C
5036 A	5033 B
5035 A	5043 B
5043 A	5041 B
5041 A	

Valves 5030 A/B and 5045 A-K are powered from a swing bus, therefore, power can be transferred to the available bus on loss of one supply.

(1) Upon loss of "A" Bus, the following valves will fail closed:

AO-5033A
AO-5043A
AO-5041A

Note: AO-5035 A and AO-5036 A will also fail closed, but will be closed due to containment isolation signal.

PCV-5030 A is powered from a swing bus and can be opened.

AO-5033 C can be open to allow N_2 makeup to the Torus.

AO-5045 A-K are powered from a swing bus and can be opened (see Note below)

The preferred method to open AO-5043 A and AO-5041 A would be to provide alternate power by jumpering the available power supplies in the Main Control Room. Should this method not be feasible, AO-5043 A and AO-5041 A will have to be manually opened by Local operator action. This can be done within approximately 10 minutes by either using a power-pac to jack open the valves or bypassing (pneumatic jumpering) the solenoid valve SV-5043A and SV-5041A with appropriate tubing and connections.

Note: If AO-5043 A can be opened, then the Drywell pressure could be reduced to 0.5 psi less than the Torus pressure, and establishing a Torus vent path via AO-5045A A-K and AO-5043 A/B.

(2) Upon loss of "B" bus, the following valves will fail closed:

AO-5033C
AO-5041B
AO-5043B

AO-5033 B, AO-5035 B and AO-5036 B will fail closed but will be closed via containment isolation signals. PCV-5030 A is powered from a swing bus and can be opened (see Note below).

AO-5033 A can be opened to allow N_2 makeup to the Drywell.

The preferred method to open AO-5043 B and AO-5041 B would be to provide alternate power by jumpering the available power supplies in the Main Control Room. Should this method not be feasible, AO-5043 B and AO-5041 B will have to be manually opened by local operator action. This can be done within approximately 10 minutes by either using a power-pac to jack open the valves or bypassing (pneumatic jumpering) the solenoid valves SV-5043B and SV-5041B with appropriate tubing connections.

Note: If AO-5041 B can be opened, then the Drywell vent path could be estabished via the Drywell and Torus downcomers through AO-5041 A/B.

(3) 10 CFR 50, Appendix A, GDC 42 and 43 require the system to be designed to be inspected and periodically pressure and functional tested. This system is designed to be inspected because significant components and piping are located outside primary containment and are normally accessible. The system is periodically pressure and functional tested because significant components and piping are used during normal operation to maintain an inert containment atmosphere.

(4) The above describes the capabilities of the system to meet the redundancy, interconnection, and loss of power with concurrent single failure requirements of 10 CFR 50, Appendix A, GDC 41 (see II.a.1/2/5 above). This system assumes local operator action to establish the flow path and meet the single failure/loss of power criterion, and is consistent with evaluation bases previously established. The calculated upper limit dose rates in the Reactor Building may preclude access for local operator action. Consequently, compliance with 10CFR50, Appendix A, GDC 41 based on local operator action cannot be assured.

(e) In order to meet the redundancy, interconnection, and loss of power with coincident single failure criterion of 10 CFR 50, Appendix A, GDC 41, without assuming accessibility (consistent with TMI Lessons Learned), modifications were made to the Pilgrim Station Containment Atmospheric Control System as shown in Drawing #M-227, Sheet 1, Revision A (PDCR 80-21) The basis for this change is discussed in the PDCR 80-03 and 80-21 Narratives.

(1) Upon occurrence of a LOCA, all valves identified in II (b) (1) above will close, in addition to the new solenoid valves SV-5081 A/B through SV-5088 A/B which are normally closed.

Two independent paths to both drywell and torus were added for both nitrogen makeup and venting after a LOCA. The existing vent and makeup valves will continue to be used for all non-accident operating modes. The new lines shown on Design Revision A (PDCR 80-21) of M-227 sheet 1, P&ID for the Containment Atmospheric Control System, each have two solenoid operated valves. Each pair of series valves are powered from the same power supply. The valves in the redundant lines at each location are powered from redundant safety related distribution systems. Each valve is controlled individually from keylocked switches mounted on the Post Accident Monitoring Panels C170 and C171. The valves are maintained closed during normal operation-opened only for test and emergency conditions. The valves receive no isolation signals, since they are normally closed, are required for post accident conditions, and have small flowports that will limit possible leakage which if it does occur will be directed to the standby gas treatment system for processing.

Consequently, the current system meets the suitable redundancy, interconnection, and loss of power with coincident single failure criteria of 10CFR 50, Appendix A, GDC 41, without requiring access to the reactor building. It should be noted that the emergency N_2 makeup supply check valves are not presently installed, and are not required for system operation.

(2) 10 CFR 50, Appendix A, GDC 42 and 43 require the system(s) to be designed to be inspected and periodically pressure/functionally tested. The current system is designed to be inspected because significant components and piping are located outside primary containment, and are normally accessible.

(f) Dose calculations are based on an average 50 scfm purge from the primary containment starting 80 hours after a postulated accident and continuing for 30 days. An average purge rate was selected to simplify calculations. Fifty scfm was selected as a conservative value of purging to maintain post-LOCA hydrogen concentration in the primary containment between 2% and 4%. With these assumptions, calculations show that the Pilgrim LPZ doses would be within 10CFR100 limits.

Purging is not required immediately after an accident. Calculations indicate that the Drywell reaches approximately 4 volume percent hydrogen about 80 hours after an accident, based on a drywell re-pressurization to 28 psig with inert (nitrogen) gas.

(g) The SGTS units are designed so that the fans draw rather than push gases through the filter trains. Flow indication and filter system differential pressure indication are provided. If gross leakage occurred, it would be detected quickly by sudden changes in SGTS flow, SGTS filter Δ P, and containment pressure. Consequently, leakage would be readily detectable.

Combustible gas monitoring and containment mixing concerns were previously evaluated and favorably reconciled. Consequently, significant combustible gas stratification is not expected.

(h) Hydrogen generation estimates are based upon the requirements of 10CFR50.44 and Regulatory Guide 1.7, Revision 2. In accordance with 10CFR50.44, the amount of hydrogen generated by a fuel cladding and water reaction can be obtained by using the larger of:

1. 5 times the total amount of hydrogen calculated in a previous Pilgrim reload submittal (in compliance with 10CFR50.46 (b) (3)).

2. An average core wide cladding penetration of 0.23 mils.

In a previous Pilgrim 1 reload submittal, GE calculated an average metal water reaction percentage of 0.13%. Five times 0.13 is 0.65 percent cladding interaction. A 0.23 mil average cladding penetration is equivalent to 0.68 percent cladding interaction. Hence, the 0.23 mil average cladding penetration is used. All hydrogen generated by the core metal-water reaction is assumed to be released over a two minute period. Radiolytic hydrogen generation rates and accumulat[illegible] curves were calculated by GE in a 7/13/73 letter, W. J. Neal (GE) to [illegible].A. Giusti (Bechtel). GE used AEC Safety Guide 7 to generate their curves. These assumptions are the same as those used in Regulatory Guide 1.7.

Hydrogen inputs from corrosion for Pilgrim (no chemical spray) are minor, as previously evaluated. Hence, their absence will not introduce a significant effect.

/FOR INFORMATION ONLY

PDCR 80-21 narrative ISSUED FOR CONSTRUCTION

A. DESCRIPTION OF MODIFICATION

Implementation of TMI Short-Term Lessons Learned, will require verification that the Primary Containment can be purged of postulated Post-LOCA combustible gases to the Augmented Off-Gas System with inert medium, assuming single active failure of components.

The existing Pilgrim Unit One Containment Atmospheric Control System, as shown on P&ID 6498-M-227, Sheet 1 of 2, Revision E2, allows Post-Loca Purge exhaust of the Torus and Drywell through normal exhaust lines (2"-HE-45) with high containment pressure (and prevailing containment isolation signal) by manually opening the 2" ∅ air operated valves. However, Post-LOCA conditions may prohibit manual operation of these valves due to high radiation.

The change to the Post-LOCA Primary Containment Purge Exhaust (vent) capability covered by this PDCR involves installing redundant solenoid operated valves, powered from separate safety busses for each valve train and remotely operable, to bypass the existing Torus and Drywell normal and purge exhaust valves.

This arrangement is shown on marked up P&ID 6498-M-227, Sheet 1 of 2, Revision A (PDCR 80-21).

Additionally, the existing Pilgrim Unit One Containment Atmospheric Control System, as shown on P&ID 6498-M-227, Sheet 1 of 2, Revision E2, permits purging the primary containment with non-safety nitrogen purge facilities, or safety qualified air purge facilities. Air should not be used to purge the primary containment of combustible gases because of the high potential for creating a flammable mixture within containment. Further, existing Nitrogen Purge lines would not withstand single active failure.

The change to the Post-LOCA Primary Containment Nitrogen Purge Supply capability covered by this PDCR involves installing redundant solenoid operated valves and piping, with valves powered from separate safety busses for each valve train and remotely operable, to bypass the existing Torus and Drywell non-safety portion of Nitrogen Purge lines.

This arrangement is shown on marked up P&ID 6498-M-227, Sheet 1 of 2, Revision A (PDCR 80-21).

For added diversity, tie-in capabilities will be provided to the existing Nitrogen Storage Tank, which is presently non-safety, non-seismic, through appropriate valving to permit use of this on-site capability following a design basis accident in the event the tank with contents and attachments are undamaged.

Refer to PDCR 80-3 for further discussion details, and for information regarding installation of wiring and controls for equipment covered by this PDCR.

The addition of the post accident vent and N_2 makeup valves discussed in paragraph (1) above, eliminates need for the existing valves and thus the "emergency open" position after a LOCA. The new vent valves, however, have extremely small ports and venting of the containment after a non-LOCA containment high pressure trip could be very slow, particularly at low containment pressures. In addition, refueling floor high radiation results in closure of the subject valves during normal operation. This signal does not cause a reactor scram nor does it prevent continued unit operation _if_ primary containment pressure control can be maintained.

Based on the above, the control circuits for the existing 2" vent valves and 1" N_2 makeup valves have been revised to reinstate "emergency open". In this operating mode, containment high pressure and refueling floor high radiation isolation signals are bypassed; however, reactor water low level isolation is maintained for protection against a serious accident as required by the NRC. This modification will allow operation of the 2" vent valves to relieve high ~~drywell~~ pressure and continue unit operation on refueling floor high radiation assuming both safety related power supplies are available and the reactor protection system is operating properly. With this change in isolation logic, it will be necessary to wire control switch contacts for the subject valves in parallel with the isolation logic sealin circuit. This arrangement will require closure of the vent and N_2 makeup valves before the isolation logic can be reset as required by paragraph 2 above.

4. IE Bulletin 79-08 and NUREG 0578 Section 2.1.4 (1) both require that there be diversity in parameters sensed for the initiation of containment isolation as described in Standard Review Plan 6.2.4. In particular, the NRC requires that isolation of all non-essential systems be accomplished based on diverse signals indicative of a LOCA obtained from qualified class IE systems.

The reactor water sample valves presently receive only one isolation signal (low low reactor water level) that meets the above criteria. A second isolation signal containing high drywell pressure will be added to the existing logics to provide the diverse signals required. Other isolation valves that do not meet the above NRC criteria have been identified to the NRC in response to IE Bulletin 79-08. The NRC has accepted the existing methods for isolation of all valves except the reactor water sample valves and the MSIV drains. As noted above, we are changing the isolation signals to the reactor water sample valves as they have no effect on plant safety. Also, a new post accident sample system will soon be installed at PNPS thus eliminating all requirements for the existing system. Changing the isolating signals to the MSIV drains, however, could affect plant safety. Operation of these valves to more restrictive isolating requirements than the MSIV's could possibly result in condensate buildup between the MSIV's thus preventing operation (opening) of the MSIV's or damaging the steamlines to the condenser. Either failure will needlessly eliminate the condenser as a heat sink after a unit scram thus removing one possible method of cool down.

Most valves controlled directly from the General Electric isolation logics(which are reset by a single operator action)are motor operated, controlled by three position spring return to normal control switches used in a "sealin" control circuit. To reopen these valves the operator has to "deliberately" reposition the control switch to "open" after the isolation logic has been reset. The only solenoid operated valves controlled by maintained contact control switches from the General Electric logic for which circuit redesign is necessary are listed below.

AO 203-1A,1B,1C, & 1D	Inboard MSIV's
AO 203-2A,2B,2C, & 2D	Outboard MSIV's
AO 220-44 and 220-45	Reactor Water Sample Valves
SV7011A and SV7011B	Drywell Floor Sump Effluent Vv's
SV7017A and SV7017B	Drywell Equip. Sump Effluent Vv's
SV5033A and SV5033C	Containment N_2 Makeup Valves (Emergency open position)
SV5041A and SV5041B	Torus Vent Valves (Emergency open position)
SV5043A and SV5043B	Drywell Vent Valves (Emergency open position)

Two basic designs have been used to prevent the automatic reopening of valves on isolation logic reset. The first involves the wiring of valve control switch contacts in series with the applicable isolation logic reset contacts. These control switch contacts are closed in the "CLOSE" position only, thus requiring repositioning of the control switch to "CLOSE" before the logics can be reset. The second approach involves the replacement of two position maintained contact control switches with three position spring return to normal switches. These new switches used in conjunction with auxiliary relays provide a sealin circuit which when deenergized by an isolation signal will remain de-energized until the operator recloses the control switch after isolation logic reset.

3. The NRC's "Interim Position for Containment Purge and Vent Valve Operation" noted above, also requires that containment isolation signals be segregated so that as a minimum, one safety injection actuation signal remains uninhibited and operable to initiate valve closure when any other isolation signal may be blocked, reset, or overriden. In December 1979, we were required by the NRC to remove the "emergency open" capability from the 2"containment vent valves because all isolation signals were bypassed.

Finally, the expected (Post TMI) high concentrations of hydrogen inside the containment after a LOCA makes the existing design based on an air purge obsolete. Instead it will be necessary to limit the concentration of oxygen which builds up more slowly after an accident. To do this redundant sources of nitrogen must be available to both the drywell and torus after an accident.

Based upon the above, two independent paths to both the drywell and torus will be added for both nitrogen make up and venting after a LOCA. The existing vent and makeup valves as discussed in paragraph 3 below will continue to be used for all non-accident operating modes. The new lines shown on Design Revision A of M-227 sheet 1, P&ID for the Containment Atmospheric Control System, will each have two solenoid operated valves. Each pair of series valves will be powered from the same power supply. The valves in the redundant lines at each location will be powered from redundant safety related distribution systems. Each valve will be controlled individually from keylocked switches mounted on the Post Accident Monitoring Panels C170 and C171. The valves will be maintained closed during normal operation -opened only for test and emergency conditions. The valves will receive no isolation signals, since they are usually closed, are required for post accident conditions, and have small flow ports that will limit possible leakage which if it does occur will be directed to the standby gas treatment system for processing. See PDCR-80-21 for the mechanical details concerning operation of the new vent and N_2 makeup valves.

2. NUREG 0578 Section 2.1.4(4) and Criterion #6 of the NRC's "Interim Position for Containment Purge and Vent Valve Operation" transmitted via an October 22, 1979 letter, require that control circuits for containment isolation valves be designed so that resetting of the isolation signal will not result in the inadvertant automatic reopening of containment isolation valves. "Reopening of containment isolation valves shall require deliberate operator action." In general, the circuits of concern are those controlling solenoid operated valves through maintained contact control switches. If these valves are tripped closed by an isolation signal, the valves will reopen automatically when the isolation logic is reset unless the applicable control switches had previously been moved to the "close" position.

During a meeting with the NRC on December 11, 1979, the NRC essentially accepted the PNPS reset circuit for the Balance of Plant (BOP) isolation valves as it provides "sufficient protection against the inadvertant reopening" of BOP isolation valves. To reset the BOP isolation logic after a scram, it is first necessary to reset the General Electric isolation logic at panel C905 and then reset the BOP logics at panel C7. The only change required by the NRC to this reset function is the replacement of the existing reset pushbuttons on panel C7 with keylocked selector switches.

PDCR #80-3 NARRATIVE
PRIMARY CONTAINMENT ISOLATION

A. DESCRIPTION

Recent developments within the nuclear industry have resulted in the issuance of a number of documents by the NRC concerning the design and operation of the containment isolation system. Based on these documents referenced below, it will be necessary to make a number of modifications to the existing containment isolation system at Pilgrim. The changes required and implemented by this PDCR are described below.

1. IE Bulletin 79-08 item 10 and NRC letter dated October 30, 1979 to Mr. G. C. Andognini, require that PNPS have a system that meets the requirements of 10CFR50.44 for containment combustible gas control after a LOCA. For PNPS vintage plants, it is necessary that the primary containment purge system be available to maintain the concentrations of combustible gases within the containment below flamability limits assuming a single failure after a loss of offsite power. Recent studies prompted by TMI indicate that the secondary containment of the reactor building will be inaccessible after a LOCA because of high radiation levels. This condition will prevent manual operation of the existing containment vent and purge valves as originally planned. Manual operation is required because the valves are designed to be single failure proof in the closing (isolating) direction and as such have two valves in series which are powered and controlled by redundant electrical systems. Failure of one system (diesel generator, distribution system, etc) will prevent remote opening of all required lines. Reassignment of power supplies so that both valves in a series pair are powered from one source will result in unacceptable separation problems, as redundant isolation signals are still required. In addition, since the valves would require override of accident signals, major modifications to the isolation logics (requiring a significant number of relays & control switches) would be necessary to meet the NRC's requirements for segregation of isolation signals. (see paragraph (3) below).

   Communication between the drywell and torus is limited. Free flow of gases from the torus to drywell is possible through the torus to drywell vacuum breakers. Flow in the reverse direction, however, is limited to gases that overcome the hydraulic head in the drywell downcomers as electrical operation of the vacuum breakers against any significant reverse differential pressure is not possible. This isolation between the two primary containment compartments eleminates the possibility of using the existing valves to provide the redundant purge paths required. Instead two paths are required to each compartment.